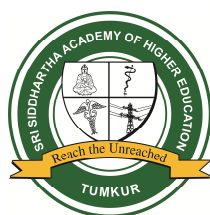


**REGULATIONS & CURRICULUM OF
GRADUATE PARAMEDICAL COURSE

BACHELOR OF SCIENCE IN

MEDICAL LABORATORY TECHNOLOGY

2020**



**Sri Siddhartha
Academy of Higher Education
Deemed-to-be-University**

**Established under Section 3 of the UGC Act, 1956
MHRD, GOI No. F.9-31/2006-U.3 (A) Dtd. 30th May 2008**

Agalakote, B.H. Road, Tumkur – 572107, Karnataka, India

SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

(DEEMED TO BE UNIVERSITY)

Declared under Section 3 of the UGC Act, 1956, MHRD GOI No. F.9-31/2006-U.3 (A) Dated: 30/05/2008

Accredited 'A' Grade by NAAC

Agalakote, B.H.Road, Tumkur – 572 107. KARNATAKA, INDIA.

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No. SSAHE/ACA-S&C(AHSP)/11/2022

Date: 01/09/2022

NOTIFICATION

Sub: Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Medical Laboratory Technology.

- Ref: 1). Proceedings of BOS Allied Health Sciences Programmes held on 06/04/2021
2). Proceedings of the Academic Council meeting held on 19/08/2021
3). Proceedings of the Board of Management held on 29/08/2022

In exercise of the powers vested under section 6 of 6.4 of MoA / Rules of SSAHE, the Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Medical Laboratory Technology is notified herewith as per Annexure.

The above Regulations shall be applicable to the students admitted to the said course from the academic year 2020-21 onwards.

By Order,

REGISTRAR
REGISTRAR

Sri Siddhartha Academy of Higher Education
TUMKUR - 572 107, Karnataka.

To,
Dean / Principal, Sri Siddhartha Medical College & Hospital,

Copy to

- 1) Office of the Chancellor, SSAHE, for kind information,
- 2) PA to Vice-Chancellor / PA to Registrar / Controller of Examinations / Finance Officer, SSAHE
- 3) The Director (AHSP), SSAHE
- 4) All Officers of the Academy Examination Branch / Academic Section
- 5) Guard File / Office copy.

ORDINANCE GOVERNING REGULATIONS & CURRICULUM OF BACHELOR OF MEDICAL LABORATORY TECHNOLOGY - 2020

1. Eligibility for admission:

A candidate seeking admission to the BSc. MLT shall have studied English as one of the principal subject during the tenure of the course and shall have passed:

1. Two year Pre-University examination or equivalent as recognized by Sri Siddhartha Academy of Higher Education with, Physics, Chemistry and Biology as subjects of study.

OR

2. Pre-Degree course from a recognized University considered as equivalent by SSAHE, (Two years after ten years of schooling) with Physics, Chemistry and Biology as subjects of study.

OR

3. Any equivalent examination recognized by the Sri Siddhartha Academy of Higher Education, Tumkur for the above purpose with Physics, Chemistry and Biology as subjects of study.

OR

4. The vocational higher secondary education course conducted by Vocational Higher Secondary Education, Government of Kerala with five subjects including Physics, Chemistry, Biology and English in addition to vocational subjects conducted is considered equivalent to plus TWO examinations of Government of Karnataka Pre University Course.

OR

5. Candidates with two years diploma from a recognized Government Board in MLT shall have passed class 12 [10+2] with Physics, Chemistry and Biology, as subjects or candidates with 3 years diploma from a recognized Government Board in MLT should have studied Physics, Biology and Chemistry as subjects during the tenure of the course.

Lateral entry to second year of B.Sc.MLT for candidates who have passed diploma program from the Government Boards and recognized by SSAHE, fulfilling the conditions specified above under Sl. No. 5 and these students are eligible to take admission on lateral entry system only in the same subject studied at diploma level for the academic year .

Note:

- a. The candidate shall have passed individually in each of the subjects.
- b. Candidates who have completed diploma or vocational course through Correspondence shall not be eligible for any of the courses mentioned above.

2. Duration of the course:

Duration shall be for a period of four years including one year of Internship.

3. Medium of instruction:

The medium of instruction and examination shall be in English.

4. Scheme of examination:

There shall be three examinations one each at the end of 1st, 2nd and 3rd year.

5. Attendance:

Every candidate should have attended at least 80% of the total number of classes conducted in an academic year from the date of commencement of the term to the last working day as notified by university in each of the subjects prescribed for that year separately in theory and practical. Only such candidates are eligible to appear for the university examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A candidate lacking in prescribed percentage of attendance in any subjects either in theory or practical in the first appearance will not be eligible to appear for the University Examination in that subject

6. Internal Assessment (IA):**1st Year B.Sc. MLT**

Theory - 20 marks

Practicals - 10 marks*. [Lab work- 06 marks and Record-04 marks]

2nd & 3rd year B.Sc. MLT

Theory – 20 Marks

Practicals – 20 Marks

There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an academic year. The average marks of the two tests will be calculated and reduced to 20. The marks of IA shall be communicated to the University at least 15 days before the commencement of the University examination. The University shall have access to the records of such periodical tests. The marks of the internal assessment must be displayed on the notice board of the respective colleges with in a fortnight from the date test is held. If a candidate is absent for any one of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

* There shall be no University Practical Examination in First year.

7. Subject and hours of teaching for Theory and Practicals

The number of hours of teaching theory and practical, subject wise in first year, second year and third year are shown in Table-I, Table-II and Table-III

Main and Subsidiary subjects are common in first year for all the courses in Allied Health Science.

The number of hours for teaching theory and practical for main subjects in first, Second and Third year are shown in Table-I, II and III.

Table - I Distribution of Teaching Hours in First Year Subjects Main subjects

Sl. no	Subject	Theory No. Of Hours	Practical No. Of Hours	Total No. Of Hours
1	Human Anatomy	70	20	90
2	Physiology	70	20	90
3	Biochemistry I	70	20	90
4	Pathology I (Clinical Pathology, Haematology & Blood Banking)	70	20	90
5	Microbiology	70	20	90
	Total	350	100	450

The classes in main and subsidiary subjects are to be held from Monday to Thursday. On Fridays and Saturday's students shall work in hospitals in the respective speciality or department chosen by them

Subsidiary Subjects

English	25 Hours
Kannada	25 Hours
Health-Care	40 Hours

Clinical/Lab posting – 470 hours (Friday 9am – 1pm and 2pm - 4-30 pm Saturday 9am - 1pm)

Table - II Distribution of Teaching Hours in Second Year Subjects Main Subjects

Sl. no	Subject	Theory No. of Hours	Practical No. Of Hours	Clinical Postings	Total No. Of Hours
1	Biochemistry II	100	80	170	350
2	Microbiology II	100	80	170	350
3	Pathology II	100	80	170	350
	Total	300	240	510	1050

Subsidiary Subjects:

Sociology	20 Hours
Constitution of India	10 Hours
Environmental Science & Health	10 Hours

Table - III Distribution of Teaching Hours in Third Year Subjects Main Subjects

Sl. no	Subjects	Theory No. Of Hours	Practical No. of Hours	Clinical Posting	Total No. of Hours
1	Biochemistry III	100	80	170	350
2	Microbiology III	100	80	170	350
3	Pathology III	100	80	170	350
	Total	300	240	510	1050

Subsidiary Subjects:

Ethics, Database Management	50 Hours
Research & Biostatistics	20 Hours
Computer application	10 Hours

9. Schedule of Examination:

The university shall conduct two examinations annually at an interval of not less than 4 to 6 months as notified by the university from time to time. A candidate who satisfies the requirement of attendance, progress and conduct as stipulated by the university shall be eligible to appear for the university examination. Certificate to that effect shall be produced from the Head of the institution along with the application for examination and the prescribed fee.

10. Scheme of Examination:

There shall be three examinations, one each at the end of I, II and III year. The examination for both main and subsidiary subjects for all courses in Allied Health Sciences shall be common in the first year. Distribution of Subjects and marks for First Year, second year & Third year University theory and practical Examinations are shown in the Table – IV, V & VI.

First year Examination:

The University examination for 1st year shall consist of only theory examination and there shall be no University Practical Examination.

Second & Third year examination:

The University examination for 2nd and 3rd year shall consist of Written Examination & Practical.

Written Examinations consists of

- 05 papers in the 1st year
- 03 papers in the 2nd Year
- 03 papers in the 3rd Year.

Practical examination:

- There shall be no practical examination in the first year.
- Three practical examinations, at the end 2nd Year.
- Three practical examinations at the end of the 3rd year.

TABLE-IV**Distribution of Subjects and marks for First Year University Theory Examination**

A	Main Subjects*	Written Paper		I A Theory	Total
		Duration	Marks	Marks	Marks
1	Basic Anatomy (Including Histology)	3 Hours	100	20	120
2	Physiology	3 Hours	100	20	120
3	Biochemistry	3 Hours	100	20	120
4	Pathology	3 Hours	100	20	120
5	Microbiology	3 Hours	100	20	120
	Subsidiary Subject**				
1	English	3 Hours	80	20	100
2	Kannada	3 Hours	80	20	100
3	Health Care	3 Hours	80	20	100

Note: I A = Internal Assessment

*Main Subjects shall have University Examination. There shall be no University Practical Examination.

**Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

TABLE - V**Distribution of Subjects and Distribution of marks for Second Year Examination of B.Sc. MLT**

Paper	Subject	Theory			Practicals			Grand Total
		Univ. exam	IA	Sub Total	Univ Prac	IA	Sub Total	
I	Biochemistry II	80	20	100	80	20	100	200
II	Microbiology II	80	20	100	80	20	100	200
III	Pathology II	80	20	100	80	20	100	200

Distribution of Subsidiary Subjects and marks for Second Year Examination of B.Sc. MLT

B	Subsidiary Subject**	Duration	Marks	I A Theory Marks	Total Marks
1	Sociology	3 Hours	80	20	100
2	Constitution of India	3 Hours	80	20	100
3	Environmental Science & Health	3 Hours	80	20	100

** Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges

TABLE - VI

Distribution of Subjects and marks for Third Year Examination of B.Sc MLT

Paper	Subject	Theory			Practicals			Grand Total
		Univ. exam	IA	Sub Total	Univ Prac	IA	Sub Total	
I	Biochemistry III	80	20	100	80	20	100	200
II	Microbiology III	80	20	100	80	20	100	200
III	Pathology III	80	20	100	80	20	100	200

Distribution of Subsidiary Subjects and marks for Third Year Examination of B.Sc. MLT

B	Subsidiary Subject**	Duration	Marks	I A Theory Marks	Total Marks
1	Ethics, Database Management	3 Hours	80	20	100
2	Research & Biostatistics	3 Hours	80	20	100
3	Computer Application	3 Hours	80	20	100

** Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

11. Pass criteria

11.1. First year examination

a. Main Subjects: A candidate is declared to have passed in a subject, if he/she secures, 50% of marks in University Theory exam and internal assessment added together.

b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the Commencement of the University examination.

11.2. Second and Third year Examination

- a. Main Subjects: A candidate is declared to have passed the examination in a subject if he/she secures 50% of the marks in Theory and 50% in practical separately. For a pass in theory, a candidate has to secure a minimum of 40% marks in the University conducted written examination, and 50% in aggregate in the University conducted written examination and internal assessment added together and for pass in Practical, a candidate has to secure a minimum of 40% marks in the university conducted Practical/Clinical examination and 50% in aggregate i.e. University conducted Practical/Clinical and Internal Assessment.
- b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

12. Carry over benefit

12.1 First year examination:

A candidate who fails in any two of the five main subjects of first year shall be permitted to carry over those subjects to second year. However, he/ she must pass the carry over subjects before appearing for second year examination.

12.2. Second year examination:

A candidate is permitted to carry over any one main subject to the third year but shall pass this subject before appearing for the third-year examination.

13. Declaration of Class

- a. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with Distinction.
- b. A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 60% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in First Class.
- c. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than 60% of grand total marks prescribed will be declared to have passed the examination in Second Class.
- d. A candidate passing the university examination in more than one attempt shall be placed in Pass class irrespective of the percentage of marks secured by him/her in the examination.

The marks obtained by a candidate in the subsidiary subjects shall not be considered for award of Class or Rank. [Please note, fraction of marks should not be rounded off clauses (a), (b) and (c)]

14. Eligibility for the award of Degree:

A candidate shall have passed in all the subjects of first, second and third year to be eligible for a compulsory 12 months of rotational internship. On completion of 12 months of the internship with pass criteria in outgoing clinical assessment exams the candidate is then eligible for the award of degree

15. Distribution of Type of Questions and Marks

SUBJECTS HAVING MAXIMUM MARKS= 80 (for First year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	1	10
Short Essay	5	5
Short Notes Type	5	3
Short Answer Type	10	2
MCQ's	10	1

1. Long essay- 1 Questions (answer any one)	1x10= 10 marks
2. Short essay- 7 Questions (answer any five)	05x5= 25 marks
3. Short Notes Type – 8 Questions (answer any five)	05x3= 15 marks
4. Short answer- 12 Questions (answer any ten)	10x2= 20 marks
5. MCQ's – 10 Questions	10x1= 10 marks
	Total= 80

SUBJECTS HAVING MAXIMUM MARKS= 80 (for Second and Third Year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	1	10
Short Essay	5	5
Short Notes Type	5	3
Short Answer Type	10	2
MCQ's	10	1

1. Long essay- 1 Questions (answer any one)	1x10= 10 marks
2. Short essay- 7 Questions (answer any five)	05x5= 25 marks
3. Short Notes Type – 8 Questions (answer any five)	05x3= 15 marks
4. Short answer- 12 Questions (answer any ten)	10x2= 20 marks
5. MCQ's – 10 Questions	10x1= 10 marks
	Total= 80

SUBJECTS HAVING MAXIMUM MARKS= 80 (for Subsidiary subjects)		
Type of Questions	No. of Questions	Marks for Each Questions
Essay Type	3 (2 x 10)	10
Short Essay Type	8 (6 x 5)	05
Short Answer Type	12 (10 x 3)	03

INTERNSHIP

Twelve-month compulsory rotational postings during which students have to work under the supervision of experienced staff in the following areas:

1. Clinical Pathology - 1 month
2. Hematology – 1 month
3. Clinical Biochemistry - 2 months
4. Clinical Microbiology – 1 months
5. Blood banking - 1 month
6. Phlebotomy – 1 month
7. Serology – 1 month
8. Histopathology – 1 month
9. Cytology – 1 month
10. Project work – 2 months

NOTE: - At the end of internship there will be a practical exam, conducted by one Internal and one External examiner.

Requirements for internship in the department of Clinical pathology and Blood banking-

Haematology-

1. A minimum of 50 haemograms or more per day
2. Bone marrow examination and reporting
3. All special tests for leukemias
4. Immunohistochemistry
5. One MD pathologist should be present Histopathology
 1. All his to pathological techniques should be done, both manual or/and automated- 10 specimens per day minimum.
 2. All special stains should be done.
 3. Immunohistochemistry in histopathology

Cytology

1. Minimum 10 specimens per day
2. All cytological techniques including staining technique- manual and automated should be done.
3. Cytopathologist should be there.

Blood bank

1. Minimum 10 blood collections per day
2. All facilities for testing eg. Automated cell counter, ELISA reader should be there
Facilities for component separation and storage should be there eg. Plasma and / or platelet pheresis machine, cooling centrifuge, blood bag refrigerator, deep freezer, platelet agitator etc.

Requirements for internship in the department of Clinical Biochemistry-

1. A medium sized lab performing tests on 100 samples per day or a hospital comprising of 100 beds with a lab performing tests on 100 samples.
2. Tests performed should include- routine tests and higher chemistry
 - a. Glucose
 - b. Calcium
 - c. Phosphorus
 - d. Uric acid
 - e. Electrolytes
 - f. Amylase
 - g. Lipase
 - h. Ig
 - i. Microalbumin
 - j. RFT
 - k. LFT
 - l. Lipid profile
 - m. Cardiac marker
 - n. Diabetic profile including HbA1C
 - o. Hypertension profile
 - p. Tumor markers
 - q. Hormones- LH, FSH, testosterone, prolactin
 - r. Thyroid profile
 - s. 24hrs urine protein
 - t. 24hrs urine creatinine
 - u. 24 hrs urine/ creatinine ratio

The lab should include equipments as per mentioned below-

- a. Chemiluminescence/ drug hormone analyser/ ELFA
- b. HPLC (optional)
- c. Arterial blood gas analysis (optional)
- d. ISE electrolyte analyser/ flame photometry
- e. Electrophoresis / chromatography
- f. Fully automated analyser
- g. Semi automated analyser
- h. Spectrophotometer/ colorimeter

- i. pH meter
- j. hot air oven
- k. distillation unit
- should have facility for performing calibrations for smaller equipments/ pipettes
- should run quality control materials
- should have proper guidelines for total quality management

Requirements for internship in the department of Microbiology-

Should learn collection and appropriate processing of various specimens.

1. Routine culture and sensitivity including blood culture- minimum of 10 per day
2. Serology by
 - a. Latex agglutination- 20 per day
 - b. Rapid tests- 20 per day
 - c. ELISA- 5 per day
3. Mycology-
 - a. Wet mount- 10 per day
 - b. Culture- 5 per month
4. Parasitology-
 - a. Wet mount- 20 per month
 - b. Peripheral smear for malaria and filaria- 10 per day
 - c. Quantitative buffy coat- 5 per day
5. Microscopy- minimum 10 per day
 - a. Grams stain
 - b. ZN stain
 - c. Urine wet mount
 - d. CSF India ink preparation

The lab should have the following instruments-

1. Autoclave
2. Hot air oven
3. Incubator
4. Centrifuge
5. Water distillation unit
6. Physical balance
7. Digital balance
8. Refrigerator
9. Microscope- monocular, binocular, fluorescent microscope
10. ELISA reader
11. Micropipettes
12. Laminar air flow
13. Water bath
14. VDRL shaker

The responsibilities that the students should learn during their internship in the department of microbiology-

- Preparation of media
- Sterilization
- Preparation of reagents
- Handling instruments
- Waste disposal
- Maintenance of microscopes
- Calibration of instruments

PROJECT

Each student is encouraged to take up a research project in the area of his/her liking. The project should be original and should have considerable clinical relevance. The concerned faculty members guide the student in his/her project. After completing the project, each student has to submit a complete report of their respective projects

PROJECT GUIDELINES

All B.Sc MLT degree students enrolled in the Sri Siddhartha Academy of Higher Education should complete a scholarly project as partial fulfillment of requirements for the award of B.Sc M LT (MEDICAL LABORATORY TECHNOLOGY) degree.

What is a project?

A Project is a preliminary form of research. It is an independent investigation. It is very largely the student's own work and is to be pursued by them from the inception till completion. It involves the student in a hands-on project led by a research supervisor/ faculty advisor who will choose, develop and guide the project from its inception to completion.

Purpose of a project work

The purpose of the Project Work is to enable the student to gain practical experience. It enables the student to meet program objectives through development of an appreciation of the interrelations between theory research and practice. A project forms an introduction to scientific thinking and working.

Project suggestions

Prior to the practical work, students work out a concept with their supervisor that could include any of the following points:

- Scientific question
- Educational objectives (which methods have to be mastered and understood)
- Recent trends in the respective fields
- Case study
- Prospective studies
- Retrospective studies

This scholarly project provides the student with the opportunity to participate in a mentored research experience. The student will actively participate in a research project throughout all current applicable phases of the project such as the case study, problem statement development, review of the literature, hypotheses formation, proposal writing, study design, data collection, data analysis, and result reporting. This may be done as a group project.

Project supervision

The supervisor schedules the project work together with the student and provides an introduction to all laboratory skills that are needed. She or he is then the contact person for all questions and problems during the project. If required, she or he may also ask for a progress report and preliminary results while the project is still ongoing.

The eligibility academic qualification and teaching experience required for recognition as research supervisor and faculty advisor by the SSAHE are:

- a. Eligibility to be a research supervisor and faculty advisor
Shall be a full time teacher in the college or institution where he or she is working.
- b. Academic qualification and teaching/professional experience for each branch
 - Research supervisor (RS)- five years of teaching/ professional experience after the postgraduate qualification in a teaching institution or laboratory approved by SSAHE
- Faculty advisor (FA)- three years of teaching/ professional experience after the postgraduate qualification in a teaching institution or laboratory approved by SSAHE
- c. Age:
The age of the RS/ FA shall not exceed 65 years.

Assessment

Four copies of the project report should be submitted to the Principal along with a soft copy (CD), three months before the Internship Practical examinations. Projects are assessed with a written report and a seminar. The written report and the presentation, as well as the practical work in the laboratory are to be assessed during Internship Practical Examination.

GUIDELINES FOR THE PREPARATION OF PROJECT REPORTS

1. The project report should be typed in Times New Roman. The size of the titles should be 14 and Bold and the size of the subtitles should be 12 and bold.
2. The matter should have double spacing except for long quotations, footnotes and endnotes, which are single spaced. The left-hand margin must be 1.5", other margins should be 1.0".
3. The project report should be hardbound.
4. The project report should be organized in the following subdivisions:
 - a. Title page
 - b. Certificate
 - c. Acknowledgement
 - d. List of abbreviations used
 - e. Table of contents
 - f. Introduction
 - g. Main project
 - h. Summary of the project work
 - i. List of references
 - j. Annexures

a. Title page

<-----Title----->

<-----Subtitle----->

by

Name of the Candidate

Project Report

In partial fulfillment
of the requirements for the degree of
Degree Name

in

Subject Name

Under the guidance of

Name of the RS and FA

Name of the Department

Name of the College

Place

Year

b. Certificate

CERTIFICATE BY THE RESEARCH SUPERVISOR

This is to certify that the project report entitled "<-----Title-----
----->" is a bonafide research work done by Name of the Candidate in partial
fulfillment of the requirement for the degree of Degree Name.

Signature of the Research Supervisor

Name

Designation & Department

Date:

Place:

ENDORSEMENT BY THE HOD, PRINCIPAL/HEAD OF THE INSTITUTION

This is to certify that the project report entitled "<-----Title-----
----->" is a bonafide research work done by Name of the Candidate under
the guidance of Name & designation of the Guide.

Seal & Signature of the HOD

Seal & Signature of the Principal

Name

Name

Date:

Place:

c. Acknowledgement

The inclusion of a paper of Acknowledgment is a traditional practice in the write up of the Project Work. This permits the candidate to write a brief perface and acknowledge the help received from persons and organizations.

d. List of abbreviations used

e. Table of Contents

f. Introduction

This section includes a brief write up about the topic, its scope and importance as well as relation to any previous studies done in the particular topic. It should also mention any present developments.

g. The main project

The main project should be divided into various sections as per the demand of the topic.

h. Summary of the project work

i. List of References (Vancouver Style)

References should be numbered consecutively in the order in which they are first mentioned in the text; they should not be listed alphabetically by author or title or put in date order.

j. Annexures

POINTS TO KEEP IN MIND

- The project work should be an original document and, candidates should maintain the originality.
- The candidate should not copy or reproduce anyone else's published or unpublished project.
- Any arguments that are put forward in the project should be supported with appropriate data.
- Proper documentation of the information is very important.
- The methodology to be used should be very clearly stated in the beginning of the work.
- Plagiarism should be avoided.

CLINICAL POSTING:

A student after having successfully completed the final year university examination is qualified to commence the Compulsory Rotatory ONE year Internship. The completion of Internship is mandatory to enable a student to obtain the B.Sc MLT degree.

GUIDELINES

- Interns should complete postings in all specialities as decided by the department
- The interns should conduct themselves in a manner befitting the profession.
- The intern should dress appropriately in the clinical areas
- It is mandatory for the intern to wear the white apron with nametag while attending clinics
- Each intern should maintain a logbook wherever he/she is posted. The intern has to get signature from the supervising staff at the end of each posting
- Log book should be submitted to the Head of the department at the end of each posting of internship after the period of posting
- Assignments/presentations given during the period of internship has to be duly undertaken and performed.
- Internship completion certificate will be issued from the College office only after passing in the Internship Practical Examination.
- The intern in the parent institute will get a monthly stipend.
- The intern will be allowed to attend the National Conference, leave will be granted only for the days of conference and travel days. Any other leave declared by the University for the students will not apply to the interns

I YEAR B.Sc. MLT

ANATOMY

Theory: 70hrs

Practicals: 20hrs

Chapter 1: Introduction:

Theory:

- Definition of anatomy and its divisions
- Terms of location, positions and planes
- Epithelium-definition, classification, describe with examples, function
- Glands- classification, describe serous, mucous & mixed glands with examples
- Basic tissues – classification with examples

Practical:

- Histology of types of epithelium
- Histology of serous, mucous & mixed salivary gland

Chapter 2: Connective tissue:

Theory:

- Cartilage – types with example & histology theory
- Bone – Classification, names of bone cells, parts of long bone, microscopy of compact
- bone, names of all bones, vertebral column, intervertebral disc, fontanelles of fetal skull
- Joints – Classification of joints with examples, synovial joint (in detail for radiology)
- Muscular system: Classification of muscular tissue & histology
- Names of muscles of the body

Practical:

- Histology of the 3 types of cartilage
- Histology of compact bone (TS & LS)
- Histology of skeletal (TS & LS) & cardiac muscle
- Demo of all bones showing parts, radiographs of normal bones & joints
- Demonstration of important muscles of the body

Chapter 3: Cardiovascular system:

Theory:

- Heart-size, location, chambers, exterior & interior, pericardium
- Blood supply of heart
- Systemic & pulmonary circulation
- Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery
- Inferior vena cava, portal vein, portosystemic anastomosis, Great saphenous vein, Dural venous sinuses
- Lymphatic system- cisterna chyli & thoracic duct, Histology of lymphatic tissues, Names of regional lymphatics, axillary and inguinal lymph nodes in brief

Practical:

- Demonstration of heart and vessels in the body
- Histology of large artery & vein, medium sized artery & vein
- Histology of lymph node, spleen, tonsil & thymus
- Radiology: Normal chest radiograph showing heart shadows

Chapter 4: Gastro-intestinal system

Theory:

- Parts of GIT: Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring), Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas, spleen, peritoneum & reflections

Practical:

- Demonstration of parts of GIT
- Radiographs of abdomen

Chapter 5: Respiratory system

- Parts of RS: nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments, diaphragm
- Histology of trachea, lung and pleura
- Names of paranasal air sinuses

Practical:

- Demonstration of parts of respiratory system.
- Normal radiographs of chest, X-ray paranasal sinuses
- Histology of lung and trachea

Chapter 6: Urinary system

Theory:

- Kidney, ureter, urinary bladder, male and female urethra
- Histology of kidney, ureter and urinary bladder

Practical:

- Demonstration of parts of urinary system
- Histology of kidney, ureter, urinary bladder
- Radiographs of abdomen-IVP, retrograde cystogram

Chapter 7: Reproductive system

Theory:

- Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology)
- Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology)
- Mammary gland – gross

Practical:

- Demonstration of section of male and female pelvis with organs in situ
- Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes, ovary
- Radiographs of pelvis – hysterosalpingogram

Chapter 8: Endocrine glands

Theory:

- Names of all endocrine glands in detail on pituitary gland, thyroid gland & suprarenal gland – (gross & histology)

Practical:

- Demonstration of the glands
- Histology of pituitary, thyroid, parathyroid, suprarenal glands

Chapter 9: Nervous system

Theory:

- Neuron & Classification of NS
- Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (gross & histology) Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei
- Blood supply of brain
- Cranial nerves
- Sympathetic trunk & names of parasympathetic ganglia

Practical:

- Histology of peripheral nerve & optic nerve
- Demonstration of all plexuses and nerves in the body
- Demonstration of all part of brain
- Histology of cerebrum, cerebellum, spinal cord

Chapter 10: Sensory organs**Theory:**

- Skin: Skin-histology & Appendages of skin
- Eye: Parts of eye & lacrimal apparatus, Extra-ocular muscles & nerve supply
- Ear: parts of ear- external, middle and inner ear and contents

Practical:

- Histology of thin and thick skin
- Demonstration and histology of eyeball
- Histology of cornea & retina

Chapter 11: Embryology:**Theory:**

- Spermatogenesis & oogenesis
- Ovulation, fertilization
- Fetal circulation
- Placenta

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

PHYSIOLOGY

Theory 70 hours

Practical 20hours

1. General Physiology

Introduction to cell physiology, transport across cell membrane Homeostasis, Body Fluid compartment & measurement.

2. Blood

Introduction- composition and function of blood Plasma. proteins, types and functions

Red blood cells - erythropoiesis, stages of differentiation, factors affecting it, function, normal count, physiological variation.

Hemoglobin- function, concentration, types & methods of Hb estimation, fate of hemoglobin Jaundice-types Anaemia,-types

ESR, PCV, osmotic fragility & blood indices

WBC- morphology, production, functions, normal count, differential count, variation, variation Immunity (in brief)

Platelets- origin, morphology, normal count, function-Platelet plug ,bleeding disorder

Haemostasis - definition, normal haemostasis, clotting factors, mechanism of clotting, anticoagulants disorders of clotting factors.

Blood group-ABO & Rh system, Rh incompatibility blood typing ,cross matching, hazards of mismatched blood transfusion

RES, spleen and lymph.

3. Nerve-Muscle

Neuron structure, types, neuroglia-types, nerve fibre classification, properties of nerve fibres, RMP,action potential, wallerian degeneration

NMJ, blockers, Myasthenia gravis

Classification of muscle, structure of skeletal muscle, sarcomere, contractile proteins

Excitation contraction coupling, mechanism of muscle contraction, types of contraction

Motor unit, fatigue, rigor mortis Smooth muscle.

4. Respiratory system

Physiological anatomy of respiratory system, muscles of respiration, respiratory & non respiratory functions of lungs, dead space

Mechanics of breathing, intrapulmonary & pleural pressures Compliance, Surfactant, Hyaline membrane disease

Lung volumes and capacities

Respiratory membrane , transport of O₂ & CO₂

Chemical regulation of respiration Neural regulation of respiration Hypoxia, Acclimatization, Dysbarism. Artificial respiration

Definition-Periodic breathing, dyspnoea, apnoea, asphyxia,, cyanosis.

5. Cardiovascular system

Introduction to CVS & general principles of circulation Properties of Cardiac muscle

Cardiac cycle, heart sounds, Pulse Cardiac output, factors and measurement Heart rate

BP-factors, measurement, Short term regulation Intermediate and long term regulation of BP

ECG uses and significance, .normal waveform, heart block Coronary circulation, Cutaneous circulation-Triple response Shock

Effects of exercise on CVS and Respiratory system.

6. Renal system, Skin and body temperature

Kidneys- functions, structure of nephron, type, juxtaglomerular apparatus-structure and function, non- excretory functions of kidney

Glomerular filtration rate (GFR)- Definition ,normal value, factors affecting GFR Tubular reabsorption - sites, substance reabsorbed, mechanisms of reabsorption Tubular secretion- sites, substance secreted, mechanisms of reabsorption

Counter current mechanism of concentration of urine Obligatory and Facultative reabsorption of water Micturition reflex, Diuretics

Artificial kidney, renal function tests-clearance tests

Skin -structure and function, body temperature measurement, physiological variation,

Regulation of body Temperature by physical chemical and nervous mechanisms-Role of Hypothalamus Hypothermia and fever.

7. Digestive system

Physiological anatomy, Enteric nervous system & functions of GIT Saliva- composition, regulation, disorder.

Deglutition- stages & disorders

Stomach-functions, composition and regulation of gastric juice Gastric motility, MMC, vomiting reflex.

Pancreas- function, composition and regulation of pancreatic juice

Liver & gall bladder-functions, bile- composition, secretion and regulation Small

intestine- Succus entericus-composition, functions & movements Large intestine- functions, movements and defecation reflex

Digestion & absorption of Carbohydrates, fats and proteins.

8. Endocrine system

Classification of Endocrine glands & their hormones & properties-chemistry and receptor, feedback mechanisms of hormone regulation.

Anterior pituitary hormones- secretion, functions , disorders Posterior pituitary

hormones- secretion , functions , disorders Thyroid hormones- secretion, functions,

Disorders Parathyroid hormones- secretion, functions, disorders Calcium homeostasis &

disorders Pancreatic hormones, -Insulin and Glucagon- . secretion, functions, disorders

Adrenal cortex- Glucocorticoids & Mineralocorticoids, Androgen - secretion, functions,

disorders Adrenal medulla- secretion, functions, disorders Thymus & Pineal gland.

9. Reproductive system

Introduction to reproductive system, sex differentiation & Puberty Male reproductive system, functions of testosterone & Spermatogenesis

Female reproductive system, functions of Estrogen, Progesterone, Oogenesis Ovulation & Menstrual cycle

Physiological changes during pregnancy, pregnancy tests, parturition & lactation Male & Female contraceptive methods.

10. Central nervous system

Introduction to CNS, Sensory receptors classification, properties Synapse– classification, properties

Sensory pathways: Anterior spino thalamic tract and Posterior column pathway

Lateral spino thalamic tract, Types of pain, Referred pain, Thalamus; nuclei and function

Classification of reflexes, Monosynaptic reflex- Stretch reflex , muscle spindle ,inverse stretch reflex. Polysynaptic reflex-Withdrawal reflex

Motor pathways : Pyramidal pathway and functions, UMNL, LMNL Cerebral cortex (Sensory and motor)-functions, Medulla and Pons-functions Cerebellum –functions, disorders

Basal ganglia-functions, disorders Hypothalamus and Limbic system-functions CSF, lumbar puncture

Sleep, EEG,

Autonomic Nervous System - Sympathetic and parasympathetic distribution and functions.

11. Special senses

Vision –Functional anatomy of eye, visual pathway, lesion Refractive errors, color vision

Audition – Physiological anatomy of ear, Mechanism of hearing, auditory pathway,

deafness Olfaction –modalities, receptor, function, abnormalities

Gustation-modalities, receptor, function, taste pathway, abnormalities.

Practicals

Blood pressure Recording

Auscultation for Heart Sounds

Artificial Respiration

Determination of vital capacity

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

REFERENCE BOOKS:

1. Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism Publishers
2. Chatterjee (CC) Human Physiology Latest Ed. Vol. 1, Medical Allied Agency
3. Choudhari (Sujith K) Concise Medical Physiology Latest Ed. New Central Book
4. Ganong (William F) Review of Medical Physiology. Latest Ed. Appleton

BIOCHEMISTRY I

No. Theory classes: 70 hours

No. Practical classes: 20 hours

1. Carbohydrate Chemistry [3 hours]

- Classification (Definition/ examples for each class)
- Monosaccharides (classification depending upon number of carbon atoms and functional group with examples)
- Disaccharides (Sucrose/ lactose/ maltose and their composition)
- Polysaccharides:
 - a) Homopolysaccharides (Structure of starch and glycogen)
 - b) Heteropolysaccharides (Functions).

2. Lipid Chemistry [3 hours]

- Definition of lipids
- Functions of lipids in the body
- Classification of lipids (subclasses with examples)
- Definition and Classification of fatty acids
- Essential fatty acids
- Phospholipids and their importance

3. Amino-acid and Protein Chemistry [3 hours]

- General structure of D and L amino acids
- Amino acids; Definition and Classification of amino acids with examples.
- Peptides; definition & Biologically important peptides
- Classification of Proteins based on composition, functions and shape (with examples)
- Functions of amino acids and Proteins.

4. Nucleotide and Nucleic acid Chemistry [3 hours]

- Nucleosides & Nucleotides
- Nucleic acid Definition & types
- Composition & functions of DNA & RNA
- Structure of DNA (Watson and Crick model)
- Structure of tRNA, & functions of tRNA, rRNA, mRNA
- Difference between DNA and RNA.

5. Enzymes [5 hours]

- Definition & Classification of Enzymes with example
- Definitions of Active site, Cofactor (Coenzyme, Activator),
- Proenzyme; Definition and examples (Pepsin & trypsin).

6. Digestion and Absorption [3 Hours]

- General characteristics of digestion and absorption,
- Digestion and absorption of carbohydrates, proteins and lipids.

7. Carbohydrate Metabolism [5 Hours]

- Glycolysis ; Aerobic, Anaerobic, Definition , Site and subcellular site , Steps with all the enzymes and coenzymes at each step , mention the regulatory enzymes , Energetics,
- Citric acid cycle; Pyruvate dehydrogenase complex (reaction and coenzymes) , Site and subcellular site , Reactions with all the enzymes and coenzymes ,Regulatory enzymes , Energetics
- Significance of HMP Shunt pathway.
- Hyperglycemic and hypoglycemic hormones
- Blood Glucose Regulation.
- Diabetes mellitus (definition, classification, signs and symptoms)
- Glycogen metabolism and gluconeogenesis.

8. Lipid Metabolism [4 Hours]

- Introduction to lipid metabolism, Lipolysis
- Beta oxidation of fatty acids ; Definition ,Site and subcellular site , Activation of palmitic acid , Transport of activated palmitic acid into mitochondria , Reactions , Energetics.
- Name the different ketone bodies . Note on ketosis.

9. Amino acid and Protein Metabolism [3 Hours]

- Introduction, transamination, deamination, Fate of ammonia, transport of ammonia,
- Urea cycle.

10. Vitamins [5 Hours]

- Definition and classification .
- RDA, sources, coenzyme forms, biochemical functions and disorders for the following water soluble vitamins: Thiamine, Niacin, Pyridoxine, Cobalamine, Folic acid, Ascorbic acid
- RDA, sources, coenzyme forms, biochemical functions and deficiency disorders for the following fat soluble vitamins; A and vitamin D.

11. Mineral Metabolism [3 Hours]

- Name the macro/ microminerals
- Iron: Sources ,RDA, Functions and Disorders of deficiency and excess
- Calcium and phosphorus: Sources ,RDA, functions, normal serum levels and hormones regulating their levels.

12. Nutrition [6 hours]

- Balanced diet (Definition)
- Caloric value ; Definition , Caloric values of carbohydrates, proteins and fats
- Total daily caloric requirements of an adult male and female,
- RDA (Definition, standard values for nutrients)
- Basal metabolic rate(BMR) ; Definition , Magnitude of BMR in men and women, Factors affecting BMR
- Thermic effect/ SDA of food (Definition, values for major macronutrients)
- Carbohydrates ;. Daily dietary requirement. 2. Dietary fibers (Definition, functions, importance and their daily requirements)
- Proteins ;. Daily requirement , Biological value. a. Definition b. Protein used as a

standard for this, Protein sources with high and low biological value , Mutual supplementation of proteins (Definition, examples).

- Fats ; Daily requirement , Essential fatty acids (Definition, functions, daily requirement and deficiency manifestations) , Saturated and unsaturated fatty acids (Definition, sources, examples).
- Malnutrition

13. Renal Function Tests [2 hours]

- Name the different tests to assess the kidney functions
- Explain Creatinine clearance & Inulin clearance
- Urinary acidification test

14. Radioactive Isotopes [1 hour]

- Definition, clinical applications
- Biological effects of radiations

15. Clinical Biochemistry [5 hours]

- A. Definitions of acid, base, pH and pKa [1 hour]
- B. Buffers • Definition [2 hours]
 - Henderson Hasselbalch equation,
 - Principal buffer systems in the ECF ICF and urine
 - Bicarbonate and phosphate buffer systems (pKa value, normal ratio of base/acid in the plasma)
 - Acidosis & Alkalosis (Definition, classification, causes and biochemical findings
- C. Normal serum levels and condition where they are altered [2 hour]
 - Glucose, Protein, urea, uric acid, and creatinine
 - Bilirubin, cholesterol
 - Serum Electrolytes

16. Fundamental Chemistry (1 hour)

- Valency, Molecular weight & Equivalent weight of elements and compounds. Normality, Molarity, Molality.

17. Solutions: Definition, use, classification where appropriate, preparation and storage (5 hours)

- Stock and working solutions.
- Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H₂SO₄, H₃PO₄, CH₃COOH etc.,)
- Preparation of percent solutions – w/w, v/v w/v (solids, liquids and acids), Conversion of a percent solution into a molar solution
- Saturated and supersaturated solutions
- Standard solutions. Technique for preparation of standard solutions and Storage. E.g: glucose, albumin etc.
- Dilutions- Diluting Normal , Molar and percent solutions. Preparing working standard from stock standard.

- Part dilutions: Specimen dilutions. Serial dilutions. Reagent dilution. Dilution factors.

ASSIGNMENT TOPICS

1. Units of measurement
2. Hazards - Physical, Chemical, Biological
3. Arterial blood gas analysis
4. Responsibilities of Health care personnel
5. Biomedical waste management

PRACTICAL DEMONSTRATION [20 hours]

- Color Reactions of Carbohydrates & amino acids.
- Precipitation Reactions of proteins
- Colorimetry
- Estimation of Blood glucose Folin Wu and enzymatic method
- Estimation of Urea by DAM method

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

Text Book References

- Biochemistry – 3rd revised edition by U Sathyanarayana & U Chakrapani
- Textbook of Medical Biochemistry-6th Edition by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology 2nd edition by Godkar and Godkar.
- Biochemistry-3rd edition by Pankaja Naik
- Medical Laboratory technology 6th edition by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students-3rd edition by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry, 4th, 5th and 6th editions.

PATHOLOGY I

(Clinical Pathology, Hematology and Blood Banking)

Theory-70 hours

Practicals-20 hours

I. Clinical Pathology- Theory

- Introduction to clinical pathology
- Collection , transport, preservation and processing of various clinical specimens
- Urine examination- collection and preservation, Physical, chemical and microscopic examination for abnormal constituents
- Examination of Body fluids
- Examination of Cerebrospinal fluid (CSF)
- Sputum examination
- Examination of feces

II. Hematology – Theory

- Introduction to hematology
- Normal constituents of Blood, their structure and functions
- Collection of Blood samples
- Various anticoagulants used in Hematology
- Hemoglobin estimation, different methods and normal values
- Packed cell volume
- Erythrocyte sedimentation rate
- Normal Haemostasis
- Bleeding time. Clotting time, prothrombin time, Activated partial Thromboplastin time

III. Blood Bank- Theory

- Introduction blood banking
- Blood group system
- Collection and processing of blood for transfusion
- Compatibility testing
- Blood transfusion reactions

IV General Pathology:

1. Cell injury:

- a. Definition, causes.
- b. Cellular adaptations – Hypertrophy, hyperplasia, atrophy and metaplasia.
- c. Types of cell injury – Reversible and irreversible; morphology of reversible injury.
- d. Necrosis – Definition and patterns of tissue necrosis.
- e. Intracellular accumulations – Lipids, cholesterol, proteins, glycogen and pigments; examples.
- f. Pathologic calcification – Types and examples.

2. Inflammation:

- a. Definition and signs of inflammation.
- b. Types – Acute and chronic inflammation.
- c. Acute inflammation – Causes, morphological patterns and outcome.
- d. Chronic inflammation – Causes, morphology and examples.
- e. Regeneration and repair – Mechanism of cutaneous wound healing.
- f. Factors affecting wound healing.

3. Hemodynamic disorders:

- a. Edema – Definition, pathogenesis and types: Renal, cardiac, pulmonary and cerebral.
- b. Difference between transudate and exudate.
- c. Shock – Definition, types of shock with examples: Hypovolemic, cardiogenic and septic shock, stages of shock: Nonprogressive, progressive and irreversible.
- d. Thrombosis – Definition, mechanism of thrombus formation (Virchow's triad) and fate of thrombus.
- e. Embolism – Definition and types: Thromboembolism, fat, air and amniotic fluid embolism.
- f. Infarction – Definition and examples.

4. Immune system:

- a. Autoimmune diseases – General features, enumerate systemic and organ specific autoimmune diseases.
- b. Systemic lupus erythematosus – Manifestations and diagnosis.

5. Neoplasia:

- a. Definition and nomenclature of tumors.
- b. Differences between benign and malignant neoplasms.
- c. Enumerate modes of carcinogenesis: Genes, physical, chemical and microbial agents of carcinogenesis.

- d. Modes of spread of tumors.
- e. Clinical aspects of neoplasia.
- f. Grading and staging of cancers.
- g. Laboratory diagnosis of cancer.

Practicals

1. Urine analysis- Physical, Chemical, Microscopic
2. Blood grouping and Rh typing
3. Hb estimation , packed cell volume (PCV), Erythrocyte Sedimentation rate (ESR)
4. Bleeding time and Clotting time
5. Histopathology - section cutting and H&E staining.

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	10

REFERENCE BOOKS:

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss- Cytology
4. Winifred Diagnostic cytopathology
5. Orell Cytopathology
6. Todd and Sanford- clinical diagnosis by Laboratory Medicine
7. Dacie and Lewis- Practical Hematology
8. Ramnik SOOD. Lab technology, Methods and interpretation, 4 th edition JP Bros New Delhi, 1996
9. Sathish Guptha , Short text book of Medical laboratory techniques for technicians
10. Sachdev K N. Clinical Pathology and Bacteriology, 8 th edi JP Bros, New Delhi, 1996.

Microbiology I

Theory: 70 Hours

Practicals: 20 Hours

1. Introduction (6 hrs)

History of Microbiology - Louis Pasteur, Antony Van Leeuwenhoek, Robert Koch, Edward Jenner, Alexander Fleming.

Use of microscope in the study of bacteria - Types of microscopes - compound microscope, phase contrast microscope, electron microscope, fluorescent microscope, dark ground microscope.

Morphology of bacterial cell

2. Growth and Nutrition (6 hrs.)

Nutrition, growth and multiplication of bacteria, bacterial growth curve, culture media, culture methods, anaerobic culture methods.

3. Sterilization and disinfection (8 hrs.)

Principles and use of equipments of sterilization, chemicals used in disinfection, testing of disinfectants.

4. Biomedical waste management principle and practice

5. Immunology (5hrs.)

Immunity - mechanism of immunity, classification, types

Vaccines

Immunization schedule

Definition of antigen, antibody, list of antigen antibody reaction (no need of detailed account of antigen antibody reactions)

Definition of hypersensitivity and classification (no need of detailed account of types of hypersensitivity)

6. Infection (5 hrs.)

Definition, types and mode of transmission

Hospital acquired infection - causative agents, mode of transmission and prophylaxis.

Antimicrobial sensitivity testing

7. Systematic bacteriology (15 hrs.)

Disease caused and laboratory diagnosis of medically important bacteria (Staphylococcus, coagulase negative Staphylococcus, MRSA, Streptococcus pyogenes, Pneumococcus, gonococcus, E.coli, diarrhoeagenic E.coli, Salmonella, Vibrio cholerae, ElTor vibrios, Halophilic vibrios, Shigella, Mycobacterium tuberculosis, Mycobacterium leprae, Atypical Mycobacteria, Treponema pallidum, leptospira)
(no need of classification, antigenic structure, virulence mechanism)

8. Parasitology (10 hrs.)

Introduction to Parasitology

List of medically important parasites and diseases (E.histolytica, Plasmodium, W.bancrofti, Ascaris, Ancylostoma, B.coli, G.lamblia, T.solium, T.saginata)

Laboratory diagnosis of parasitic infection (No need of including life cycles)

9. Virology (10 hrs.)

Introduction to virology

List of medically important viruses and diseases (AIDS, Hepatitis, Rabies, Polio, Arbo viruses)

Cultivation of viruses and laboratory diagnosis of viral infections

10. Mycology (5 hrs.)

Introduction to Mycology

Classification of medically important fungi - (based on morphology, spore production, disease production, taxonomy)

List of medically important fungi and diseases (Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis, Mucor Mycosis)

Laboratory diagnosis of fungal infections.

Practicals (20 hrs.)

Compound microscope (Demonstration)

Demonstration of sterilization equipments

Demonstration of culture media and culture methods

Demonstration of antibiotic sensitivity testing

Demonstration of serological tests - Widal, VDRL, ASO, CRP, RA

Demonstration of gram stain and ZN staining

Demonstration of Helminthic ova

Grams stain, Acid fast staining

Stool exam for Helminthic ova

There shall be no university practical examination and Internal Assessment marks secured in practicals need not be sent to the university.

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	10

Reference Books-

1. Ananthanarayana & Panikar Medical Microbiology- University Press
2. Robert Cruickshank- Medical Microbiology- The Practice of Medical Microbiology
3. Chatterjee- Parasitology- Interpretation to Clinical Medicine
4. Rippon- Medical Mycology
5. Emmons- Medical Mycology
6. Basic Laboratory methods in Parasitology, J P Bros, New Delhi
7. Basic Laboratory procedures in clinical bacteriology, J P Bros, New Delhi
8. Medical Parasitology- Ajit Damle
9. Introduction to medical microbiology- Ananthanarayana- Orient Longman Pvt. Ltd.

SUBSIDIARY SUBJECTS

ENGLISH

COURSE OUTLINE

COURSE DESCRIPTION: This course is designed to help the student acquire a good command and comprehension of the English language through individual papers and conferences.

BEHAVIOURAL OBJECTIVES:

The student at the end of training is able to

1. Read and comprehend English language
2. Speak and write grammatically correct English
3. Appreciates the value of English literature in personal and professional life.

UNIT - I: INTRODUCTION:

Study Techniques

Organisation of effective note taking and logical processes of analysis and synthesis Use of the dictionary

Enlargement of vocabulary Effective diction

UNIT - II: APPLIED GRAMMAR:

Correct usage

The structure of sentences The structure of paragraphs Enlargements of Vocabulary

UNIT - III: WRITTEN COMPOSITION:

Precise writing and summarizing Writing of bibliography Enlargement of Vocabulary

UNIT - IV: READING AND COMPREHENSION:

Review of selected materials and express oneself in one's words. Enlargement of Vocabulary.

UNIT - V: THE STUDY OF THE VARIOUS FORMS OF COMPOSITION:

Paragraph, Essay, Letter, Summary, Practice in writing

UNIT - VI: VERBAL COMMUNICATION:

Discussions and summarization, Debates, Oral reports, use in teaching

Scheme of Examination

Written (Theory): Maximum Marks: –80 marks. No Practical or Viva voce examination

SUBJECTS HAVING MAXIMUM MARKS= 80 (for First year)		
Type of Questions	NO. of questions	Marks for Each Questions
Essay Type	3 (2 x 10)	10
Short Essay Type	8 (6 x 5)	05
Short Answer Type	12 (10 x 3)	03

This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%

REFERENCE

1. English Grammar Collins, Birmingham University, International Language Data Base, Rupa & Co. 1993
2. Wren and Martin - Grammar and Composition, 1989, Chanda & Co, Delhi

3. Letters for all Occasions. A S Myers. Pub - Harper Perennial
4. Spoken English V. Shasikumar and P V Dhanija. Pub. By: Tata Mcgraw Hill, New Delhi
5. Journalism Made Simple D Wainwright
6. Writers Basic Bookself Series, Writers Digest series
7. Interviewing by Joan Clayton Platkon
8. Penguin Book of Interviews.

HEALTH CARE

Teaching Hours : 40 Introduction to Health

Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept.

National Health Policy

National Health Programmes (Briefly Objectives and scope) Population of India and Family welfare programme in India **Introduction to Nursing**

What is Nursing ? Nursing principles. Inter-Personnel relationships. Bandaging : Basic turns; Bandaging extremities; Triangular Bandages and their application.

Nursing Position, Bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's positions, comfort measures, Aids and rest and sleep.

Lifting And Transporting Patients: Lifting patients up in the bed. Transferring from bed to wheel chair. Transferring from bed to stretcher.

Bed Side Management: Giving and taking Bed pan, Urinal : Observation of stools, urine. Observation of sputum, Understand use and care of catheters, enema giving.

Methods of Giving Nourishment: Feeding, Tube feeding, drips, transfusion Care of Rubber Goods

Recording of body temperature, respiration and pulse, Simple aseptic technique, sterilization and disinfection. Surgical Dressing: Observation of dressing procedures

First Aid :

Syllabus as for Certificate Course of Red Cross Society of St. John's Ambulance Brigade.

Reference Books:

1. Preventive and Social Medicine by J.Park
2. Text Book of P & SM by Park and Park
3. Counseling & Communicate skills for medical and health, Bayne- Orient Longman Pvt. Ltd.

Scheme of Examination

Written (Theory): Maximum Marks: –80 marks. No Practical or Viva voce examination

SUBJECTS HAVING MAXIMUM MARKS= 80 (for First year)		
Type of Questions	NO. of questions	Marks for Each Questions
Essay Type	3 (2 x 10)	10
Short Essay Type	8 (6 x 5)	05
Short Answer Type	12 (10 x 3)	03

This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%.

II YEAR B.Sc. MLT

BIOCHEMISTRY II

No. Theory classes: 100 hours No.

Practical classes: 80 hours

THEORY SYLLABUS

1. Clinical Laboratory [02 hours]

- Responsibilities of health care personnel
- Laboratory hazards – physical, chemical and biological, laboratory safety measures– safety regulations and first aid in laboratory

2. Laboratory apparatus :

Different types, use, care and maintenance (Where appropriate, diagrams to be drawn in practical record) [10 hours]

- **Glass ware in laboratory – Significance of boro silicate glass.**
- Plastic ware in laboratory
- Cleaning of glass ware and plastic ware
- Pipettes - Glass and Automated
- Burettes, Beakers, Petri dishes, Porcelain dish
- Flasks - different types (volumetric, round bottomed, Erlenmeyer, conical etc.,)
- Funnels – different types (Conical, Buchner etc.,)
- Bottles – Reagent, Wash bottles
- Measuring cylinders, reagent dispensers
- Tubes – Test tube, Centrifuge tube, Folin-Wu tube
- Cuvettes and its use in measurements , cuvettes for visible and UV range
- Racks – Bottle, Test tube, Pipette and draining racks
- Tripod stand, Wire gauze, Bunsen burner, Dessicator, Stop watch, timers

3. Instruments: Use, care and maintenance (Where appropriate, pictures/diagrams and schematic diagrams to be drawn in practical record) [17hours]

- Water bath, Oven & Incubators, Distillation apparatus - water distillation plant and water deionisers, Reflux condenser, Cyclomixers , Magnetic stirrer, Shakers
- Refrigerators, Deep freezers, Cold box
- Centrifuges*: Principle, Svedberg unit, centrifugal force, centrifugal field, rpm, Conversion of G to rpm and vice versa) Components, working. Different types of centrifuges
- Laboratory balances*: Physical and analytical. Mono & double pan, Electronic balances. Weighing different types of chemicals, liquids, hygroscopic compounds etc. Precautionary measures while handling (Diagram)
- Photometry - Colorimeter*- Principle, limitations of Beer-lambert's law, components, working.
- pH meter*- Principle, components-

- pH measuring electrodes, Working, Precautions taken while handling. (Diagram of pH meter) (***Diagrams mandatory**)

4. Units of measurement [1 hour]

- Metric system. Common laboratory measurements, Prefixes in metric system
- International system of units- SI units- definition, classification, Conversion of conventional and SI Units

5. Fundamental Chemistry[2 hours]

Valency, Molecular weight & Equivalent weight of elements and compounds. Normality, Molarity, Molality.

6. Solutions: Definition, use, classification where appropriate, preparation and storage [7 hours]

- Stock and working solutions.
- Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H₂SO₄, H₃PO₄, CH₃COOH etc.,)
- Preparation of percent solutions – w/w, v/v w/v (solids, liquids and acids), Conversion of a percent solution into a molar solution
- Saturated and supersaturated solutions
- Standard solutions. Technique for preparation of standard solutions and Storage. E.g: glucose, albumin etc.
- Dilutions- Diluting Normal, Molar and percent solutions. Preparing working standard from stock standard. Part dilutions: Specimen dilutions. Serial dilutions. Reagent dilution. Dilution factors.

7. Chemistry of Carbohydrates; [5 hours]

Structural properties- Stereoisomerism, optical activity, cyclic structures, mutarotation, epimers.

- Monosaccharide's of biological importance .Important chemical reactions – formation of furfural derivatives, enediols, osazones, sugar acids, sugar alcohols , Deoxy sugars, Biomedical importance of Amino sugars, glycosides.
- Disaccharides; Properties of Maltose, Lactose, Sucrose. Invert sugars. Biomedical importance of Lactose, sucrose.
- Polysaccharides; Properties of Starch & Glycogen . Biomedical importance of Inulin. Mucopolysaccharides – composition, tissue distribution and functions.

8. Chemistry of amino acids & Proteins ; [6 hours]

- Properties of amino acids- Isomerism, amphoteric nature, and isoelectric pH. Peptide bond formation, Peptides and functions. Color reactions of amino acids . Use of amino acids analysis in diagnosis of diseases.
- Proteins ; Functions, Structure of proteins- Primary, secondary, tertiary, and quaternary.
- Precipitation reactions of proteins.
- Denaturation of proteins.
- Preparation of protein free filtrate for quantitative analysis.

9. Enzymes; [6 hours]

- Definition, Classification, Properties, Mechanism of action, factors affecting enzyme

activity , enzyme inhibition. Coenzymes

- Analytical & therapeutic role of enzymes
- Immobilized enzymes.

10. Metabolism of carbohydrates; [6 hours]

- Diabetes mellitus; diagnosis & management
- Principles and procedures for the determination of plasma glucose levels; reductometric & enzymatic methods
- Urinary glucose.

11. Metabolism of lipids [3 hours]

- Ketogenesis, ketone bodies utilization, ketosis, Rothera's test and it's importance.

12. Metabolism of amino acids; [7hours]

- Urea cycle and disorders , Blood urea / blood urea nitrogen – clinical importance
- Biosynthesis of creatinine- formation, clinical importance
- Principles and procedures for the determination of Blood urea nitrogen and Creatinine; Colorimetric & enzymatic methods.

13. Specimen Collection ; [4 hours]

- Capillary, Arterial , Venous blood collection techniques,
- Anticoagulants used
- Various types Urine sample collections (Random, times, 24 hrs etc)
- Preservatives used , storage of samples,
- Disposal.

14. Urine analysis; [4 hours]

- Physical characteristics,
- Chemical examination of normal urine
- Abnormal constituents of urine.

15. Techniques ; [10 hours]

- Spectrophotometry-Principle, Instrumentation, Operation, Applications, care & maintenance, Standardization
- Reflectance photometry-Principle, Instrumentation, Applications
- Turbidimetry & Nephelometry-Principle, Instrumentation, Applications
- Glucometers-Principle, Instrumentation, Applications
- Chromatography – Paper & TLC- Principle, Instrumentation, Applications
- Electrophoresis – agarose and SDS-PAGE

ASSIGNMENT TOPIC;

- Oral glucose tolerance test
- Glycated HbA1c
- Microalbuminuria

PRACTICALS

I. PRACTICAL APPROACH TO BASIC LABORATORY PRACTICES

1. Pipetting techniques

2. Operation of the instruments

- Analytical balance
- pH meter
- Centrifuges
- Urinometer, Esbach's albuminometer

3. Techniques of preparation of Solutions & reagents;

- Normal, Molar,
- Percent (Na_2CO_3 , NaCl , NaOH , KCl , HCl , H_2SO_4 , H_3PO_4 , CH_3COOH , sodium tungstate
- Buffers (Phosphate buffer, Citrate buffer)
- Standard solutions – Glucose, urea, creatinine, Total protein etc

4. Dilution Techniques;

- Dilution of stock standard ,
- Dilution of acids
- Part Dilution of the body fluids

5. Determination of pH ;

II. QUALITATIVE;

1. Color reactions – known test solution

- Carbohydrates; Glucose, Fructose , Sucrose, Starch, Lactose, Maltose
- NPN- Urea, creatinine, Uric acid
- Albumin, Casein

2. Precipitation reactions

- Albumin, Casein
- Preparation of protein free filtrates for quantitative analysis of - Glucose,
- urea, creatinine, uric acid estimations

3. Identification of unknown carbohydrate

4. Identification of unknown protein

5. Urine Analysis; normal and Abnormal

III. QUANTITATIVE;

1. Operation of colorimeter / spectrophotometer;

2. Quantitative estimations by manual methods- Preparation of calibration curve, & estimation of unknown analyte concentration.

- **Blood glucose by Glucose oxidase – peroxidase method**
- Blood urea by DAM method
- Serum & urine creatinine by Jaffe's method. Determination of creatinine clearance
- Serum uric acid by commercially available kit method

PRACTICAL DEMONSTRATION;

1. Paper chromatography of amino acids
2. Dipsticks for urine analysis

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work* 20

Text Book References

- Biochemistry – 3rd revised edition by U Sathyanarayana & U Chakrapani

Textbook of Biochemistry (For Medical Students)-5th Edition by DM Vasudevan & Sreekumari S

- Textbook of Medical Biochemistry-6th Edition by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology 2nd edition by Godkar and Godkar.
- Biochemistry-3rd edition by Pankaja Naik
- Medical Laboratory technology 6th edition by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students-3rd edition by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry, 4th, 5th and 6th editions
- Clinical Chemistry, Theory, Analysis, Correlation-4th edition by Lawrence A Kaplan
- Tietz Textbook of Clinical Chemistry 3rd edition by Burtis, Ashwood and Bruns
- Clinical Chemistry-Principles, procedures, correlations- 5th edition by Michael L. Bishop, Edward P. Fody and Larry Schoeff.
- Practical Clinical Biochemistry, methods and interpretation –2nd edition by Ranjna Chawla.

MICORBIOLOGY II

(SYSTEMATIC BACTERIOLOGY AND PARASITOLOGY)

No. of Theory hours - 100 hrs.

No. of Practical hours- 80 hrs

I SYSTEMATIC BACTERIOLOGY (60hrs)

Biochemical reactions for identification of bacteria

Antimicrobial susceptibility testing

Normal flora of the human body

Gram positive bacteria: systematic study of the following bacteria with special reference to morphology, cultural characteristics, pathogenicity, lab diagnosis and prophylaxis-

- Staphylococcus
- Streptococcus
- Pneumococcus
- Corynebacterium
- Bacillus
- Mycobacterium
- Clostridium
- Actinomycetes

Gram negative bacteria:

- Neisseria
- Haemophilus, Bordetella, Brucella
- Enterobacteriaceae, Salmonella, Shigella
- Vibrio, Campylobacter, Helicobacter
- Pseudomonas, Burkholderia and non fermenters
- Yersinia

Spirochetes and others:

- Treponemes, Leptospira & Borrelia

Applied Bacteriology:

- UTI, Diarrhoeal diseases and food poisoning, Meningitis, Sexually transmitted diseases, pyogenic infections, Hospital acquired infections and PUO
- Specimen collection for the above said infections

Bacteriology of water, milk and air**II PARASITOLOGY (40 hrs.)****1. Protozoology**

Entamoeba, Balantidium coli, Trichomonas, Giardia, Leishmania, Trypanosoma, Malaria, Toxoplasma, Cryptosporidium, Microsporidium, Isospora, Cyclospora

2. Helminthology

- **Cestodes**- Taenia, Echinococcus, D. latum, H. nana
- **Trematodes**- Schistosoma, Fasciola
- **Nematodes**- Ascaris, Ancylostoma, Enterobius, Strongyloides, Trichuris, Trichinella, Dracunculus, Wuchereria and other filarial worms

Lab diagnosis of parasitic infections**Arthropods of medical importance****PRACTICALS:****Stainings**

1. Gram staining, ZN stain, Albert stain
2. Hanging drop preparation
3. Culture methods
4. Introduction to biochemical reactions
5. Identifications of pure culture based on morphology, colony characteristics, motility, biochemical reaction and anti biogram
6. Antibiotic sensitivity testing- Kirby-Bauer method
7. Stool examination
8. Saline mount
9. Iodine mount
10. Peripheral smear examination for malaria and filariasis

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work* 20

SCHEME OF EXAMINATION – PRACTICALS

The scheme of examination for Microbiology II Practical shall be as follows: Distribution of marks

Type of Question	Marks allotted
Spotters	20
ZN staining	10
Pure culture of the organism	25
Stool examination	15
Record	10
Total	80

Reference Books-

1. Ananthanarayana & Panikar Medical Microbiology- University Press
2. Robert Cruickshank- Medical Microbiology- The Practice of Medical Microbiology
3. Chatterjee- Parasitology- Interpretation to Clinical Medicine
4. Rippon- Medical Mycology
5. Emmons- Medical Mycology

6. Basic Laboratory methods in Parasitology, J P Bros, New Delhi
7. Basic Laboratory procedures in clinical bacteriology, J P Bros, New Delhi
8. Medical Parasitology- Ajit Damle
9. Introduction to medical microbiology- Ananthanarayana- Orient Longman Pvt. Ltd.

PATHOLOGY II

No. Theory classes: 100 hours

No. Practical classes: 80 hours

Theory:-

Histopathology and Hematology Histopathology

Instrumentation:

- a) Automated tissue processor
- b) Microtomes, knives, knife, sharpner and ultra microtome
- c) Freezing microtome and Cryostat
- d) Automatic slide stainer

Techniques:

- Receiving specimens
- Grossing, fixation
- Tissue processing, Decalcification, Section cutting
- Haematoxylin & Eosin Staining
- Frozen section and Cryostat section studies

Staining techniques: Special stains for Carbohydrates, Connective tissue, Nervous tissue, Bone tissue, Collage fibers, Elastic Fibers, Lipids, Organisms, fungi, parasites, pigments and deposits in tissues

Mounting techniques: Various mounts and mounting techniques

- Electron microscope - Scanning electron microscope
- Dark ground microscope
- Fluorescent microscope
- Museum technology
- Microphotography and its application
- Maintenance of records and filing of slides
- ICDS classification and coding
- Application of computers in pathology

HAEMATOLOGY

- Haemopoiesis, stem cells, formed elements and their functions
- Anticoagulants used in various haematological studies

Routine haematological tests and normal values :

- A) Determination of haemoglobin and Hematocrit
- B) Enumeration of RBC, WBC and platelets
- C) Absolute eosinophil count
- D) Reticulocyte
- E) Calculation of red cell indices
- F) Preparation and staining of blood film for morphology of red cells and differential count

Special haematological tests :

- A) Sickling test
- B) Osmotic fragility tests
- C) Determination of HbF and HbA₂
- D) Haemoglobin electrophoresis
- E) Investigation of G6PD deficiency
- F) Plasma haptoglobin and demonstration of hemosiderin in urine
- G) Tests of autoimmune and hemolytic anemia
- H) Measurement of abnormal Hb pigments

Hemostasis and coagulation :

- A) Normal hemostasis, mechanism of blood coagulation and normal fibrinolytic system
- B) Collection of blood and anticoagulants used in coagulation studies
- C) Investigation of hemostatic mechanism - BT, CT, whole blood coagulation time test, PT, PTT
- D) Assay of clotting factors
- E) Tests for fibrinolytic activity - Euglobulin, clot lysis test and FDP
- F) Platelet function tests.

Investigation of Megaloblastic anemia and Iron deficiency anemia :

- A) B12 and folate assay and Schilling test
 - B) Estimation of serum iron and iron binding capacity Bone marrow biopsy study
 - C) Needle aspiration and surgical biopsy technique
 - D) Preparation of smears and staining
- Demonstration of LE cells
 - Cytochemistry
 - Administration in hematology and quality control

Practicals:

1. Paraffin section cutting
2. Staining by Hematoxylin & Eosin and other special stains
3. Determination of Hemoglobin and Hematocrit
4. Red blood cell count
5. Total white blood cell count
6. Platelet count
7. Differential count of white blood cells
8. Absolute Eosinophil count
9. Reticulocyte count
10. Calculation of red cell indices
11. Determination of ESR
12. Determination of BT, CT, Whole blood clotting time
13. Determination of PT and PTT
14. Blood smear preparation and staining
15. Osmotic fragility test
16. Sickling test
17. LE cell preparation

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	20

REFERENCE BOOKS:

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques

3. Koss- Cytology
4. Winifred Diagnostic cytopathology
5. Orell Cytopathology
6. Todd and Sanford- clinical diagnosis by Laboratory Medicine
7. Dacie and Lewis- Practical Hematology
8. Ramnik SOOD. Lab technology, Methods and interpretation, 4 th edition JP Bros New Delhi, 1996
9. Sathish Guptha , Short text book of Medical laboratory techniques for technicians
10. Sachdev K N. Clinical Pathology and Bacteriology, 8 th edi JP Bros, NewDelhi, 1996.

SUBSIDIARY SUBJECTS

SOCIOLOGY

Teaching Hours: 20 Course Description

This course will introduce student to the basic sociology concepts, principles and social process, social institutions [in relation to the individual, family and community and the various social factors affecting the family in rural and urban communities in India will be studied.

Introduction:

Meaning – Definition and scope of sociology

Its relation to Anthropology, Psychology, Social Psychology

Methods of Sociological investigations – Case study, social survey, questionnaire, interview and opinion poll methods.

Importance of its study with special reference to health care professionals

Social Factors in Health and Disease:

Meaning of social factors

Role of social factors in health and disease

Socialization:

Meaning and nature of socialization

Primary, Secondary and Anticipatory socialization Agencies of socialization

Social Groups:

Concepts of social groups, influence of formal and informal groups on health and sickness. The role of primary groups and secondary groups in the hospital and rehabilitation setup.

Family:

The family, meaning and definitions Functions of types of family Changing family patterns Influence of family on individual's health, family and nutrition, the effects of sickness in the family and psychosomatic disease and their importance to physiotherapy

Community:

Rural community: Meaning and features – Health hazards to rural communities, health hazards to tribal community.

Urban community – Meaning and features – Health hazards of urbanities Culture and Health:

Concept of Health Concept of culture Culture and Health

Culture and Health Disorders Social Change:

Meaning of social changes Factors of social changes

Human adaptation and social change Social change and stress

Social change and deviance

Social change and health programme

The role of social planning in the improvement of health and rehabilitation Social

Problems of disabled:

Consequences of the following social problems in relation to sickness and disability

remedies to prevent these problems

Population explosion Poverty and unemployment Beggary

Juvenile delinquency Prostitution Alcoholism

Problems of women in employment

Social Security:

Social Security and social legislation in relation to the disabled

Social Work:

Meaning of Social Work

The role of a Medical Social Worker

Reference Books:

1. Sachdeva & Vidyabhushan, Introduction to the study of sociology
2. Indrani T.K., Text book of sociology for graduates nurses and Physiotherapy students, JP Brothers, New Delhi 10

INDIAN CONSTITUTION

Prescribed for the First Year students of all degree classes

Unit-I: Meaning of the term 'Constitution'. Making of the Indian Constitution 1946-1950.

Unit-II: The democratic institutions created by the constitution Bicameral system of Legislature at the Centre and in the States.

Unit-III: Fundamental Rights and Duties their content and significance.

Unit – IV: Directive Principles of States Policies the need to balance Fundamental Rights with Directive Principles.

Unit – V: Special Rights created in the Constitution for: Dalits, Backwards, Women and

Children and the Religious and Linguistic Minorities.

Unit-VI: Doctrine of Separation of Powers legislative, Executive and Judicial and their functioning in India.

Unit – VII: The Election Commission and State Public Service commissions.

Unit – VIII: Method of amending the Constitution.

Unit – IX: Enforcing rights through Writs:

Unit – X: Constitution and Sustainable Development in India.

Reference Books:

1. J.C. Johari: The Constitution of India- A Politico-Legal Study-Sterling Publication, Pvt. Ltd. New Delhi.
2. J.N . Pandey: Constitution Law of India, Allahbad, Central Law Agency, 1998.
3. Granville Austin: The Indian Constitution – Corner Stone of a Nation-Oxford, New Delhi, 2000.

ENVIRONMENT SCIENCE AND HEALTH

Introduction to Environment and Health

Sources, health hazards and control of environmental pollution Water

The concept of safe and wholesome water. The requirements of sanitary sources of water.

Understanding the methods of purification of water on small scale and large scale.

Various biological standards, including WHO guidelines for third world countries.

Concept and methods for assessing quality of water.

Domestic refuse, sullage, human excreta and sewage their effects on environment and health, methods and issues related to their disposal.

Awareness of standards of housing and the effect of poor housing on health.

Role of arthropods in the causation of diseases, mode of transmission of arthropods borne diseases, methods of control

Recommended Books.

Text Book of Environmental Studies for under graduate courses By Erach Bharucha
Reprinted in 2006, Orient Longman Private Limited /Universities Press India Pvt. Ltd.

III year - B.Sc. MLT

Biochemistry III

No. Theory classes: 100 hours

No. Practical classes: 80 hours

THEORY SYLLABUS

1. Laboratory Management [6 hours]
 - **Soft skills in patient handling**
 - Clinical automation- different types of automation
 - Quality assurance in clinical laboratory- control of Pre analytical, analytical & post analytical variables
 - General approach to quality control . Commonly used terms; accuracy, precision specificity, sensitivity, mean , standard deviation, co-efficient variation ,bias, errors etc
 - Preparation of quality control sera, internal quality control, control charts& Westgard rules
 - External quality control
 - Biological reference intervals
2. **Techniques: Principle, instrumentation, application [14 hours]**
 - Atomic absorption spectrophotometry
 - Potentiometry, Ion selective electrodes
 - Agarose gel electrophoresis
 - Immunochemical assays; RIA, ELISA, Chemiluminescence
 - Osmometry
 - Arterial Blood Gas analyzer
 - HPLC, Mass Spectrometry
 - Capillary Electrophoresis
3. **Clinical enzymology [4 hours]**
 - Sources of Plasma enzymes. Units of enzyme activity
 - Diagnostic importance of enzymes
 - Isoenzymes, cardiac troponins
4. **Plasma proteins [4 hours]**
 - Total proteins
 - Functions & clinical importance of- albumin , Globulins – acute phase proteins (CRP, Ceruloplasmin, AAT, Immunoglobulins) . Genetic deficiency & disorders
 - Electrophoretic separation of plasma proteins .-pattern, interpretation , reference intervals etc
5. **Metabolism of Carbohydrates; [8 hours]**
 - HMP shunt Pathway & its significance
 - Uronic acid pathway
 - Metabolism of Galactose & Fructose and associated disorders
 - Glycogen storage disorders
 - Sorbitol pathway
 - OGTT, OGCT, HbA1c

6. Lipid metabolism [6 hours]

- Cholesterol pool; Body cholesterol & and cellular. Excretion of cholesterol.
- Lipoproteins;
- Classification based on separation and Electrophoretic mobility.
- Functions & Metabolism
- Hyperlipoproteinemias
- Lipid profile, atherosclerosis & coronary artery diseases

7. Amino acid metabolism [6 hours]

- Catabolism of Branched chain amino acids, Phenyl alanine / tyrosine metabolism.
- Pathway disorders; Phenyl ketonuria, Alkaptonuria, Maple syrup urine diseases

8. Metabolism of nucleic acids [4 hours]

- Outline of Purine metabolism and associated disorders
- Outline of Pyrimidine metabolism and associated disorders

9. Molecular genetics [10 hours]

- Salient features of genetic code
- Protein biosynthesis – eukaryotic
- Semiconservative DNA replication, Transcription , Translation
- Mutations & cancer

10. Tumor markers [4 hours]

- Definition, Classification, and clinical applications.
- Overview of specific tumor markers; AFP, CEA, CA-125, PSA, ALP, hCG

11. Acid base balance [6 hours]

- Regulation of pH
- Disorders
- Blood gases; symbols, reference intervals for arterial blood gasses, procedure for arterial blood collection , preanalytical variables

12. Liver function tests [4 hours]

- Role of liver in metabolism , functions of liver
- Liver enzymes
- Formation of Bilirubin
- Jaundice
- Panel of Liver function tests in clinical laboratory
- Formation & analysis of gall stones.

13. Pancreatic function tests [2 hours]

- Functions of pancreas, Composition of Pancreatic juice
- Clinical utility of enzyme determination in pancreatitis

14. Thyroid function tests [2 hours]

- Overview of Functions of Thyroid Hormones
- Clinical utility and methods for the measurement of Circulating thyroid hormones.

15. Renal function tests & Renal Calculi [4 hours]

- Glomerular function test ; Clearance tests (Urea, creatinine, Inulin clearance tests)

- Tests for tubular function ; Concentration and dilution tests, Measurement of specific gravity and osmolality
- Urinary acidification tests; ammonium chloride loading test.
- Microalbuminuria and its importance
- Formation & analysis of Renal calculi

16. Cardiac markers [2 hours]

- Chemistry & overview of cardiac markers
- Diagnostic & prognostic use of cardiac markers
- Laboratory evaluation.

17. Overview of Body Fluids ; [1 hour]

- Quantitative analysis of different types of fluids; CSF, Synovial, peritoneal, Pleural, pericardial and Ascitic fluids.

18. Measurements in clinical laboratory ; [6 hours]

- Quantitative estimations; Selecting a method, linearity of a method, end point and rate reaction methods.
- Checking accuracy & precision.
- Calibration; Preparation of calibration curve, importance of calibration curve
- Techniques of preparation of calibration curve using stock standard solutions.
- Graphic representation of calibration.

19. Specimen collection; [1 hour]

- Color Codes of vacutainer tubes and its uses
- Order of sample draw

ASSIGNMENT TOPIC; [6 hours]

- Laboratory design
- Laboratory safety & first aid in laboratory
- Point care of testing

PRACTICALS;

I. QUALITATIVE;

- 1. Renal calculi**
- 2. Gall stone analysis**
- 3. Urine Analysis; normal and Abnormal**
- 4. Spot test for; Phenyl ketonuria, Alkaptonuria, MSUD**

II. QUANTITATIVE;

- 1. Concept of preparation of buffered substrate, use of control serum**
 - 2. Quantitative estimations by manual methods- Preparation of calibration curve, & estimation of unknown analyte concentration.**
- **Total protein & albumin by Biuret method & calculation of A/G ratio**

- Albumin by BCG (Bromo cresol green) method.
- Total & conjugated bilirubin by Malloy & Evelyn method
- AST and ALT by IFCC kit method
- ALP by DEA kit method.
- Serum amylase by (CNP3) substrate method
- Serum calcium by kit method
- Phosphate in the serum by Fiske Subbarow method(care & cleaning of tubes before and after analysis)
- Serum Chloride by method of Schales & Schales

III. PRACTICAL DEMONSTRATION;

- ❖ Electrolyte & Arterial blood gas measurements
- ❖ Agarose gel electrophoresis for serum proteins
- ❖ Automated analyzers
- ❖ Semi automated and automated methods for
 - Lipid profile,
 - T3,T4,TSH
 - Troponin T or I, CK, Ck-MB

CASE REPORTS;

- Inborn errors of Galactose, pentose, Fructose.
- OGTT curves
- Jaundice
- Acid base imbalances
- Electrophoretogram- normal, abnormal
- Cardiac markers
- Lipid disorders
- Tumor markers

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	20

SCHEME OF EXAMINATION PRACTICAL

The scheme of examination for Biochemistry III practical shall be as follow ;
Distribution of Marks

TYPE OF QUESTION	MARKS ALLOTTED
Quantitative estimation	30
Renal calculi	20
Urine examination	20
Case reports	10
Total	80

Split up of marks for experiments:

Qualitative:

Carrying out color reactions of the given solution + Bench viva

II yr B.Sc.,	8 mks + 2 mks
III yr B.Sc.,	15 mks + 5 mks

Quantitative:

- a. Writing principle & procedure before conducting the experiment

II yr B.Sc.,	3 mks
III yr B.Sc.,	5 mks

- b. Standardisation of expt & determining unknown concentration+ Bench viva

II yr B.Sc.,	25mks + 2 mks
III yr B.Sc.,	40 mks + 5 mks

Text Book References

- Biochemistry – 3rd revised edition by U Sathyanarayana & U Chakrapani
- Textbook of Biochemistry (For Medical Students)-5th Edition by DM Vasudevan & reekumari S
- Textbook of Medical Biochemistry-6th Edition by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology 2nd edition by Godkar and Godkar.
- Biochemistry-3rd edition by Pankaja Naik
- Medical Laboratory technology 6th edition by Ramnik Sood.

- Practical Clinical Biochemistry, methods and interpretation –2nd edition by Ranjna Chawla
- Varley's Practical Clinical Biochemistry, 4th, 5th and 6th editions
- Clinical Chemistry, Theory, Analysis, Correlation-4th edition by Lawrence A Kaplan
- Tietz Textbook of Clinical Chemistry 3rd edition by Burtis, Ashwood and Bruns
- Clinical Chemistry-Principles, procedures, correlations- 5th edition by Michael L. Bishop, Edward P. Fody and Larry Schoeff.
- Biophysical chemistry-Principles and Techniques by Upadhyay, Upadhyay and Nath
- Clinical Diagnosis and management by laboratory methods 20th edition by John Bernard Henry
- Mark's Basic Medical Biochemistry- A clinical approach 2nd Edition by Smith, Marks and Lieberma.

MICROBIOLOGY III

(Immunology, Virology and Mycology)

Theory - 100 hrs.

Practicals- 80hrs.

I Immunology (40 hrs)

1. Infection

2. Immunity

- ❖ Innate Immunity
- ❖ Acquired Immunity (adaptive)
- ❖ Active and Passive Immunity

3. Immune System

- ❖ Cell development
- ❖ B lymphocytes (general knowledge of their role)
- ❖ T lymphocytes
- ❖ Natural killer cells

4. Immune responses

- ❖ Humoral immunity
- ❖ Cell mediated immunity
- ❖ Antigen and antibody
- ❖ Primary and secondary responses
- ❖ Theories of antibody productions
- ❖ Monoclonal antibodies (production and applications)

5. Antigens

- ❖ Antigen (definition, types, factors of antigenicity)

6. Antibodies

- ❖ Properties of antibodies (immunoglobulins)
- ❖ Structures of immunoglobulin

- ❖ Classes of immunoglobulins

7. Antigen-antibody reactions

- ❖ Precipitation
- ❖ Agglutination
- ❖ ELISA
- ❖ Immunofluorescence and miscellaneous tests

8. Complement system

- ❖ Classical pathway
- ❖ Alternative pathway
- ❖ Biological effects of complement
- ❖ Regulation of complement activation

9. Hypersensitivity reactions

- ❖ Immediate and delayed type

10. Autoimmunity

11. Transplantation and malignancy Immunity

12. Immunodeficiency diseases

II. Virology (40 hrs)

- General properties of virus, cultivation of viruses
- Virus host interaction
- Bacteriophage
- Pox viruses
- Herpes viruses (HSV, Varicella-Zoster, Cytomegalo virus, Epstein-Barr virus)
- Adeno viruses
- Picornaviruses
 - Enteroviruses (Polio virus, Echo viruses)
 - Rhinoviruses
- Orthomyxo viruses (Influenza virus)
- Paramyxo viruses (Parainfluenza virus, Mumps, Measles, RSV)
- Arboviruses
 - Discuss in detail Chikungunya, Dengue, KFD
 - Enumerate remaining arbovirus with disease caused
- Rhabdoviruses
- Hepatitis viruses
- HIV
- Papova virus, Parvovirus, Corona virus
- Rubivirus
- Viruses causing gastroenteritis
 - Rotavirus, Norwalk virus, Astro Virus
- Viral hemorrhagic fevers, SARS, Slow viruses
- Oncogenic viruses

III Mycology (20 hrs)

- Introduction to Mycology, Classification
- Lab diagnosis of fungal infections

3. Mycoses
 - a. **Superficial Mycoses**
Malassezia furfur, T.nigra, T.piedra
 - b. **Dermatophytes**
 - c. **Subcutaneous mycoses**
Mycetoma, Rhinosporidiosis, Sporotrichosis, Chromomycosis
 - d. **Systemic mycoses**
Histoplasmosis, Blastomycosis, Coccidioidomycosis, Paracoccidioidomycosis
 - e. **Opportunistic fungi**
Aspergillosis, Penicillosis, Zygomycosis, Pneumocystis
 - f. **Candidiasis , Cryptococcosis**
4. Mycotoxins and antifungal agents

PRACTICALS

80 hrs.

1. **Immunology:** Serological tests
Principle, procedure, normal values, significant titre, interpretation and limitation of the following tests
WIDAL, Brucella
VDRL RPR, ASO, CRP, RF
ELISA for HbsAg, HIV
2. **Virology**
Demonstration of embryonated egg inoculation/animals/inclusion bodies Virology exercise
ELISA (HIV,HBV)
Western blot,
Spot test (Tri dot/immune comb test)
3. **Mycology**
Slide culture technique
KOH mount
Identification of fungal culture
Macroscopic and microscopic examination of Candida, Cryptococcus/ Dermatophytes, Aspergillus, Rhizopus, Mucor, Penicillium

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	20

SCHEME OF EXAMINATION – PRACTICALS

The scheme of examination for Microbiology III Practical shall be as follows:
Distribution of marks

Type of Question	Marks allotted
Virology exercise	10
Mycology 2 exercise	15
Serology(Widal/ Brucella)	15
Serology (ASO/ CRP RPR/ RF)	10
Spotters	20
Record	10
Total	80

Reference Books-

1. Ananthanarayana & Panikar Medical Microbiology- University Press
2. Robert Cruickshank- Medical Microbiology- The Practice of Medical Microbiology
3. Chatterjee- Parasitology- Interpretation to Clinical Medicine
4. Rippon- Medical Mycology
5. Emmons- Medical Mycology
6. Basic Laboratory methods in Parasitology, J P Bros, New Delhi
7. Basic Laboratory procedures in clinical bacteriology, J P Bros, New Delhi
8. Medical Parasitology- Ajit Damle
9. Introduction to medical microbiology- Ananthanarayana- Orient Longman Pvt. Ltd.

PATHOLOGY III

Cytology, Automation in cytology, Cytogenetics, Cytochemistry, Immunohaematology and Blood transfusion

No. Theory classes: 100 hrs

Practical classes: 80 hrs.

Cytology

1. Normal cell structure, functions, cytologic criteria of malignancy
2. Types of specimens, methods of collection & preparation of cell block
3. Different fixatives and methods of fixation
4. Staining : (a) Papanicolaou's stain- principle , preparation and staining techniques
(b) May Grunwald Giemsa stain
(c) Shorr's stain
(d) Aceto orcin stain

Female Genital tract

1. Anatomy, Histology, Physiology & normal cytology
2. Techniques of collection of specimen for cervical cytology study
3. Hormonal cytology and cytological indices
4. Cervical cytology screening for malignant and nonmalignant conditions, Radiation changes & follow up
5. Cytology of Endometrium - normal nonmalignant and in malignant conditions
6. Cytology in Ovarian cancers

Respiratory tract, Gastrointestinal tract and Urinary tract

1. Anatomy, Histology, Physiology
2. Collection of sample, preparation of smears and staining
3. Cytology of normal, nonmalignant & malignant conditions

C S F and Effusions

1. Cytology of CSF in inflammatory, nonmalignant & malignant conditions
2. Cytology of effusions in nonmalignant and malignant conditions

Glands - Breast, Thyroid, Salivary glands and Lymph nodes

1. Anatomy, Histology and Physiology
2. Fine needle aspiration cytology of glands and other soft tissue mass
3. Cytologic features in nonmalignant and malignant conditions of different glands and nipple discharges.

Automation in Cytology

1. Flow cytometry

2. Image Analysis
3. Principles, equipments, Procedures & Evaluation

Tissue culture and Immunohistochemistry

1. Equipments for Tissue culture studies

- a) Laminar air flow equipment
- b) Carbon dioxide incubator
- c) Inverted microscope

2. Derivation of culture from tissue

- a) Enzymatic digestion of tissue using collagenase, protease
- b) Plating in tissue culture media
- c) Observation of cells in invertoscope
- d) Subculturing & derivation of cell lines

3. Characterization of cell lines

- a) Determination of biochemical markers in cells
- b) Chromosomal & DNA content of cells
- c) Immunological properties of cells

4. Preservation of Immortalized cell lines

- a) Storage in Glycerol in Liquid Nitrogen
- b) Storage in Dimethyl sulfoxide in Liquid Nitrogen

Cytogenetics

1. Introduction to cytogenetics, terminology, classification and nomenclature of human chromosomes
2. Methods of karyotypic analysis
- (a) Culture of bone marrow cells,
- (b) peripheral blood lymphocytes, solid tumors and skin fibroblasts Direct preparation from tumour materials
3. Characterization of human chromosomes by various banding techniques
4. Sex chromatin identification
5. Chromosomes in neoplasia and oncogenes

Immunocytochemistry

1. Basics concepts, monoclonal antibodies and preparation
2. Fluorescence reactions

Immunohematology and Blood transfusion

1. ABO blood group and Rh system
2. Subgroups of A and B, other blood groups and Bombay group
3. HLA antigens and their significance
4. Principles of Blood transfusion:
 - (a) Blood donor selection
 - (b) Methods of bleeding donors
 - (c) Blood containers, anticoagulants and storage of blood

- (d) Coomb's test and its significance
- (e) Screening of blood for infective material
- (f) Blood components, preparation & component therapy
- (g) Autologous transfusion
- (h) Transfusion reactions and work up
- (i) Blood bank organization, standards, procedures, techniques and quality control.

Practicals

Preparation of various cytology smears and fixation

1. Papanicolaou's and May Grunwald Geimsa staining
2. Hormonal cytology study
3. Blood grouping and Rh typing
4. Cross matching techniques
5. Screening of Donor's blood for infective agents
6. Transfusion reaction work up
7. Preparation of blood components

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	20

SCHEME OF EXAMINATION – PRACTICALS

The scheme of examination for Pathology III Practical shall be as follows: Distribution of marks

Type of Question	Marks allotted
Pap stain	20
Blood grouping and typing	10
Cross matching	15
Coomb's test	15
Spotters	10
Record	10
Total	80

SUBSIDIARY SUBJECTS

BIO STATISTICS

Time Allotted: 20 Hours

Course Description:

Introduction to basic statistical concepts: methods of statistical analysis; and interpretation of data

Behavioral Objectives:

Understands statistical terms.

Possesses knowledge and skill in the use of basic statistical and research methodology.

Unit – I : Introduction

Meaning, definition, characteristics of statistics. Importance of the study of statistics.

Branches of statistics.

Statistics and health science including nursing. Parameters and estimates.

Descriptive and inferential statistics. Variables and their types.

Measurement scales

Unit – II : Tabulation of Data

Raw data, the array, frequency distribution. Basic principles of graphical representation.

Types of diagrams - histograms, frequency polygons, smooth frequency polygon, commulative frequency curve, ogive.

Normal probability curve.

Unit - III: Measure of Central Tendency

Need for measures of central tendency

Definition and calculation of mean - ungrouped and grouped

Meaning, interpretation and calculation of median ungrouped and grouped. Meaning and calculation of mode.

Comparison of the mean, and mode.

Guidelines for the use of various measures of central tendency.

Unit - IV: Measure of Variability Need for measure of dispersion. The range, the average deviation. The variance and standard deviation.

Calculation of variance and standard deviation ungrouped and grouped. Properties and uses of variance and SD

Unit -V: Probability and Standard Distributions. Meaning of probability of standard distribution. The Binominal distribution.

The normal distribution.

Divergence from normality - skewness, kurtosis.

Unit - VI: Sampling Techniques

Need for sampling - Criteria for good samples. Application of sampling in Community. Procedures of sampling and sampling designs errors. Sampling variation and tests of significance.

Unit - VII: Health Indicator

Importance of health Indicator.

Indicators of population, morbidity, mortality, health services. Calculation of rates and ratios of health.

Recommended Books.

B.K. Mahajan & M. Gupta (1995) Text Book of Preventive & Social Medicine, 2002,17th Edition Jaypee Brothers.

BASICS IN COMPUTER APPLICATIONS

Time allotted: 20 hours

The course enables the students to understand the fundamentals of computer and its applications.

Introduction to Data processing :

Features of computers, Advantages of using computers. Getting data into / out of computers. Role of computers. What is Data processing? Application areas of computers involved in Data processing. Common activities in processing. Types of Data processing, Characteristics of information. What are Hardware and Software?

Hardware Concepts :

Architecture of computers, Classification of computers, Concept of damage. Types of

storage devices. Characteristics of disks, tapes, Terminals, Printers, Network.
Applications of networking concept of PC System care, Floppy care, Data care.

Concept of Software.

Classification of software : System software. Application of software. Operating system.
Computer system. Computer virus. Precautions against viruses. Dealing with viruses.
Computers in medical electronics Basic Anatomy of Computers

Principles of programming

Computer application - principles in scientific research ; work processing, medicine,
libraries, museum , education, information system.

Data processing

Computers in physical therapy - principles in EMG, Exercise testing equipment, Laser.

No Practical or Viva voce examination

BMLT IV YEAR - INTERNSHIP

1. Project

Submission of a Project work is a compulsory requirement for the B Sc MLT –course. Each student can choose a topic for the project in any one of the subjects – Microbiology/Biochemistry/Pathology which would be approved by his/her supervising teacher. The topics for project shall be divided equally among total number of students from the three main subjects Microbiology/ Biochemistry/ Pathology.

The option for topics selection for the project will be based on the following criteria

- Total marks obtained in all the previous university examinations up to 3rd year.
- If total marks obtained equal for more than one student then marks obtained for the optional subject may be considered.

The supervising Teacher should have minimum 3 years full time teaching experience in the concerned subject. The student should be under the guidance of the supervising staff, carry out the work on the topic selected and prepare a project report including results and references. The project report duly certified by the supervising staff and head of the department of MLT Three months prior to fourth year university practical examination should be submitted to the Principal.

The project report evaluation will be conducted by the concerned subject internal and external examiners together in the Fourth year B.Sc MLT University practical examination.

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# **REGULATIONS & CURRICULUM OF GRADUATE PARAMEDICAL COURSE**

## **BACHELOR OF SCIENCE IN OPERATION THEATRE AND ANAESTHESIA TECHNOLOGY**

**2020**



**Sri Siddhartha  
Academy of Higher Education  
Deemed-to-be-University**

**Established under Section 3 of the UGC Act, 1956  
MHRD, GOI No. F.9-31/2006-U.3 (A) Dtd. 30th May 2008**

**Agalakote, B.H. Road, Tumkur – 572107, Karnataka, India**

# SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

(DEEMED TO BE UNIVERSITY)

Declared under Section 3 of the UGC Act, 1956, MHRD GOI No. F.9-31/2006-U.3 (A) Dated: 30/05/2008

Accredited 'A' Grade by NAAC

**Agalakote, B.H.Road, Tumkur – 572 107.KARNATAKA, INDIA.**

Ph. 0816- 2275516, Fax : 0816-2275510 website: sahetumkur.ac.in email: info@sahe.in



No. SSAHE/ACA-S&C(AHSP)/12/2022

Date: 01/09/2022

## NOTIFICATION

Sub: Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Operation Theatre and Anaesthesia Technology.

- Ref: 1). Proceedings of BOS Allied Health Sciences Programmes held on 06/04/2021  
2). Proceedings of the Academic Council meeting held on 19/08/2021  
3). Proceedings of the Board of Management held on 29/08/2022

In exercise of the powers vested under section 6 of 6.4 of MoA / Rules of SSAHE, the Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Operation Theatre and Anaesthesia Technology is notified herewith as per Annexure.

The above Regulations shall be applicable to the students admitted to the said course from the academic year 2020-21 onwards.

By Order,

**REGISTRAR**  
**REGISTRAR**

Sri Siddhartha Academy of Higher Education  
TUMKUR - 572 107, Karnataka.

To,  
Dean / Principal, Sri Siddhartha Medical College & Hospital,

Copy to

- 1) Office of the Chancellor, SSAHE, for kind information,
- 2) PA to Vice-Chancellor / PA to Registrar / Controller of Examinations / Finance Officer, SSAHE
- 3) The Director (AHSP), SSAHE
- 4) All Officers of the Academy Examination Branch / Academic Section
- 5) Guard File / Office copy.

# **ORDINANCE GOVERNING REGULATIONS & CURRICULUM OF B.Sc. ANAESTHESIA AND OPERATION THEATRE TECHNOLOGY COURSE - 2020**

## **1. Eligibility for admission:**

A candidate seeking admission to the B.Sc. Anaesthesia and Operation Theatre Technology shall have studied English as one of the principal subject during the tenure of the course and shall have passed:

1. Two year Pre-University examination or equivalent as recognized by Sri Siddhartha Academy of Higher Education with, Physics, Chemistry and Biology as subjects of study.

OR

2. Pre-Degree course from a recognized University considered as equivalent by SSAHE, (Two years after ten years of schooling) with Physics, Chemistry and Biology as subjects of study.

OR

3. Any equivalent examination recognized by the Sri Siddhartha Academy of Higher Education, Tumkur for the above purpose with Physics, Chemistry and Biology as subjects of study.

OR

4. The vocational higher secondary education course conducted by Vocational Higher Secondary Education, Government of Kerala with five subjects including Physics, Chemistry, Biology and English in addition to vocational subjects conducted is considered equivalent to plus TWO examinations of Government of Karnataka Pre University Course.

OR

5. Candidates with two years diploma from a recognized Government Board in Anaesthesia Technology or Operation Theatre technology shall have passed class 12 [10+2] with Physics, Chemistry and Biology, as subjects or candidates with 3 years diploma from a recognized Government Board in Anaesthesia Technology or Operation Theatre technology should have studied Physics, Biology and Chemistry as subjects during the tenure of the course.

6. Lateral entry to second year of B.Sc. Anaesthesia and Operation Theatre Technology for candidates who have passed diploma program from the Government Boards and recognized by SSAHE, fulfilling the conditions specified above under Sl. No. 5.

**Note:**

- a. The candidate shall have passed individually in each of the subjects.
- b. Candidates who have completed diploma or vocational course through Correspondence shall not be eligible for the above course.

**2. Duration of the course:**

Duration shall be for a period of four years including one year of Internship.

**3. Medium of instruction:**

The medium of instruction and examination shall be in English.

**4. Scheme of examination:**

There shall be three examinations one each at the end of 1 st, 2nd and 3rd year.

**5. Attendance**

Every candidate should have attended at least 80% of the total number of classes conducted in an academic year from the date of commencement of the term to the last working day as notified by university in each of the subjects prescribed for that year separately in theory and practical. Only such candidates are eligible to appear for the university examinations in their first attempt. A candidate lacking in prescribed percentage of attendance in any subjects either in theory or practical in the first appearance will not be eligible to appear for the University Examination in that subject.

**6. Internal Assessment (IA):****1st Year B.Sc Anaesthesia and Operation Theatre Technology**

Theory - 20 marks

**2nd & 3rd year B.Sc Anaesthesia and Operation Theatre Technology**

Theory – 20 Marks

Practicals - 10 marks\*. [Lab work- 06 marks and Record-04 marks]

There shall be a minimum of two periodical tests preferably one in each term in theory

and practical of each subject in an academic year. The average marks of the two tests will be calculated and reduced to 20 marks in case of theory and 10 marks in case of practicals. The marks of IA shall be communicated to the University at least 15 days before the commencement of the University examination. The University shall have access to the records of such periodical tests.

The marks of the internal assessment must be displayed on the notice board of the respective colleges with in a fortnight from the date of the test conducted. If a candidate is absent for any one of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

\* There shall be no University Practical Examination in First year.

## 7. Subject and hours of teaching for Theory and Practical

Main and Subsidiary subjects are common in first year for all the courses in Allied Health Sciences.

The number of hours for teaching theory and practical for main subjects in first, Second and Third year are shown in Table-I, II and III.

The classes in main and subsidiary subjects are to be held from Monday to Thursday. On Fridays and Saturdays students shall work in hospitals in the respective specialty or department.

**Table - I Distribution of Teaching Hours in First Year Subjects**  
**Main Subjects**

| Sl. No. | Subject                                                      | Theory No. of Hours | Practical No. of Hours | Total No. of Hours |
|---------|--------------------------------------------------------------|---------------------|------------------------|--------------------|
| 1       | Human Anatomy                                                | 70                  | 20                     | 90                 |
| 2       | Physiology                                                   | 70                  | 20                     | 90                 |
| 3       | Biochemistry I                                               | 70                  | 20                     | 90                 |
| 4       | Pathology I(Clinical Pathology, Haematology & Blood Banking) | 70                  | 20                     | 90                 |
| 5       | Microbiology                                                 | 70                  | 20                     | 90                 |
|         | Total                                                        | 350                 | 100                    | 450                |

## Microbiology I

The classes in main and subsidiary subjects are to be held from Monday to Thursday. On Fridays and Saturdays students shall work in hospitals in the respective specialty or department chosen by them

### Subsidiary Subjects

English 25 Hours

Kannada 25 Hours

Health-Care 40 Hours

Clinical/Lab posting- 470 Hours Friday 9am-1pm and 2pm-4-30 pm

Saturday 9am - 1pm

**Table - II Distribution of Teaching Hours in Second Year Subjects**

Main Subjects

| Sl. No. | Subject                                                       | Theory No. of Hours | Practical No. of Hours | Clinical posting | Total No. of Hours |
|---------|---------------------------------------------------------------|---------------------|------------------------|------------------|--------------------|
| 1.      | Medicine relevant to O.T & Anaesthesia. technology            | 50                  | --                     | --               | 50                 |
| 2.      | Section A Applied Pathology<br>Section B Applied Microbiology | 30<br>30            | 30<br>30               | --               | 120                |
| 3.      | Pharmacology                                                  | 50                  | --                     | --               | 50                 |
| 4.      | Introduction to Anaesthesia & Operation Theatre Technology    | 80                  | 100                    | 650              | 830                |
|         | Total                                                         | 240                 | 160                    | 650              | 105                |

### Subsidiary Subjects:

Sociology 20 Hours

Constitution of India 10 Hours

Environmental Science & Health 10 Hours

**Table -III Distribution of Teaching Hours in Third Year Subjects****Main Subjects**

| Sl. No. | Subject                                               | Theory No. of Hours | Practical No. of Hours | Clinical posting | Total No. of Hours |
|---------|-------------------------------------------------------|---------------------|------------------------|------------------|--------------------|
| 1.      | Anaesthesia & Operation Theatre Technology - Clinical | 50                  | 50                     | 250              | 350                |
| 2.      | Anaesthesia & Operation Theatre Technology - Applied  | 50                  | 50                     | 250              | 350                |
| 3.      | Anaesthesia & Operation Theatre Technology - Advanced | 50                  | 50                     | 250              | 350                |
|         | <b>Total</b>                                          | <b>150</b>          | <b>150</b>             | <b>750</b>       | <b>1050</b>        |

**Subsidiary Subjects**

|                             |          |
|-----------------------------|----------|
| Ethics, Database Management | 50 Hours |
| Research & Biostatistics    | 20 Hours |
| Computer application        | 10 Hours |

**3. Schedule of Examination:**

The university shall conduct two examinations annually at an interval of not less than 4 to 6 months as notified by the university from time to time. A candidate who satisfies the requirement of attendance, progress and conduct as stipulated by the university shall be eligible to appear for the university examination. Certificate to that effect shall be produced from the Head of the institution along with the application for examination and the prescribed fee.

**4. Scheme of Examination**

There shall be three examinations, one each at the end of I, II and III year. The examination for both main and subsidiary subjects for all courses in Allied Health Sciences shall be common in the first year.

**Main Subjects** shall have University Examination.

**Subsidiary subjects:** Examination for subsidiary subjects shall be conducted by respective colleges. Distribution of Subjects and marks for First Year, Second year & Third year University theory and practical Examinations are shown in the Table-IV, V & VI.



**First year examination:**

The University examination for 1st year shall consist of only theory examination and there shall be no University Practical Examination.

**Second & Third year examination:**

The University examination for 2nd and 3rd year shall consist of Written Examination & Practical.

Written Examinations consists of

04 papers in the 2nd Year

03 papers in the 3rd Year.

**Practical examination:**

Two practical examinations, at the end 2nd Year and one practical examination at the end of the 3rd year.

**TABLE-IV**

**Distribution of Subjects and marks for First Year University theory Examination**

| Main Subjects        |                                     | Duration | Theory Marks | IA Marks | Total Marks |
|----------------------|-------------------------------------|----------|--------------|----------|-------------|
| 1.                   | Basic Anatomy [Including Histology] | 3 hours  | 80           | 20       | 100         |
| 2.                   | Physiology                          | 3 hours  | 80           | 20       | 100         |
| 3.                   | Biochemistry                        | 3 hours  | 80           | 20       | 100         |
| 4.                   | Pathology                           | 3 hours  | 80           | 20       | 100         |
| 5.                   | Microbiology                        | 3hours   | 80           | 20       | 100         |
| Subsidiary Subject** |                                     |          |              |          | Total       |
| 1.                   | English                             | 3 hours  | 80           | 20       | 100         |
| 2.                   | Kannada                             | 3 hours  | 80           | 20       | 100         |
| 3.                   | Health Care                         | 3 hours  | 80           | 20       | 100         |

#### 14. Eligibility for the award of Degree:

A candidate shall have passed in all the subjects of first, second and third year to be eligible for a compulsory 12 months of rotational internship. On completion of 12 months of the internship with pass criteria in outgoing clinical assessment exams the candidate is then eligible for the award of degree

#### 15. Distribution of Type of Questions and Marks

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>First year</b> ) |                  |                          |
|------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                          | No. of Questions | Marks for Each Questions |
| Long Essay                                                 | 1                | 10                       |
| Short Essay                                                | 5                | 5                        |
| Short Notes Type                                           | 5                | 3                        |
| Short Answer Type                                          | 10               | 2                        |
| MCQ's                                                      | 10               | 1                        |

- |                                                     |                  |
|-----------------------------------------------------|------------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks   |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks   |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks   |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks   |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks   |
|                                                     | <b>Total= 80</b> |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Second and Third Year</b> ) |                  |                          |
|-----------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                     | No. of Questions | Marks for Each Questions |
| Long Essay                                                            | 1                | 10                       |
| Short Essay                                                           | 5                | 5                        |
| Short Notes Type                                                      | 5                | 3                        |
| Short Answer Type                                                     | 10               | 2                        |
| MCQ's                                                                 | 10               | 1                        |

- |                                                     |                  |
|-----------------------------------------------------|------------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks   |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks   |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks   |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks   |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks   |
|                                                     | <b>Total= 80</b> |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Subsidiary subjects</b> ) |                  |                          |
|---------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                   | No. of Questions | Marks for Each Questions |
| Essay Type                                                          | 3 (2 x 10)       | 10                       |
| Short Essay Type                                                    | 8 (6 x 5)        | 05                       |
| Short Answer Type                                                   | 12 (10 x 3)      | 03                       |

Main Subjects shall have University Examination. There shall be no University Practical Examination.

**TABLE - V**  
**Distribution of Subjects and marks for Second Year Examination**

| Paper | Subject                                          | Theory |    |    |           | Practicals     |    |           | Grand Total |
|-------|--------------------------------------------------|--------|----|----|-----------|----------------|----|-----------|-------------|
|       |                                                  | Theory |    | IA | Sub Total | Univ Practical | IA | Sub Total |             |
| i     | Section A – Applied Pathology                    | 40     |    | 20 | 100       | 40             | 10 | 50        | 200         |
|       | Section B – Applied Microbiology                 | 40     |    |    |           |                |    |           |             |
| ii    | Introduction to Anaesthesia & OT Technology      | 80     |    | 20 | 100       | 40             | 10 | 50        | 200         |
| iii   | Applied Pharmacology                             | 80     | -- | 20 | 100       | No Practicals  |    |           | 100         |
| iv    | Medicine Relevant to Anaesthesia & OT Technology | 80     | -- | 20 | 100       | No Practicals  |    |           | 100         |

**Distribution of Subsidiary Subjects and marks for Second Year Examination**

| B  | Subsidiary Subject**           | Duration | Marks | I .A Theory Marks | Total Marks |
|----|--------------------------------|----------|-------|-------------------|-------------|
| 1. | Sociology                      | 3 hours  | 80    | 20                | 100         |
| 2. | Constitution of India          | 3 hours  | 80    | 20                | 100         |
| 3. | Environmental Science & Health | 3 hours  | 80    | 20                | 100         |

\*\* Subsidiary subjects: Examination for subsidiary Subjects shall be conducted by respective colleges

**TABLE - VI**  
**Distribution of Subjects and marks for Third Year Examination**

| Paper | Subject                                | Theory |    |    |           | Practicals        |                  |           | Grand Total |
|-------|----------------------------------------|--------|----|----|-----------|-------------------|------------------|-----------|-------------|
|       |                                        | Theory | -- | IA | Sub Total | Univ Practical    | IA               | Sub Total |             |
| i     | Anaesthesia & OT Technology - Clinical | 80     | -- | 20 | 100       | 120<br>(40+40+40) | 30<br>(10+10+10) | 150       | 450         |
| ii    | Anaesthesia & OT Technology - Applied  | 80     | -- | 20 | 100       |                   |                  |           |             |
| iii   | Anaesthesia & OT Technology - Advanced | 80     | -- | 20 | 100       |                   |                  |           |             |

\* Practicals-One common practical for all the three papers with equal weightage of marks i.e. 40 practical marks and 10 I.A. marks for each paper.

#### **Distribution of Subsidiary Subjects and marks for Third Year Examination**

| B  | Subsidiary Subject**        | Duration | Marks | I .A Theory Marks | Total Marks |
|----|-----------------------------|----------|-------|-------------------|-------------|
| 1. | Ethics, Database Management | 3 hours  | 80    | 20                | 100         |
| 2. | Research & Biostatistics    | 3 hours  | 80    | 20                | 100         |
| 3. | Computer application        | 3 hours  | 80    | 20                | 100         |

\*\* Subsidiary subjects : Examination for subsidiary subjects shall be conducted by respective colleges

### **5. Pass criteria**

#### **First year examination.**

- a. Main Subjects: A candidate is declared to have passed in a subject, if he/she secures, 50% of marks in University Theory exam and internal assessment added together.
- b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the Commencement of the University examination.

#### **Second and Third year Examination**

- a. Main Subjects: A candidate is declared to have passed the Examination in a subject if he/she secures 50% of the marks in theory and 50% in practical separately. For a pass in theory, a candidate has to

secure a **minimum of 40% marks** in the University conducted written examination, and 50% in aggregate in the University conducted written examination, internal assessment and Viva-Voce added together and for pass in Practical, a candidate has to secure a minimum of 40% marks in the university conducted Practical/Clinical examination and 50% in aggregate i.e. University conducted Practical/Clinical and Internal Assessment.

In the third year a candidate is declared to have passed only if he/she passes all the three theory papers and one practical examination in a single attempt. Where in the candidate fails in one or more theory papers and or practical examination he/she will have to re appear for all the 3 theory papers and the practical examination in the subsequent attempt.

- b. **Subsidiary Subjects:** The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

## **6. Carry over benefit**

### **a) First year examination:**

A candidate who fails in any two of the five main subjects of first year shall be permitted to carry over those subjects to second year. However, he/se must pass the carry over subjects before appearing for second year examination; otherwise he/she shall not be permitted to proceed to third year.

### **b) Second year examination.**

A candidate is permitted to carry over any one main subject to the third year but shall pass this subject before appearing for the third year examination

## **7. Declaration of Class**

- a. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with Distinction.
- b. A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 60% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in First Class.

- c. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than 60% of grand total marks prescribed will be declared to have passed the examination in Second Class.
- d. A candidate passing the university examination in more than one attempt shall be placed in Pass class irrespective of the percentage of marks secured by him/her in the examination.
- e. The marks obtained by a candidate in the subsidiary subjects shall be reflected in the marks card but the marks obtained by a candidate in the subsidiary subjects shall not be considered for award of Class or Rank.  
[Please note fraction of marks should not be rounded off for clauses (a), (b) and (c)]

#### **8. Eligibility for the award of Degree:**

A candidate shall have passed in all the subjects of first, second and third year to be eligible for a compulsory 12 months of rotational internship. On completion of 12 months of the internship with pass criteria in outgoing clinical assessment exams, the candidate is eligible for award of degree.

# FIRST YEAR B.Sc ANAESTHESIA AND OPERATION THEATRE TECHNOLOGY

## ANATOMY

No. of theory  
classes: 70 hours  
No. of practical  
classes: 20 hours

Theory: 70hrs

Practicals: 20hrs

### **Chapter 1**

#### **Introduction:**

##### **Theory:**

- Definition of anatomy and its divisions
- Terms of location, positions and planes
- Epithelium-definition, classification, describe with examples, function
- Glands- classification, describe serous, mucous & mixed glands with examples
- Basic tissues – classification with examples

##### **Practical:**

- Histology of types of epithelium
- Histology of serous, mucous & mixed salivary gland

### **Chapter 2**

#### **Connective tissue:**

##### **Theory:**

- Cartilage – types with example & histology theory
- Bone – Classification, names of bone cells, parts of long bone, microscopy of compact bone, names of all bones, vertebral column, intervertebral disc, fontanelles of fetal skull
- Joints – Classification of joints with examples, synovial joint (in detail for radiology)

- Muscular system: Classification of muscular tissue & histology
- Names of muscles of the body

**Practical:**

- Histology of the 3 types of cartilage
- Histology of compact bone (TS & LS)
- Histology of skeletal (TS & LS) & cardiac muscle
- Demo of all bones showing parts, radiographs of normal bones & joints
- Demonstration of important muscles of the body

**3. Cardiovascular system:**

**Theory:**

- Heart-size, location, chambers, exterior & interior, pericardium
- Blood supply of heart
- Systemic & pulmonary circulation
- Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery
- Inferior vena cava, portal vein, portosystemic anastomosis ,Great saphenous vein, Dural venous sinuses
- Lymphatic system- cisterna chyli & thoracic duct ,Histology of lymphatic tissues, Names of regional lymphatics, axillary and inguinal lymph nodes in brief

**Practical:**

- Demonstration of heart and vessels in the body
- Histology of large artery & vein, medium sized artery & vein
- Histology of lymph node, spleen, tonsil & thymus
- Radiology: Normal chest radiograph showing heart shadows

**4. Gastro-intestinal system**

**Theory:**

- Parts of GIT: Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring), Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas, spleen, peritoneum & reflections

**Practical:**

- Demonstration of parts of GIT
- Radiographs of abdomen



## **5. Respiratory system**

- Parts of RS: nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments, diaphragm
- Histology of trachea, lung and pleura
- Names of paranasal air sinuses

### **Practical:**

- Demonstration of parts of respiratory system.
- Normal radiographs of chest, X-ray paranasal sinuses
- Histology of lung and trachea

## **6. Urinary system**

### **Theory:**

- Kidney, ureter, urinary bladder, male and female urethra
- Histology of kidney, ureter and urinary bladder

### **Practical:**

- Demonstration of parts of urinary system
- Histology of kidney, ureter, urinary bladder
- Radiographs of abdomen-IVP, retrograde cystogram

## **7. Reproductive system**

### **Theory:**

- Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology)
- Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology)
- Mammary gland – gross

### **Practical:**

- Demonstration of section of male and female pelvis with organs in situ
- Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes, ovary
- Radiographs of pelvis – hysterosalpingogram

## **8. Endocrine glands**

### **Theory:**

- Names of all endocrine glands in detail on pituitary gland, thyroid gland & suprarenal gland – (gross & histology)

**Practical:**

- Demonstration of the glands
- Histology of pituitary, thyroid, parathyroid, suprarenal glands

**9. Nervous system****Theory:**

- Neuron & Classification of NS
- Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve  
(gross & histology) Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei
- Blood supply of brain
- Cranial nerves
- Sympathetic trunk & names of parasympathetic ganglia

**Practical:**

- Histology of peripheral nerve & optic nerve
- Demonstration of all plexuses and nerves in the body
- Demonstration of all part of brain
- Histology of cerebrum, cerebellum, spinal cord

**10. Sensory organs****Theory:**

- Skin: Skin-histology & Appendages of skin
- Eye: Parts of eye & lacrimal apparatus, Extra-ocular muscles & nerve supply
- Ear: parts of ear- external, middle and inner ear and contents

**Practical:**

- Histology of thin and thick skin
- Demonstration and histology of eyeball
- Histology of cornea & retina

**11. Embryology:****Theory:**

- Spermatogenesis & oogenesis
- Ovulation, fertilization

- Fetal circulation
- Placenta

### **INTERNAL ASSESSMENT**

|                                              |    |
|----------------------------------------------|----|
| Theory-average of 2 exams conducted          | 20 |
| Practicals: record and lab work <sup>*</sup> | 10 |

<sup>\*</sup>There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

### **SCHEME OF EXAMINATION THEORY**

There shall be one theory paper of three hours duration carrying 100 marks. Distribution of type of questions and marks for Anatomy shall be as given under.

## PHYSIOLOGY

Theory 70 hours Practical 20hours

### 1. General Physiology

Introduction to cell physiology, transport across cell membrane

Homeostasis, Body Fluid compartment & measurement

### 2. Blood

Introduction - composition and function of blood

Plasma. proteins, types and functions

Red blood cells - erythropoiesis, stages of differentiation, factors affecting it, function, normal count, physiological variation.

Hemoglobin- function, concentration, types & methods of Hb estimation, fate of hemoglobin

Jaundice-types Anaemia,-types

ESR, PCV, osmotic fragility & blood indices

WBC- morphology, production, functions, normal count, differential count, variation, variation Immunity (in brief)

Platelets- origin, morphology, normal count, function-Platelet plug, bleeding disorder

Haemostasis - definition, normal haemostasis, clotting factors, mechanism of clotting, anticoagulants disorders of clotting factors.

Blood group-ABO & Rh system, Rh incompatibility blood typing ,cross matching, hazards of mismatched blood transfusion

RES, spleen and lymph

### 3. Nerve-Muscle

Neuron structure, types, neuroglia-types, nerve fibre classification, properties of nerve fibres, RMP,action potential, wallerian degeneration

NMJ, blockers, Myasthenia gravis

Classification of muscle, structure of skeletal muscle, sarcomere, contractile proteins

Excitation contraction coupling, mechanism of muscle contraction, types of contraction  
Motor unit, fatigue, rigor mortis Smooth muscle

#### 4. Respiratory system

Physiological anatomy of respiratory system, muscles of respiration, respiratory & non respiratory functions of lungs, dead space

Mechanics of breathing, intrapulmonary & pleural pressures

Compliance, Surfactant, Hyaline membrane disease

Lung volumes and capacities

Respiratory membrane , transport of O<sub>2</sub> & CO<sub>2</sub>

Chemical regulation of respiration

Neural regulation of respiration

Hypoxia, Acclimatization,

Dysbarism. Artificial respiration

Definition-Periodic breathing, dyspnoea, apnoea, asphyxia,, cyanosis

#### 5. Cardiovascular system

Introduction to CVS & general principles of circulation

Properties of Cardiac muscle

Cardiac cycle, heart sounds, Pulse

Cardiac output, factors and measurement

Heart rate

BP-factors, measurement, Short term regulation

Intermediate and long term regulation of BP

ECG uses and significance, .normal waveform, heart block

Coronary circulation, Cutaneous circulation-Triple response

Shock

Effects of exercise on CVS and Respiratory system

#### 6. Renal system, Skin and body temperature

Kidneys- functions, structure of nephron, type, juxtaglomerular apparatus-structure and function, non-excretory functions of kidney

Glomerular filtration rate (GFR)- Definition ,normal value, factors affecting GFR

Tubular reabsorption - sites, substance reabsorbed, mechanisms of reabsorption

Tubular secretion- sites, substance secreted, mechanisms of reabsorption

Counter current mechanism of concentration of urine

Obligatory and Facultative reabsorption of water

Micturition reflex, Diuretics

Artificial kidney, renal function tests-clearance tests

Skin -structure and function, body temperature measurement, physiological variation,  
Regulation of body Temperature by physical, chemical and nervous mechanisms-Role of  
Hypothalamus  
Hypothermia and fever

## 7. Digestive system

Physiological anatomy, Enteric nervous system & functions of GIT

Saliva- composition, regulation, disorder.

Deglutition- stages & disorders

Stomach-functions, composition and regulation of gastric juice

Gastric motility, MMC, vomiting reflex.

Pancreas- function, composition and regulation of pancreatic juice

Liver & gall bladder-functions, bile- composition, secretion and regulation

Small intestine- Succus entericus-composition, functions & movements

Large intestine- functions, movements and defecation reflex

Digestion & absorption of Carbohydrates, fats and proteins

## 8. Endocrine system

Classification of Endocrine glands & their hormones & properties-chemistry and receptor,  
feedback mechanisms of hormone regulation.

Anterior pituitary hormones- secretion, functions, disorders

Posterior pituitary hormones- secretion, functions, disorders

Thyroid hormones- secretion, functions, disorders

Parathyroid hormones- secretion, functions, disorders

Calcium homeostasis & disorders

Pancreatic hormones, -Insulin and Glucagon- . secretion, functions, disorders

Adrenal cortex- Glucocorticoids & Mineralocorticoids, Androgen - secretion, functions,  
disorders

Adrenal medulla- secretion, functions, disorders Thymus & Pineal gland

## 9. Reproductive system

Introduction to reproductive system, sex differentiation & Puberty

Male reproductive system, functions of testosterone & Spermatogenesis

Female reproductive system, functions of Estrogen, Progesterone, Oogenesis

Ovulation & Menstrual cycle

Physiological changes during pregnancy, pregnancy tests, parturition & lactation

Male & Female contraceptive methods

## 10. Central nervous system

Introduction to CNS, Sensory receptors classification, properties

Synapse– classification, properties

Sensory pathways: Anterior spino thalamic tract and Posterior column pathway

Lateral spino thalamic tract, Types of pain, Referred pain, Thalamus; nuclei and function

Classification of reflexes, Monosynaptic reflex- Stretch reflex , muscle spindle ,inverse stretch reflex. Polysynaptic reflex-Withdrawal reflex

Motor pathways : Pyramidal pathway and functions, UMNL, LMNL

Cerebral cortex (Sensory and motor)-functions, Medulla and Pons-functions

Cerebellum –functions, disorders

Basal ganglia-functions, disorders

Hypothalamus and Limbic system-functions

CSF, lumbar puncture

Sleep, EEG,

Autonomic Nervous System - Sympathetic and parasympathetic distribution and functions

## 11. Special senses

Vision –Functional anatomy of eye, visual pathway, lesion

Refractive errors, color vision

Audition – Physiological anatomy of ear, Mechanism of hearing, auditory pathway, deafness

Olfaction –modalities, receptor, function, abnormalities

Gustation-modalities, receptor, function, taste pathway, abnormalities

Practicals Blood pressure Recording

Auscultation for Heart Sounds

Artificial Respiration

Determination of vital capacity

## INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work\* 10

\* There shall be no university practical examination and internal assessment marks secured in Practical need not be sent to the university.

## SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 100 marks. Distribution of

# BIOCHEMISTRY

No. Theory classes: 70hours

No. of practical classes: 20 hours

## 1. Carbohydrate Chemistry [3 hours]

- Classification (Definition/ examples for each class)
- Monosaccharides (classification depending upon number of carbon atoms and functional group with examples)
- Disaccharides (Sucrose/ lactose/ maltose and their composition)
- Polysaccharides :
  - a) Homopolysaccharides (Structure of starch and glycogen)
  - b) Heteropolysaccharides (Functions )



## 2. Lipid Chemistry [3 hours]

- Definition of lipids
- Functions of lipids in the body
- Classification of lipids (subclasses with examples)
- Definition and Classification of fatty acids
- Essential fatty acids
- Phospholipids and their importance

## 3. Amino-acid and Protein Chemistry [3 hours]

- General structure of D and L amino acids
- Amino acids; Definition and Classification of amino acids with examples.
- Peptides; definition & Biologically important peptides
- Classification of Proteins based on composition, functions and shape (with examples)
- Functions of amino acids and Proteins

## 4. Nucleotide and Nucleic acid Chemistry [ 3 hours]

- Nucleosides & Nucleotides
- Nucleic acid Definition & types
- Composition & functions of DNA & RNA
- Structure of DNA (Watson and Crick model)
- Structure of tRNA, & functions of tRNA, rRNA, mRNA
- Difference between DNA and RNA

## 5. Enzymes [5 hours]

- Definition & Classification of Enzymes with example
- Definitions of Active site, Cofactor (Coenzyme, Activator),
- Proenzyme; Definition and examples (Pepsin & trypsin)

## 6. Digestion and Absorption [ 3 Hours]

- General characteristics of digestion and absorption,
- Digestion and absorption of carbohydrates, proteins and lipids.

#### 7. Carbohydrate Metabolism [ 5 Hours]

- Glycolysis ; Aerobic, Anaerobic, Definition , Site and subcellular site , Steps with all the enzymes and coenzymes at each step , mention the regulatory enzymes , Energetics,
- Citric acid cycle; Pyruvate dehydrogenase complex (reaction and coenzymes) , Site and subcellular site , Reactions with all the enzymes and coenzymes ,Regulatory enzymes , Energetics
- Significance of HMP Shunt pathway.
- Hyperglycemic and hypoglycemic hormones
- Blood Glucose Regulation.
- Diabetes mellitus (definition, classification, signs and symptoms)
- **Glycogen metabolism and gluconeogenesis**

#### 8. Lipid Metabolism [ 4 Hours]

- Introduction to lipid metabolism, Lipolysis
- Beta oxidation of fatty acids ; Definition ,Site and subcellular site , Activation of palmitic acid , Transport of activated palmitic acid into mitochondria , Reactions , Energetics.
- Name the different ketone bodies . Note on ketosis

#### 9. Amino acid and Protein Metabolism [ 3 Hours]

- Introduction, transamination, deamination, Fate of ammonia, transport of ammonia,
- Urea cycle.

#### 10. Vitamins [5 Hours]

- Definition and classification .

- RDA, sources, coenzyme forms, biochemical functions and disorders for the following water soluble vitamins: Thiamine, Niacin, Pyridoxine, Cobalamine, Folic acid, Ascorbic acid
- RDA, sources, coenzyme forms, biochemical functions and deficiency disorders for the following fat soluble vitamins; A and vitamin D

#### 11. Mineral Metabolism [**3 Hours**]

- Name the macro/ microminerals
- Iron: Sources ,RDA, Functions and Disorders of deficiency and excess
- Calcium and phosphorus: Sources ,RDA, functions, normal serum levels and hormones reulating their levels

#### 12. Nutrition [**6 hours**]

- Balanced diet (Definition)
- Caloric value ; Definition , Caloric values of carbohydrates, proteins and fats
- Total daily caloric requirements of an adult male and female,
- RDA (Definition, standard values for nutrients)
- Basal metabolic rate(BMR) ; Definition , Magnitude of BMR in men and women, Factors affecting BMR
- Thermic effect/ SDA of food (Definition, values for major macronutrients)
- Carbohydrates : Daily dietary requirement. 2. Dietary fibers (Definition, functions, importance and their daily requirements)
- Proteins ;. Daily requirement , Biological value. a. Definition b. Protein used as a standard for this, Protein sources with high and low biological value , Mutual supplementation of proteins (Definition, examples).
- Fats ; Daily requirement , Essential fatty acids (Definition, functions, daily requirement and deficiency manifestations) , Saturated and unsaturated fatty acids (Definition, sources, examples).
- Malnutrition

#### 13. Renal Function Tests [ 2 hours]

- Name the different tests to asses the kidney functions

- Explain Creatinine clearance & Inulin clearance
- Urinary acidification test

#### 14. Radioactive Isotopes [**1 hour**]

- Definition, clinical applications
- Biological effects of radiations

#### 15. Clinical Biochemistry [ 5 hours ]

##### A. Definitions of acid, base, pH and pKa [1 hour]

##### B. Buffers

- Definition [2 hours]
- Henderson Hasselbalch equation,
- Principal buffer systems in the ECF ICF and urine
- Bicarbonate and phosphate buffer systems (pKa value, normal ratio of base/acid in the plasma)
- Acidosis & Alkalosis (Definition, classification, causes and biochemical findings)

##### C. Normal serum levels and condition where they are altered [2 hour]

- Glucose, Protein, urea, uric acid, and creatinine
- Bilirubin, cholesterol
- Serum Electrolytes

#### 16. Fundamental Chemistry (1 hour)

- Valency, Molecular weight & Equivalent weight of elements and compounds. Normality, Molarity, Molality.

#### 17. Solutions: Definition, use, classification where appropriate, preparation and storage (5 hours)

- Stock and working solutions.
- Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H<sub>2</sub>SO<sub>4</sub>, H<sub>3</sub>PO<sub>4</sub>, CH<sub>3</sub>COOH etc.,)
- Preparation of percent solutions – w/w, v/v w/v (solids, liquids and acids), Conversion of a percent solution into a molar solution

- Saturated and supersaturated solutions
- Standard solutions. Technique for preparation of standard solutions and Storage. E.g: glucose, albumin etc.
- Dilutions- Diluting Normal , Molar and percent solutions. Preparing working standard from stock standard.
- Part dilutions: Specimen dilutions. Serial dilutions. Reagent dilution. Dilution factors

### **ASSIGNMENT TOPICS**

1. Units of measurement
2. Hazards - Physical, Chemical, Biological
3. Arterial blood gas analysis
4. Responsibilities of Health care personnel
5. Biomedical waste management

**Total theory hours = 70**

### **PRACTICAL DEMONSTRATION [20 hours]**

- Color Reactions of Carbohydrates & amino acids.
- Precipitation Reactions of proteins
- Colorimetry
- Estimation of Blood glucose Folin Wu and enzymatic method
- Estimation of Urea by DAM method

### **INTERNAL ASSESSMENT**

|                                     |    |
|-------------------------------------|----|
| Theory-average of 2 exams conducted | 20 |
| Practicals: record and lab work*    | 10 |

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

## **PATHOLOGY**

### **Clinical Pathology, Hematology and Blood Banking**

**Theory-70 hours**

**Practicals-20 hours**

#### **I. Clinical Pathology- Theory**

- Introduction to clinical pathology
- Collection , transport, preservation and processing of various clinical specimens
- Urine examination- collection and preservation, Physical, chemical and microscopic examination for abnormal constituents
- Examination of Body fluids
- Examination of Cerebrospinal fluid (CSF)
- Sputum examination
- Examination of feces

## **II. Hematology – Theory**

- Introduction to hematology
- Normal constituents of Blood, their structure and functions
- Collection of Blood samples
- Various anticoagulants used in Hematology
- Hemoglobin estimation, different methods and normal values
- Packed cell volume
- Erythrocyte sedimentation rate
- Normal Haemostasis
- Bleeding time. Clotting time, prothrombin time, Activated partial Thromboplastin time

## **III. Blood Bank- Theory**

- Introduction blood banking
- Blood group system
- Collection and processing of blood for transfusion
- Compatibility testing
- Blood transfusion reactions
- **General Pathology:**
- **Cell injury:**
  - a. Definition, causes.
  - b. Cellular adaptations – Hypertrophy, hyperplasia, atrophy and metaplasia.

- c. Types of cell injury – Reversible and irreversible; morphology of reversible injury.
- d. Necrosis – Definition and patterns of tissue necrosis.
- e. Intracellular accumulations – Lipids, cholesterol, proteins, glycogen and pigments; examples.
- f. Pathologic calcification – Types and examples.

### **3) Inflammation:**

- g. Definition and signs of inflammation.
- h. Types – Acute and chronic inflammation.
- i. Acute inflammation – Causes, morphological patterns and outcome.
- j. Chronic inflammation – Causes, morphology and examples.
- k. Regeneration and repair – Mechanism of cutaneous wound healing.
- l. Factors affecting wound healing.

### **4) Hemodynamic disorders:**

- a) Edema – Definition, pathogenesis and types: Renal, cardiac, pulmonary and cerebral.
- b) Difference between transudate and exudate.
- c) Shock – Definition, types of shock with examples: Hypovolemic, cardiogenic and septic shock, stages of shock: Nonprogressive, progressive and irreversible.
- d) Thrombosis – Definition, mechanism of thrombus formation (Virchow's triad) and fate of thrombus.
- e) Embolism – Definition and types: Thromboembolism, fat, air and amniotic fluid embolism.



f) Infarction – Definition and examples.

### **5) Immune system:**

- a. Autoimmune diseases – General features, enumerate systemic and organ specific autoimmune diseases.
- b. Systemic lupus erythematosus – Manifestations and diagnosis.

### **6) Neoplasia:**

- a. Definition and nomenclature of tumors.
- b. Differences between benign and malignant neoplasms.
- c. Enumerate modes of carcinogenesis: Genes, physical, chemical and microbial agents of carcinogenesis.
- d. Modes of spread of tumors.
- e. Clinical aspects of neoplasia.
- f. Grading and staging of cancers.
- g. Laboratory diagnosis of cancer.

### **Practicals**

- 1. Urine analysis- Physical, Chemical, Microscopic
- 2. Blood grouping and Rh typing
- 3. Hb estimation , packed cell volume (PCV), Erythrocyte Sedimentation rate (ESR)
- 4. Bleeding time and Clotting time
- 5. Histopathology- section cutting and H & E Staining ( for BSc MLT only)

### **INTERNAL ASSESSMENT**

|                                     |    |
|-------------------------------------|----|
| Theory-average of 2 exams conducted | 20 |
| Practicals: record and lab work*    | 10 |

\* There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

# **Microbiology I**

Theory: 70 Hours

Practicals: 20 Hours

## **1. Introduction**

**(6 hrs)**

History of Microbiology,

Classification of microorganisms,

Microscope (Different types and uses )

Morphology of bacterial cell.

## **2. Growth and nutrition**

**(6 hrs)**

Growth and Nutrition

Multiplication of bacteria,

Culture media and Culture methods.

## **3. Sterilization and disinfection**

**(6 hrs)**

Principles and use of equipments of sterilization, Chemicals used in disinfection

4. Biomedical waste management principle and practice

## **5. Immunology**

**(8 hrs)**

Immunity (Innate and Acquired immunity)

Antigen (Definition, types, factors of antigenicity)

Antibody (Properties, Structures Classes of immunoglobulins)

List Antigen antibody reactions.

Vaccines

Immunization schedule

## **6. Infection**

**(5hrs)**

Definition, types and mode of transmission

Hospital infections – causative agents, mode of transmission and prophylaxis

Antimicrobial susceptibility testing

## **7. Systematic bacteriology**

**(15 hrs)**

Disease caused and lab diagnosis of medically important bacteria.

(Staphylococcus, Streptococcus, Gonococcus, Echerichia coli, Klebsiella, Proteus Salmonella, Shigella, Vibrio, Pseudomonas, Mycobacteria, Treponema, )

**(No need of classification, antigenic structure, virulence mechanism)**

## **8. Parasitology**

**(10hrs)**

Introduction to Parasitology

List of medically important parasites and diseases

(E.histolytica, Plasmodium, Ascaris, Ancylostoma, W.bancrofti, Tape worm )

Lab diagnosis of parasitic infections

## **9. Virology**

**(10 hrs)**

Introduction to virology

List of medically important viruses and diseases

HIV, Hepatitis, Rabies, Polio,

Arboviruses (Chikungunya,Dengue,KFD,)

Lab diagnosis of viral infections

## **9. Mycology**

**(9 hrs)**

Introduction to Mycology

List of medically important fungi and diseases

(Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis and Mucor mycosis)

Lab diagnosis of fungal infections

11. Automated techniques

### **PRACTICALS**

**(20hrs)**

Compound Microscope

Demonstration and sterilization of equipments

Demonstration of commonly used culture media and media with growth

Antibiotic susceptibility test

Demonstration of common serological tests –widal, VDRL,

Grams stain, Acid fast staining

Stool exam for Helminthic ova

### **INTERNAL ASSESSMENT**

Theory-average of 2 exams conducted 20

Practicals: record and lab work\* 10

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.



## **SUBSIDIARY SUBJECTS**

### **SOCIOLOGY**

**Teaching Hours : 20**

#### **Course Description**

This course will introduce student to the basic sociology concepts, principles and social process, social institutions [in relation to the individual, family and community and the various social factors affecting the family in rural and urban communities in India will be studied.

introduction :

**Meaning** – Definition and scope of sociology

Its relation to Anthropology, Psychology, Social Psychology

**Methods of Sociological investigations** – Case study, social survey, questionnaire, interview and opinion poll methods.

Importance of its study with special reference to health care professionals Social Factors in Health and Disease:

Meaning of social factors

Role of social factors in health and disease

Socialization:

Meaning and nature of socialization

Primary, Secondary and Anticipatory socialization Agencies of socialization

Social Groups:

1. Concepts of social groups, influence of formal and informal groups on health and sickness.
2. The role of primary groups and secondary groups in the hospital and rehabilitation setup.

Family :

The family, meaning and definitions Functions of types of family Changing family patterns

Influence of family on individual's health, family and nutrition, the effects of sickness in the family and psychosomatic disease and their importance to physiotherapy

Community :

Rural community: Meaning and features – Health hazards to rural communities, health hazards to tribal community.

Urban community – Meaning and features – Health hazards of urbanities

Culture and Health :

Concept of Health Concept of culture Culture and Health

Culture and Health Disorders

Social Change :

Meaning of social changes Factors of social changes

Human adaptation and social change Social change and stress

Social change and deviance

Social change and health programme

The role of social planning in the improvement of health and rehabilitation Social Problems of disabled :

Consequences of the following social problems in relation to sickness and disability remedies to prevent these problems

Population explosion Poverty and unemployment Beggary

Juvenile delinquency Prostitution Alcoholism

Problems of women in employment

Social Security :

Social Security and social legislation in relation to the disabled

Social Work :

Meaning of Social Work

The role of a Medical Social Worker

## **ENGLISH**

### **COURSE OUTLINE**

**COURSE DESCRIPTION:** This course is designed to help the student acquire a good command and comprehension of the English language through individual papers and conferences.

### **BEHAVIOURAL OBJECTIVES:**

The student at the end of training is able to

1. Read and comprehend English language
2. Speak and write grammatically correct English
3. Appreciates the value of English literature in personal and professional life.

### **UNIT - I: INTRODUCTION:**

Study Techniques

Organisation of effective note taking and logical processes of analysis and synthesis Use



of the dictionary Enlargement of vocabulary Effective diction

#### UNIT - II: APPLIED GRAMMAR:

Correct usage the structure of sentences The structure of paragraphs Enlargements of Vocabulary

#### UNIT - III: WRITTEN COMPOSITION:

Precise writing and summarizing Writing of bibliography Enlargement of Vocabulary

#### UNIT - IV: READING AND COMPREHENSION:

Review of selected materials and express oneself in one's words. Enlargement of Vocabulary.

#### UNIT - V: THE STUDY OF THE VARIOUS FORMS OF COMPOSITION:

Paragraph, Essay, Letter, Summary, Practice in writing

#### UNIT - VI: VERBAL COMMUNICATION:

Discussions and summarization, Debates, Oral reports, use in teaching

Scheme of Examination

Written (Theory): Maximum Marks: –80 marks. No Practical or Viva voce examination

This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%

#### REFERENCE

1. English Grammar Collins, Birmingham University, International Language

Data Base, Rupa & Co. 1993

2. Wren and Martin - Grammar and Composition, 1989, Chanda & Co, Delhi
3. Letters for all Occasions. A S Myers. Pub - Harper Perennial
4. Spoken English V. Shasikumar and P V Dhanija. Pub. By: Tata Mcgraw Hill, New Delhi
5. Journalism Made Simple D Wainwright
6. Writers Basic Bookself Series, Writers Digest series
7. Interviewing by Joan Clayton Platkon
8. Penguin Book of Interviews.

## **BIO STATISTICS**

Time Allotted: 20 Hours Course Description:

Introduction to basic statistical concepts: methods of statistical analysis; and interpretation of data Behavioural Objectives:

Understands statistical terms.

Possesses knowledge and skill in the use of basic statistical and research methodology.

Unit – I : Introduction

Meaning, definition, characteristics of statistics. Importance of the study of statistics.

Branches of statistics.

Statistics and health science including nursing. Parameters and estimates.

Descriptive and inferential statistics. Variables and their types.

## Measurement scales

Unit – II : Tabulation of Data Raw data, the array, frequency distribution. Basic principles of graphical representation.

Types of diagrams - histograms, frequency polygons, smooth frequency polygon, cumulative frequency curve, ogive.

Normal probability curve.

Unit - III : Measure of Central Tendency Need for measures of central tendency

Definition and calculation of mean - ungrouped and grouped

Meaning, interpretation and calculation of median

ungrouped and grouped. Meaning and calculation of mode.

Comparison of the mean, and mode.

Guidelines for the use of various measures of central tendency.

Unit - IV : Measure of Variability Need for measure of dispersion. The range, the average deviation. The variance and standard deviation. Calculation of variance and standard deviation ungrouped and grouped. Properties and uses of variance and SD

Unit -V : Probability and Standard Distributions. Meaning of probability of standard distribution. The Binominal distribution. The normal distribution. Divergence from normality - skewness, kurtosis. Sampling Techniques or sampling - Criteria for good samples. Application of sampling in Community. Procedures of sampling and sampling

designs errors. Sampling variation and tests of significance.

Unit - VII : Health Indicator Importance of health Indicator.

Indicators of population, morbidity, mortality, health services. Calculation of rates and ratios of health. Recommended Books. B.K. Mahajan & M. Gupta (1995) Text Book of Preventive & Social Medicine, 2002, 17th Edition Jaypee Broth

## **SECOND YEAR B.Sc ANAESTHESIA AND OPERATION THEATRE TECHNOLOGY**

## **APPLIED PHARMACOLOGY**

- General concepts about pharmacodynamic and Pharmacokinetics Principles involved in drug activity.

### **I. Autonomic nerves system.**

- Anatomy & functional organisation.
- List of drugs acting on ANS including dose, route of administration, indications, contra indications and adverse effects.

### **II. Cardiovascular drugs-** Enumerate the mode of action, side effects and therapeutic uses of the following drugs.

- a. Antihypertensives
  - Beta Adrenergic antagonists
  - Alpha Adrenergic antagonists
  - Peripheral Vasodilators
  - Calcium channel blockers
- b. Antiarrhythmic drugs
- c. Cardiac glycosides
- d. Sympathetic and nonsympathetic inotropic agents.
- e. Coronary vasodilators.
- f. Antianginal and anti failure agents
- g. Lipid lowering & anti atherosclerotic drugs.
- h. Drugs used in Haemostasis - anticoagulants Thrombolytics and antithrombolytics.
- i. Cardioplegic drugs- History, Principles and types of cardioplagia.
- j. Primary solutions - History, principles & types.
- k. Drugs used in the treatment of shock.

### **III. Anaesthetic agents.**

- Definition of general and local anaesthetics.
- Classification of general anaesthetics.
- Pharmacokinetics and Pharmacodynamics of inhaled anaesthetic agents.
- Intravenous general anaesthetic agents.
- Local anaesthetics - classification mechanism of action, duration of action and methods to prolong the duration of action. Preparation, dose and routes of administration.

#### **IV. Analgesics**

- Definition and classification
- Routes of administration, dose, frequency of administration, Side effects and management of non opioid and opioid analgesics

#### **V. Antihistamines and antiemetics-**

- Classification, Mechanism of action, adverse effects, Preparations, dose and routes and administration.

#### **VI. CNS stimulants and depressants**

- Alcohol
- Sedatives, hypnotics and narcotics
- CNS stimulants
- Neuromuscular blocking agents and muscle relaxants.

#### **VII. Pharmacological protection of organs during CPB VIII. Inhalational gases and emergency drugs.**

#### **IX. Pharmacotherapy of respiratory disorders**

- Introduction - Modulators of bronchial smooth muscle tone and pulmonary vascular smooth muscle tone
- Pharmacotherapy of bronchial asthma
- Pharmacotherapy of cough
- Mucokinetic and mucolytic agents
- Use of bland aerosols in respiratory care.

#### **X. Corticosteroids - Classification, mechanism of action, adverse effects and complications. Preparation, dose and routes of administration.**

#### **XI. Diuretics**

- Renal physiology
- Side of action of diuretics
- Adverse effects
- Preparations, dose and routes of administration.

#### **XII. Chemotherapy of infections**

- Definition

- Classification and mechanism of action of antimicrobial agents
- Combination of antimicrobial agents
- Chemoprophylaxis.
- Classification, spectrum of activity, dose, routes of administration and adverse effects of penicillin, cephalosporins, aminoglycosides, tetracyclines, chloramphenicol, antitubercular drugs.

### **XIII. Miscellaneous.**

- IV fluids- various preparations and their usage.
- Electrolyte supplements
- Immunosuppressive agents
- New drugs included in Anaesthesia and Operation Theatre technology.
- Drugs used in metabolic and electrolyte imbalance

### **PRACTICALS:**

1. Preparation and prescription of drugs of relevance.
2. Experimental pharmacology directed to show the effects of commonly used drugs of relevance and interpretation of few charts.

### **NO PRACTICAL EXAMINATION**

#### **Recommended Books.**

1. R. S. Satoskar, S.D. Bhandarkar, S. S. Ainapure, Pharmacology and Pharmacotherapeutics, 18th Edition, single Volume, M/S Popular Prakashan, 350, Madan Mohan Marg, Tardeo, Bombay - 400 034.
2. K.D. Tripathi, Essentials of Medical Pharmacology, V. Edition, M/s. Jaypee Brothers, Post Box, 7193, G-16, EMCA House, 23/23, Bansari Road, Daryaganj, New Delhi.
3. Laurence and Bennet, Clinical Pharmacology, ELBS Edition, 9th Edition.

### **APPLIED PATHOLOGY**

## **I. CARDIOVASCULAR SYSTEM**

- Atherosclerosis- Definition, risk factors, briefly Pathogenesis & morphology, clinical significance and prevention.
- Hypertension- Definition, types and briefly Pathogenesis and effects of Hypertension.
- Aneurysms- Definition, classification, Pathology and complications.
- Pathophysiology of Heart failure.
- Cardiac hypertrophy - causes, Pathophysiology & Progression to Heart Failure.
- Ischaemic heart diseases- Definition, Types. Pathophysiology, in brief Pathology & Complications of various types of IHD.
- Valvular Heart diseases- causes, Pathology & complication. Complications of artificial valves.
- Cardiomyopathy - Definition, Types, causes and significance.
- Pericardial effusion- causes, effects and diagnosis.
- Congenital heart diseases - Basic defect and effects of important types of congenital heart diseases.

## **II. HAEMATOLOGY**

- Anaemia - Definition, morphological types and diagnosis of anaemia. Brief concept about Haemolytic anaemia and polycythaemia.
- Leukocyte disorders- Briefly leukaemia, leukocytosis, agranulocytosis etc.,
- Bleeding disorders- Definition, classification, causes & effects of important types of bleeding disorders. Briefly various laboratory tests used to diagnose bleeding disorders.

## **III. RESPIRATORY SYSTEM**

- Chronic obstructive airway diseases - Definition and types. causes, Pathology & complications of each type of COPD in brief.
- Briefly concept about obstructive versus restrictive pulmonary disease.
- Pneumoconiosis- Definition, types, Pathology and effects in brief.
- Pulmonary congestion and edema.
- Pleural effusion - causes, effects and diagnosis.

## **IV. RENAL SYSTEM**



- Clinical manifestations of renal diseases. Briefly the causes, mechanism, effects and laboratory diagnosis of ARF & CRF. Briefly Glomerulonephritis and Pyelonephritis.
- End stage renal disease - Definition, causes, effects and role of dialysis and renal transplantation in its management.
- Brief concept about obstructive uropathy.

## **PRACTICALS**

1. Description & diagnosis of the following gross specimens.
  - a. Atherosclerosis.
  - b. Aortic aneurysm.
  - c. Myocardial infraction.
  - d. Emphysema
  - e. Chronic glomerulonephritis.
  - f. Chronic pyelonephritis.
2. Interpretation & diagnosis of the following charts.
  - a. Hematology Chart - AML, CML, Hemophilia, neutrophilia, eosinophilia.
  - b. Urine Chart - ARF, CRF, Acute glomerulonephritis.
3. Estimation of Hemoglobin.
4. Estimation Bleeding & Clotting time.

### **PRACTICAL EXAMINATION - 40 Marks.**

There will be a Combined Practical examination for Applied Pathology & Applied Microbiology (20 marks each)

Applied Pathology:

| Sl.No. | Tests                                                  | Marks |
|--------|--------------------------------------------------------|-------|
| 1.     | Interpretation of Hematology Chart                     | 05    |
| 2.     | Interpretation of Urine Chart Estimation of Hemoglobin | 05    |
| 3.     | Estimation of Bleeding time & Clotting time            | 05    |
| 4.     | Estimation of Bleeding time & Clotting time            | 05    |
|        | Total                                                  | 20    |

### **APPLIED MICROBIOLOGY THEORY - 40 HOURS**

1. Health care associated infections and Antimicrobial resistance: Infections that patients acquire during the course of receiving treatment for other conditions within a healthcare setting like Methicillin Resistant Staphylococcus aureus infections, Infections caused by Clostridium difficile, Vancomycin resistant enterococci etc. Catheter related blood stream infections, Ventilator associated pneumonia, Catheter Related urinary tract infections, Surveillance of emerging resistance and changing flora. The impact and cost attributed to Hospital Associated infection.  
6 Hours
2. Disease communicable to Healthcare workers in hospital set up and its preventive measure: Occupationally acquired infections in healthcare professionals by respiratory route (tuberculosis, varicella-zoster, respiratory syncytial virus etc), blood borne transmission ( HIV, Hepatitis B, Hepatitis C, Cytomegalovirus, Ebola virus etc), oro faecal route ( Salmonella, Hepatitis A etc), direct contact ( Herpes Simplex Virus etc). Preventive measures to combat the spread of these infections by monitoring and control.  
6Hours
3. Microbiological surveillance and sampling: Required to determine the frequency of potential bacterial pathogens including Streptococcus pneumoniae, Haemophilus influenzae, and Moraxella catarrhalis and also to assess the antimicrobial resistance.

Sampling: rinse technique, direct surface agar plating technique.

6 Hours

4. Importance of sterilization:

- a. Disinfection of instruments used in patient care: Classification, different methods, advantages and disadvantages of the various methods.
- b. Disinfection of the patient care unit
- c. Infection control measures for ICU's

10 Hours

5. Sterilization:

- a. Rooms: Gaseous sterilization, One Atmosphere Uniform Glow Discharge Plasma (OAUGDP).
- b. Equipments: classification of the instruments and appropriate methods of sterilization.
- c. Central supply sterile department: the four areas and the floor plan for instrument cleaning, high-level disinfecting and sterilizing areas.

8 Hours

6. Preparation of materials for autoclaving: Packing of different types of materials, loading, holding time and unloading.

4 Hours

**PRACTICALS- 30 HOURS**

- 1. Principles of autoclaving & quality control of Sterilization.
- 2. Collection of specimen from outpatient units, inpatient units, minor operation theater and major operation theater for sterility testing.
- 3. The various methods employed for sterility testing.
- 4. Interpretation of results of sterility testing.
- 5. Disinfection of wards, OT and Laboratory.

**PRACTICAL EXAMINATION -**

**40 Marks.**

There will be a Combined Practical examination for Applied Pathology & Applied Microbiology.

(20 marks each)

Applied Microbiology:

| Sl. No. | Tests                                                                                                                                                    | Marks |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1.      | Dry heat / Moist heat: Temperature recording charts interpretation                                                                                       | 05    |
| 2.      | Dry heat / Moist heat: Color change indicators interpretation                                                                                            | 05    |
| 3.      | Air sampling culture plates interpretation of Colony forming units based on air flow rate and sampling time                                              | 05    |
| 4.      | Interpretation of Sterility of Hemodialysis water / Distilled water / Deionised water based on growth of colonies in BHI agar to be reported as X CFU/mL | 05    |
|         | Total                                                                                                                                                    | 20    |

**MEDICINE RELEVANT TO ANAESTHESIA & OPERATION**  
**THEATRE TECHNOLOGY**

Diabetes Mellitus

Hypertension

Ischaemic heart disease

Obesity

Elderly Patient

Pregnancy

Shock

COPD

Chronic renal failure Chronic liver disease / failure Anaemia

Pediatric patient Infant / Neonate Epilepsy

CVA

**NO PRACTICAL EXAMINATION**

## **INTRODUCTION TO ANAESTHESIA & OPERATION THEATRE TECHNOLOGY**

1. Physical layout of surgical suite
  - Transition zones
  - Location
  - Peripheral support areas
  - Layout of operation theatre
  - Special procedure rooms
2. Care of perioperative environment
  - Establishing surgical environment
  - Transportation of patient to the O.T
  - Environmental, physical, chemical, and biological hazards
  - Appropriate operating room attire
3. Sterilization of instruments and O.T cleaning
  - Daily terminal cleaning
  - Decontamination and disinfection & sterilization
    - ◆ Definition
    - ◆ Thermal sterilization
    - ◆ Autoclaving
    - ◆ CSSD & its functioning
  - General care and testing of instruments
  - Assembly and packing of instruments
  - WHO checklist (safe surgery)
4. Biomedical waste management
5. Anaesthesia machine
  - Central gas supply
  - Safety features of anaesthesia machine
  - Medical gas cylinders
  - Pressure control system
  - Flow meters

- Vaporizers
6. Anaesthesia techniques
    - History
    - Pre-operative, intra-operative and post- operative care of patients
    - General anaesthesia
    - Regional anaesthesia
    - Combined spinal and epidural anaesthesia
    - Neuraxial blockades
    - Positioning the patients
  7. Intraoperative monitoring
    - Pulse oximetry
    - Capnography
    - ECG monitoring
    - NIBP
    - IBP
    - CVP
    - Temperature
    - TEE
    - BIS
    - NEUROMUSCULAR MONITORING
  8. Airway equipments
    - Supraglottic airway devices including igel,LMA,BASKA MASK,etc
    - Face mask
    - Airways
    - Combitube
    - AMBU bag
    - Intubation devices
    - Different types of Laryngoscopes
    - Endotracheal tubes
    - Flexible fiberoptic bronchoscope
  9. Breathing systems
    - Classifications
    - Oxygen therapy
    - Mechanical ventilation

#### 10. Difficult airway management devices

- Indications and contraindications
- Retrograde intubation
- Cricothyroidectomy
- Tracheostomy
- Styilet, bougies
- Jet ventilation
- Video laryngoscopes

#### 11. Equipments used inside OT

- Humidifier
- Warming devices
- Suction equipment
- Peripheral nerve stimulator
- Defibrillator
- Infusion pump
- Nerve locator
- Diathermy or cautery device
- OT lights
- Scavenging systems
- Basic introduction to laparoscopy unit including insufflators, cameras, telescope etc

#### 12. Anaesthetic agents

- Premedication
- Analgesics
- Muscle relaxants
- Inhalational agents
- Emergency drugs
- Induction agents
- Sedatives
- Local anaesthetics
- IV fluids
- Blood transfusion
- Antiemetics

#### 13. Principles of monitored anaesthesia care-MAC

#### 14. Introduction to CPR/resuscitation- BLS

PRACTICAL EXAMINATION - 40 Marks

Subsidiary Subjects

**SOCIOLOGY**

Teaching Hours : 20

**Course Description**

This course will introduce student to the basic sociology concepts, principles and social process, social institutions [in relation to the individual, family and community and the various social factors affecting the family in rural and urban communities in India will be studied.

**Introduction :**

Meaning - Definition and scope of sociology

Its relation to Anthropology, Psychology, Social Psychology

Methods of Sociological investigations - Case study, social survey, questionnaire, interview and opinion poll methods.

Importance of its study with special reference to health care professionals

**Social Factors in Health and Disease:**

Meaning of social factors

Role of social factors in health and disease



**Socialization :**

Meaning and nature of socialization  
Primary, Secondary and Anticipatory  
socialization Agencies of socialization

**Social Groups:**

1. Concepts of social groups, influence of formal and informal groups on health and sickness. The role of primary groups and secondary groups in the hospital and rehabilitation setup.

**Family :**

The family, meaning and definitions Functions of types of family Changing family patterns  
Influence of family on individual's health, family and nutrition, the effects of sickness in the family  
and psychosomatic disease and their importance to physiotherapy

**Community :**

Rural community: Meaning and features - Health hazards to rural communities, health hazards to tribal community.

Urban community - Meaning and features - Health hazards of urbanities

**Culture and Health :**

Concept of Health Concept of culture Culture and Health Culture and Health Disorders

**Social Change :**

Meaning of social changes Factors of social changes Human adaptation and social change Social change and stress Social change and deviance Social change and health programme. The role of social planning in the improvement of health and rehabilitation

## **Social Problems of disabled :**

Consequences of the following social problems in relation to sickness and disability remedies to prevent these problems Population explosion Poverty and unemployment Beggary Juvenile delinquency Prostitution Alcoholism Problems of women in employment

## **Social Security :**

Social Security and social legislation in relation to the disabled

## **Social Work :**

Meaning of Social Work

The role of a Medical Social Worker

## **INDIAN CONSTITUTION**

Prescribed for the First Year students of all degree classes

### **Unit-I:**

Meaning of the term 'Constitution' making of the Indian Constitution 1946-1940.

### **Unit-II:**

The democratic institutions created by the constitution Bicameral system of Legislature at the Centre and in the States.

### **Unit-III:**

Fundamental Rights and Duties their content and significance.

### **Unit - IV:**

Directive Principles of States Policies the need to balance Fundamental Rights with Directive Principles.

### **Unit - V:**

Special Rights created in the Constitution for: Dalits, Backwards, Women and Children and the Religious and Linguistic Minorities.

**Unit-VI:**

Doctrine of Separation of Powers legislative, Executive and Judicial and their functioning in India.

**Unit - VII:**

The Election Commission and State Public Service commissions.

**Unit - VIII:**

Method of amending the Constitution.

**Unit - IX:**

Enforcing rights through Writs:

**Unit - X:**

Constitution and Sustainable Development in India.

**Books:**

1. J.C. Johari: The Constitution of India- A Politico-Legal Study-Sterling Publication, Pvt. Ltd. New Delhi.
2. J.N . Pandey: Constitution Law of India, Allahbad, Central Law Agency, 1998.
3. Granville Austin: The Indian Constitution - Corner Stone of a Nation-Oxford, New Delhi, 2000.

**Environment Science And Health**

Introduction to Environment and Health Sources, health hazards and control of environmental pollution Water The concept of safe and wholesome water. The requirements of sanitary sources of water. Understanding the methods of purification of water on small scale and large scale. Various biological standards, including WHO guidelines for third world countries. Concept and methods for assessing quality of water. Domestic refuse, sullage, human excreta and sewage their effects on environment and health, methods and issues related to their disposal. Awareness of standards of housing and the effect of poor housing on health. Role of arthropods in the causation of diseases, mode of transmission of arthropods borne diseases, methods of control

### **Recommended Books.**

1. Text Book of Environmental Studies for undergraduate courses By Erach Bharucha Reprinted in 2006, Orient Longman Private Limited / Universities Press India Pvt. Ltd.

# THIRD YEAR B.Sc ANAESTHESIA AND OPERATION THEATRE TECHNOLOGY

## COURSE CONTENTS OF THIRD YEAR MAIN SUBJECTS

### PART-I ANAESTHESIA & OPERATION THEATRE TECHNOLOGY – CLINICAL

1. Surgical asepsis & sterile technique
  - Principles of asepsis & sterile techniques
  - Transmission of microorganisms
  - Human-borne and non-human borne sources of contamination
  - Standard precautions
2. Personnel care & hand asepsis
  - Appropriate operating room attire
  - Surgical hand and skin cleansing
  - Gowning and gloving
3. Surgical instruments & equipments
  - Fabrication
  - Classification
  - Powered surgical instruments
  - Handling instruments
  - Microsurgical instruments
4. Pre-operative preparation
  - Pre-anaesthetic assessment
  - Checking of all relevant records, importance of pre op protocols
  - Informed consent
  - Investigations check list with all images
5. Pre op –wheeling in
  - Iv access
  - Premedication
  - Detailed account on positioning and expected skills/knowledge
  - Assistance to anesthesiologist in conducting regional techniques including epidurals, nerve blocks or spinal.-relevant skill/knowledge
  - Assistance in conducting central venous access or intra arterial lines as reqd -knowledge /skill
6. Intra-operative patient care including managing hemodynamics ,use of appropriate drugs among others
7. Post- operative care
  - Reversal
  - Extubation
  - Transfer of patient
  - Fluid management

- Pain management
- 8. General surgery
  - Breast procedures
    - General principles
    - Surgical procedures and preparation
    - Positioning and surgical instruments
    - Technique and special considerations
    - Post-operative care
- 9. Abdominal surgery
  - Biliary tract procedures
  - Liver procedures
  - Spleen procedures
  - Pancreatic procedures
  - Oesophageal procedures
  - Gastric procedures
  - Intestinal procedures
- 10. Colorectal procedures
- 11. Anorectal procedures
- 12. Hernia procedures
- 13. Amputation of extremities
- 14. Laproscopic surgeries
- 15. Cancer surgeries
- 16. Orthopedic surgerys
  - Principles: Basic knowledge of implants screws, k wires, steiman poins, plates, nails
  - Wound debridement
  - Tendon repair
  - Excision of ganglion
  - Carpel tunnel release
  - Principles of fracture reduction – closed & open
  - Use of C ARM
  - Nailing of Long bone fractures
  - Nailing of femoral shaft fracture
  - Ankle and foot surgeries
  - Humerus fixation- nailing and plating
  - Hand surgeries
  - Forearm fracturs – nailing and plating
  - Spine surgeries- dicectomy/instrumentation
  - Replacement surgeries-principles, TKR, THR
  - Arthroplasty, arthroscopy
  - Amputations
- 17. Obstetrics & gynaecology
  - General principles
  - The surgical preparation and technique
  - Positioning

- Surgical equipments
- Normal labour
- LSCS
- Dilatation of the cervix and curettage
- Hysterectomy
- Vaginal
- Total abdominal
- Ectopic Pregnancy
- Post-partum female sterilization/tubectomy –laparoscopic /open
- Myomectomy
- Principles of laparoscopic gynecological procedures
- IVF

#### 18. ENT Surgery

**6hrs**

- General principles
- The surgical preparation and technique
- Positioning
- Surgical equipments for
- Tonsillectomy
- Adenoidectomy
  - Tracheostomy
  - Myringoplasty
  - Mastoidectomy
  - Tympanoplasty
  - Radical neck dissection
  - Turbinectomy
  - Septoplasty
  - Rhinoplasty
  - FESS
  - Thyroidectomy

#### 19. Ophthalmic Surgery

**5hrs**

- General Principles
- The surgical preparation and technique
- Positioning
- Surgical equipments
- Excision of Chalazion
- Iridectomy
- Corneal Transplants
- Cataract
- Glaucoma
- Refractive Keratoplasty
- Lacrimal Duct Dilatation

#### 20. Neurosurgery

**6hrs**

- General principles
- The surgical preparation
- Positioning

- Surgical instruments
- Technique
- Special considerations
- Post-operative care.
- Craniotomy
- VP shunt
- Burr hole
- Awake craniotomy
- Spine surgeries
- Aneurysm surgeries

## 21. Urology

**5hrs**

- General principles
- The surgical preparation
- Positioning
- Surgical instruments
- Technique
- Special considerations
- Post-operative care
- PCNL
- ESWL
- Renal transplantation
- TURP
- Cystoscopy
- Nephrectomy
- AV Fistula

## 22. Cardio Thoracic surgery

**5hrs**

- General principles
- The surgical preparation
- Positioning
- Surgical instruments
- Technique
- Special considerations
- Post-operative care
- CABG
- Valve replacement surgeries
- Lung isolation
- Chest injury
- ICD
- Pulmonary lobotomy
- Thoracoplasty
- ASD and VSD closure



**23. Plastic , Reconstructive & Vascular surgery** **5hrs**

- General principles
- The surgical preparation
- Positioning
- Cosmetic Rhinoplasty
- Lipo suction
- Scar excision /revision Z plasty
- Skin grafting
- Burns- Acute & reconstructive management

**24. Paediatric surgery** **5hrs**

- General principles
- The surgical preparation
- Positioning
- Surgical instruments
- Technique
- Special considerations
- Post-operative care
- Urethroplasty
- Colostomy
- Cystoscopy
- .Appendicectomy

**PRACTICAL EXAMINATION**

One common practical for all the three papers with equal weight age of marks i.e. 40 practical marks for each paper.

## **PART-II ANAESTHESIA & OPERATION THEATRE TECHNOLOGY – APPLIED**

### **1. Airway management**

**15hrs**

- Airway assessment
- Management of obstructed airway
  - Triple maneuver
  - Gadgets to manage airway obstruction
  - Laryngoscopy and intubation
  - Surgical airway
- Airway management technique
  - Ventilation with a face mask
  - Endotracheal intubation
  - Fiberoptic Endotracheal intubation
    - Airway blocks
    - Preparation
    - Technique of fibre optic intubation
- Difficult airway management
- Use of LMA/different gadgets
- Proper use of stylette/bougie
- Retrograde tracheal intubation
- Trans tracheal techniques
  - Cricothyrotomy
  - PCDT
- Complications of tracheal intubation
- Airway management in infants and children
  - Airway difference between infants and adults
  - Managing the normal airway in infants and children
  - Managing the difficult airways in infants and children
  - Tracheal extubation in infants and children

### **2. Anaesthetic monitoring**

**12hrs**

- Electrocardiography
- Blood pressure monitoring
  - Non invasive
  - Invasive
- Pulse oximetry
- Capnography
- Central venous pressure monitoring
- Pulmonary artery pressure monitoring
- Trans Oesophageal Echocardiography
- Temperature monitoring
- Blood gas analysis
- Airway pressure monitoring
- Neuromuscular monitoring

- Bispectral Index (BIS)-

### 3. Anaesthesia outside the operating room

**8hrs**

- Non invasive radiographic procedure
- CT consoles
- MRI units
  - Safety considerations
  - Monitoring issues
  - Compatible equipment
  - Management of anaesthesia
- Invasive radiographic procedure
  - Angiography
- Radiation therapy
- Electro convulsive therapy
- Extra corporeal shock wave lithotripsy
- Dental chair procedures
- Endoscopy –ERCP
- Colonoscopy
- IVF procedure
- Labour analgesia
- Anaesthesia in cath lab –procedures in cath lab

### 4. Acute post-operative pain management

**8hrs**

- Analgesic delivery system
  - Oral administration
  - Intra muscular administration
  - Intravenous administration
  - Patient controlled analgesia
  - Neuraxial analgesia
- Alternative approach to management of Acute post operative pain
  - Peripheral nerve blocks
  - TENS

### 5. Concept and idea of recovery room

**5hrs**

- Requisite skill and knowledge to deal with immediate post op problems like
  - severe shivering, chills,
  - possible airway problems,
  - hypotension,
  - drain care,
  - oxygen supplementation,
  - assesment of pain and need of analgesics,
  - Post op vomiting

### 6. Fluid management

**5hrs**

- Pre operative considerations
- Perioperative fluid therapy – quantitative considerations - Pre existing fluid deficit, Maintenance requirement, Surgical fluid losses

- Types and choice of fluids with respect to colloids /crystalloids
- Precautions on special cases like paediatrics, renal patients, elderly, cardiac patients etc
- Use of pressure bags

#### 7. Blood therapy

**8hrs**

- Assessment of blood loss
- Blood groups
- Cross matching
- Blood components
- Blood transfusion
  - Indications
  - Complications
- Autologous blood transfusion
- Mismatched blood transfusion

**25hrs**

#### 8. Medical emergencies in the intra operative period

- Difficult airway
  - Difficult mask ventilation
  - Difficult intubation
  - CVC
- Hypoxia
- Tight bag
- Bronchospasm
- Laryngospasm
- Hypertension
- Hypotension
- Bradycardia
- Tachycardia
- Hypothermia
- Arrhythmia
- Hyperthermia-Malignant hyperthermia
- Shivering
- Raised ICT
- Hypercarbia
- Thyrotoxicosis
- High spinal
- Total spinal
- Anaphylaxis
- Pulmonary edema
- DIC
- Mismatched blood transfusion
- TURP syndrome
- LA toxicity
- Emergency LSCS
- PPH

- Intraoperative cardiac arrest
- Post-operative restlessness
- OT fire & electrical mishap
- Concept of emergency surgeries and emergency preparedness in OT

#### 9. Post Anaesthesia recovery

**6hrs**

- Admission to the post anaesthesia care unit (PACU)
- Airway obstruction
  - Loss of pharyngeal muscle tone
  - Residual neuromuscular blockade
  - Laryngospasm
  - Airway edema
  - Management of upper airway obstruction
- Post-operative de saturation
  - Hypoventilation
- Pulmonary edema
  - Post obstructive pulmonary edema
  - Transfusion-related lung injury
- Hemodynamic Instability
  - Systemic hypertension
  - Systemic hypotension
  - Myocardial ischemia
  - Cardiac dysrhythmias
- Post-operative restlessness
  - Risk factors
  - Management
- Renal dysfunction
  - Oliguria secondary to depletion of intravascular fluid volume
  - Intra- abdominal hypertension
  - Rhabdomyolysis
- Body temperature and shivering
  - Mechanism
  - Treatment
  - Clinical effects
- Post-operative nausea and vomiting
  - High risk patients
  - Prevention and treatment
- Post-operative bleeding
- Delayed recovery
  - Treatment
- Criteria for discharge from PACU

## **PRACTICAL EXAMINATION**

One common practical for all the three papers with equal weightage of marks i.e. 40 practical marks for each paper.

## **PART-III ANAESTHESIA & OPERATION THEATRE TECHNOLOGY – ADVANCED**

### **1. Introduction/ General Concepts**

- Death in ICU: Ethical consideration
- EOL issues – concept of DNR/DNI
- Informed consent
- Universal precautions : Protecting the practitioner

### **2. Monitoring & Diagnostic Procedures in ICU**

**10 Hrs**

- Invasive pressure monitoring: general principles
- Non-invasive cardiovascular monitoring
- Monitoring tissue Anaesthesia and Operation Theatre & oxygenation
- Bedside assessment & monitoring of pulmonary function & power of breathing in the critically ill
- Echocardiography- point of care
- Blood volume measurements in critical care
- Radiologic imaging & bedside ultrasound in the intensive care unit

### **3. Techniques, Procedures & Treatment**

- Clean & aseptic techniques at the bed side
- Vascular Cannulation
  - Central venous
  - Arterial
- Temporary cardiac pacemakers
- Feeding tube placement.
- Urinary catheter & Endotracheal tube care
- Blood & blood products transfusion
- Tracheostomy & care of tracheotomised patient

### **4. General Care of the Patient in ICU**

**5hrs**

- Bed care
- Eye care
- Bladder care
- Care of mechanically ventilated patient
- Vascular lines- arterial, venous line
- Intensive spirometry
- Introduction to BUNDLES and FAST HUG in ICU

### **5. Nutrition and Toxicology**

**6hrs**

- Nutritional issues
- Fluid balance
- Parenteral nutrition
- Practical aspects of TPN & enteral nutrition
- Toxicology
- Substance abuse & withdrawal : Alcohol ,cocaine, opioids & other drugs
- Transfusion reactions

**6. The Surgical Patient****7hrs**

- Initial management of the trauma patient
- Secondary & tertiary triage of the trauma patient
- Surgical & post-surgical bleeding
- Abdominal trauma: Non operative management & postoperative considerations
- Burn injury : Thermal & electrical

**7. Infectious Disease****8hrs**

- Basic concept of infection control and rational antibiotic use
- Antibiotic resistance
- The role of antibiotics in the management of serious hospital acquired infections
- An approach to the febrile ICU patient
- Skin wounds & musculoskeletal infection
- Catheter related Blood stream infections
- Human immune deficiency virus in the intensive care intensive care unit
- Bed sore management
- Surgical Site Infections- Classification, diagnosis & management

**8. Respiratory Disorders****6hrs**

- Mechanical ventilation
- Non-invasive ventilatory support modes
- Invasive ventilatory support modes-basic modes
- Oxygen therapy & basic respiratory care
- Aspiration
- Severe asthma
- Acute respiratory failure in chronic obstructive pulmonary disease
- Chest physiotherapy, positioning for drainage & respiratory exercises

**9. Neurologic Disease & Dysfunction****4hrs**

- Sedation score
- Elevated intracranial pressure
- Altered consciousness & coma in the ICU
- Seizures & status epilepticus
- Neurological evaluation /monitoring
- Glasgow coma scale

**10. Cardiovascular Disease & Dysfunction****3hrs**

- Cardiovascular failure
- Inotropic support
- Vasodilator drugs
- Arrhythmias

**11. Specialized Management Issues: Disaster Management****2hrs**

- Mass casualty incidents: Organizational & triage management issues that impact critical care
- Disaster response
- Code yellow



## **12. Resuscitation**

**5hrs**

- ABC
- BLS
- ACLS
- ALGORITHMS

## **13. Transportation**

- Trauma management
- Disaster management
- Triaging
  - Patient safety during transport
  - Cervical spine injury & patient transfer
  - Patient transfer
- Types- Interhospital & Intrahospital

### **Practical/Demonstration:**

**30hrs**

- Universal precautions in ICU
- Hand hygiene
- Informed consent
- Setting of peripheral line & catheterization tray
- Setting of emergency airway equipments trolley
- Setting of emergency drug trolley
- Setting of ventilator
- Setting of Infusion pumps
- Setting of defibrillator
- Setting and preparation for arterial blood pressure monitoring line
- Setting and preparation of tracheostomy set
- Setting of CVP monitoring set
- BLS and ACLS in ICU
- Parenteral nutrition in ICU

## **PRACTICAL EXAMINATION**

One common practical for all the three papers with equal weightage of marks i.e. 40 practical marks for each paper

## Subsidiary Subjects

### **BIO STATISTICS**

Time Allotted: 20 Hours

#### **Course Description:**

Introduction to basic statistical concepts: methods of statistical analysis; and interpretation of data

#### **Behavioural Objectives:**

Understands statistical terms.

Possesses knowledge and skill in the use of basic statistical and research methodology.

#### **Unit - I : Introduction**

Meaning, definition, characteristics of statistics. Importance of the study of statistics.

Branches of statistics. Statistics and health science including nursing. Parameters and estimates.

Descriptive and inferential statistics. Variables and their types. Measurement scales

#### **Unit - II: Tabulation of Data**

Raw data, the array, frequency distribution. Basic principles of graphical representation.

Types of diagrams - histograms, frequency polygons, smooth frequency polygon, cumulative frequency curve, ogive. Normal probability curve.

#### **Unit - III : Measure of Central Tendency**

Need for measures of central tendency Definition and calculation of mean - ungrouped and grouped Meaning, interpretation and calculation of median ungrouped and grouped. Meaning and calculation of mode. Comparison of the mean, and mode. Guidelines for the use of various measures of central tendency.

#### **Unit - IV : Measure of Variability**

Need for measure of dispersion. The range, the average deviation. The variance and standard deviation. Calculation of variance and standard deviation ungrouped and grouped. Properties and uses of variance and SD

Unit -V : Probability and Standard Distributions.

Meaning of probability of standard distribution. The binomial distribution.

The normal distribution. Divergence

#### **Unit - VI : Sampling Techniques**

Need for sampling - Criteria for good samples. Application of sampling in Community.

Procedures of sampling and sampling designs errors. Sampling variation and tests of significance.

#### **Unit - VII : Health Indicator**

Importance of health Indicator. Indicators of population, morbidity, mortality, health services. Calculation of rates and ratios of health.

#### **Recommended Books.**

B.K. Mahajan & M. Gupta (1995) Text Book of Preventive & Social Medicine, 2002, 17th Edition Jaypee Brothers.

## **BASICS IN COMPUTER APPLICATIONS**

The course enables the students to understand the fundamentals of computer and its applications.

### **Introduction to Data processing :**

Features of computers, Advantages of using computers. Getting data into / out of computers. Role of computers. What is Data processing? Application areas of computers involved in Data processing. Common activities in processing. Types of Data processing, Characteristics of information. What are Hardware and Software?

### **Hardware Concepts :**

Architecture of computers, Classification of computers, Concept of damage. Types of storage devices. Characteristics of disks, tapes, Terminals, Printers, Network. Applications of networking concept of PC System care, Floppy care, Data care.

### **Concept of Software.**

Classification of software : System software. Application of software. Operating system. Computer system. Computer virus. Precautions against viruses. Dealing with viruses. Computers in medical electronics

Basic Anatomy of Computers Principles of programming

Computer application - principles in scientific research ; work processing, medicine, libraries, museum , education, information system.

Data processing Computers in physical therapy - principles in EMG, Exercise testing equipment, Laser. Scheme of Examination for MEDICAL ELECTRONICS including COMPUTER APPLICATIONS One Written (Theory) paper: Maximum Marks: - 80 marks.

No Practical or Viva voce examination

## **CLINICAL TRAINING**

### **Content and purpose**

The clinical component has been designed to complement the academic program and runs throughout the course. The placement have to be designed so that the students will be able to observe the practical application of the academic course wherever possible. Content can be tailored to meet either National or Local needs as is deemed to be most appropriate.

**1st year : Introduction to the Hospital Setting The purpose of this phase is :**

- i. For the students to become familiar with some of the practical applications of the academic course
- ii. To introduce the wider hospital setting
- iii. To help the students to identify the various disciplines within a hospital, their role and the importance of cooperation.
- iv. To introduce patients in a clinical setting and begin to acquire basic communication skills.

## **2nd year : Skills Necessary to work in a Hospital**

To be completed very early in the training. The following procedures will be demonstrated to the students who will be expected to observe or participate as appropriate.

### **General procedures to be observed when patients attend for appointment :**

- Lifting and moving techniques.
- Administration of bedpans, vomit bowls, etc.,
- Care and management of drugs in the hospital setting.

### **Correct procedures when dealing with patients with infectious diseases**

- University precautions.

### **Correct procedures when dealing with immuno-compromised patients :**

- Hygiene practices
- Simple dressings
- Sterile procedures
- Oxygen administration

### **Care of patients with :**

- Breathing difficulties
- Terminal illness
- Mental impairment
- Physical disability
- Special care of the geriatric and pediatric patient
- Stoma care
- Handling of patients with bone metastases
- Care of the patient following an anaesthetic
- Care of lines in the incubated patient
- Communication skills with patients and relatives
- Terminally ill and Hospice

## **2nd & 3rd year : Skills Related to working in a department**

Introduction to the department. Time will be spent on each unit within the department. The purpose of this phase is to :

### **In the department :**

- i. Familiarize the students with the different units within the department and the procedures carried out on each unit.

- ii. Enable the student to recognize and relate to the basic terminology introduced in the academic program.
- iii. Help to establish a sense of identity within the student group and to understand the role of the Technology in the management of various cases.
- iv. Introduce the students to the staff of the department.
- v. Help the student to understand team roles.
- vi. Familiarize the students with written QA programs within the department.

### **Equipments and Integration :**

- i. Begin to become competent in the manipulation of the equipment.
- ii. Be able to communicate effectively with patients.
- iii. Begin to integrate into the department as part in specific and multidisciplinary teams.
- iv. Begin to empathize with patients and to appreciate their own feelings in the clinical situation.
- v. Being able to handle and achieve proficiency in mould room techniques.

### **Safety & Precautions in Practice :**

- i. Identifying the functions of various equipment and safe handling.
- ii. Identifying the functions on a control panel, indicating their purpose and safely using these when appropriate.
- iii. Safely using the accessory equipment in the correct context.
- iv. Correctly and safely using equipment related to patient immobilization.
- v. Demonstrating the correct procedure for various techniques

### **To Achieve Clinical Competence**

The purpose of this phase is for the students to :

- i. Demonstrate competence in the manipulation of equipment.
- ii. Demonstrate an ability to anticipate the physical and psychological needs of the patient and respond to them.
- iii. Demonstrate the ability to communicate with ease with other staff involved in the multidisciplinary treatment of the patient.
- iv. Increasingly participate as a team member in all aspects of the patient's management.
- v. Demonstrate competence in simulator procedures.
- vi. Acquire basic computer skills.
- vii. Participate in the development / revision of formal written quality assurance procedures / programme.
- viii. Set up a patient on their first visit.

### **To achieve final competency substantial time will be spent :**

- i. Setting up multi field techniques under supervision.
- ii. Participating in the quality control procedures in the department in accordance with the protocols.
- iii. Simulating and localizing a target volume.
- iv. Discussing the role of local rules and outline those in place in the different departments.

### **Graded Responsibility (structured training schedule)**

**I year :** Theory classes, observation in treatment planning and treatment execution.

**II year :** Theory classes, participation in OPD, mould room techniques, treatment planning, treatment execution under the supervision of consultant, senior technologist, project work.

**III year :** Theory classes, participation in OPD, Treatment planning and execution under supervision of consultant & Senior Technologist. Submission of Project Work, Mould Room Techniques, Quality Assurance.

### **Rotation posting**

Students may be posted to other relevant departments or other centers with better and latest equipment's for a minimum period of 1 to 2 months, for completion of training in recent advance in the specialty. The student on completion of the training shall submit a report duly signed by the concerned department to the HOD.

### **Monitoring Learning Progress**

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only also helps teachers to evaluate students but also students to evaluate themselves. The monitoring be done by the staff of the department based on participation of students in various teaching / learning activities. It may be structured and assessment be done using sample checklist provided (Assessment forms).

### **The learning outcomes to be assessed should include :**

- i. Personal Attitudes
- ii. Acquisition of knowledge
- iii. Clinical and operative skills
- iv. Teaching skills

**Candidate should be encouraged to participate in teaching activities, seminars and literature reviews.**

#### **1. Periodic tests:**

The departments may conduct periodic tests (Internal Assessment), the tests may include written papers, practical with viva voce. Work diary / Log, Personal Attitudes.

### **The essential items are :**

- Caring attitudes
- Initiative
- Organizational ability
- Potential to cope with stressful situations and undertake responsibility
- Trustworthiness and reliability
- To understand and communicate intelligibly with patients and other
- To behave in manner which establishes professional relationships with patients and colleagues
- Ability to work in team
- A critical enquiring approach to the acquisition of knowledge the methods used mainly consist of observation. It is appreciated that these items require a degree subjective assessment by the guide, supervisors and peers.

### 3. Acquisition of Knowledge :

The methods used comprise of 'Log Book' which records participation in various teaching / learning activities by the students. The number of activities attended and the number in which presentations are made are to be recorded. The log book should periodically be validated by the supervisors, some of the activities are listed.

The list is not complete. Institutions may include additional activities, if so, desired.

### 4. Technical skills

Day to day work : Skills on the machines should be assessed periodically. The assessment should include the candidates' sincerity and punctuality, analytical ability and communication skills.

**Clinical and procedural skills :** The candidate should be given graded responsibility to enable learning by apprenticeship. The performance is assessed by the guide by direct observation. Particulars are recorded by the student in the log book.

### 5. Teaching Skills :

Every candidate shall maintain a work diary and record his / her participation in the training programs conducted by the department such as practical, literature reviews, seminars, etc. Special mention may be made of the presentations, by the candidate as well as details of practical or laboratory procedures, if any conducted by the candidate.

### 6. Records :

Records, log books, project report and marks obtained in tests will be maintained by the Head of the Department and will be made available to the University as indicated. The record books maintained by the student should be submitted to the Head of the Department 6 months prior to completion of the course and the head of the department makes a certification of the of the academic progress an assessment of student performance throughout the said courses shall be made by the HOD.

The log book is a record of the important activities of the candidates during his training internal assessment should be based on the evaluation of the log book collectively, log books are a tool for the evaluation of the training programme of the institution by external agencies. The record includes academic activities as well as the presentations and procedures carried out by the candidate.

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**REGULATIONS & CURRICULUM OF  
GRADUATE PARAMEDICAL COURSE  
  
BACHELOR OF SCIENCE IN  
  
CARDIAC CARE TECHNOLOGY  
  
2020**



**Sri Siddhartha  
Academy of Higher Education  
Deemed-to-be-University**

**Established under Section 3 of the UGC Act, 1956  
MHRD, GOI No. F.9-31/2006-U.3 (A) Dtd. 30th May 2008**

**Agalakote, B.H. Road, Tumkur – 572107, Karnataka, India**



# SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

(DEEMED TO BE UNIVERSITY)

Declared under Section 3 of the UGC Act, 1956, MHRD GOI No. F.9-31/2006-U.3 (A) Dated: 30/05/2008

Accredited 'A' Grade by NAAC

Agalakote, B.H.Road, Tumkur – 572 107. KARNATAKA, INDIA.

Ph. 0816- 2275516, Fax : 0816-2275510 website: sahetumkur.ac.in email: info@sahe.in



No. SSAHE/ACA-S&C(AHSP)/13/2022

Date: 01/09/2022

## NOTIFICATION

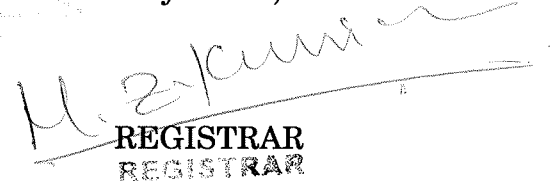
Sub: Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Cardiac Care Technology.

- Ref: 1). Proceedings of BOS Allied Health Sciences Programmes held on 06/04/2021  
2). Proceedings of the Academic Council meeting held on 19/08/2021  
3). Proceedings of the Board of Management held on 29/08/2022

In exercise of the powers vested under section 6 of 6.4 of MoA / Rules of SSAHE, the Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Cardiac Care Technology is notified herewith as per Annexure.

The above Regulations shall be applicable to the students admitted to the said course from the academic year 2020-21 onwards.

By Order,

  
REGISTRAR  
REGISTRAR

Sri Siddhartha Academy of Higher Education  
TUMKUR - 572 107, Karnataka.

To,  
Dean / Principal, Sri Siddhartha Medical College & Hospital,

Copy to

- 1) Office of the Chancellor, SSAHE, for kind information,
- 2) PA to Vice-Chancellor / PA to Registrar / Controller of Examinations / Finance Officer, SSAHE
- 3) The Director (AHSP), SSAHE
- 4) All Officers of the Academy Examination Branch / Academic Section
- 5) Guard File / Office copy.

**REGULATIONS & CURRICULUM FOR BACHELOR OF  
B.Sc. CARDIAC CARE TECHNOLOGY -2020**

**1. Eligibility for admission:**

A candidate seeking admission to the BSc. Cardiac Care Technology shall have studied English as one of the principal subject during the tenure of the course and shall have passed:

1. Two year Pre-University examination or equivalent as recognized by Sri Siddhartha Academy of Higher Education with, Physics, Chemistry and Biology as subjects of study.

OR

2. Pre-Degree course from a recognized University considered as equivalent by SSAHE, (Two years after ten years of schooling) with Physics, Chemistry and Biology as subjects of study.

OR

3. Any equivalent examination recognized by the Sri Siddhartha Academy of Higher Education Bangalore for the above purpose with Physics, Chemistry and Biology as subjects of study.

OR

4. The vocational higher secondary education course conducted by Vocational Higher Secondary Education, Government of Kerala with five subjects including Physics, Chemistry, Biology and English in addition to vocational subjects conducted is considered equivalent to plus TWO examinations of Government of Karnataka Pre University Course.

OR

5. Candidates with two years diploma from a recognized Government Board in Cardiac Care Technology shall have passed class 12 [10+2] with Physics, Chemistry and Biology, as subjects or candidates with 3 years diploma from a recognized Government Board in Cardiac Care Technology should have studied Physics, Biology and Chemistry as subjects during the tenure of the course.

6. Lateral entry to second year of B.Sc.Cardiac CareTechnology for candidates who have passed diploma program from the Government Boards and recognized by SSAHE, fulfilling the conditions specified above under Sl. No. 5 and these students are eligible to take admission on lateral entry system only in the same subject studied at diploma level for the academic year.

**Note:**

- a. The candidate shall have passed individually in each of the subjects.
- b. Candidates who have completed diploma or vocational course through Correspondence shall not be eligible for any of the courses mentioned above.

**2. Duration of the course:**

Duration shall be for a period of four years including one year of Internship.

**3. Medium of instruction:**

The medium of instruction and examination shall be in English.

**4. Scheme of examination:**

There shall be three examinations one each at the end of 1 st, 2nd and 3rd year.

**5. Attendance**

Every candidate should have attended at least 80% of the total number of classes conducted in an academic year from the date of commencement of the term to the last working day as notified by university in each of the subjects prescribed for that year separately in theory and practical. Only such candidates are eligible to appear for the university examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A candidate lacking in prescribed percentage of attendance in any subjects either in theory or practical in the first appearance will not be eligible to appear for the University Examination in that subject

## **6. Internal Assessment (IA):**

### 1st Year B.Sc Cardiac Care Technology

Theory - 20 marks

Practical's - 10 marks\*. [Lab work- 06 marks and Record-04marks] 2nd

### & 3rd year B.Sc Cardiac Care Technology

Theory – 20 Marks

Practicals – 20Marks

There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an academic year. The average marks of the two tests will be calculated and reduced to 20. The marks of IA shall be communicated to the University at least 15 days before the commencement of the University examination. The University shall have access to the records of such periodical tests. The marks of the internal assessment must be displayed on the notice board of the respective colleges with in a fortnight from the date test is held. If a candidate is absent for any one of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

\* There shall be no University Practical Examination in First year.

## **7. Subject and hours of teaching for Theory and practical's**

The number of hours of teaching theory and practical, subject wise in first year, second year and third year are shown in Table-I, Table-II and Table-III

Main and Subsidiary subjects are common in first year for all the courses in Allied Health Science.

The number of hours for teaching theory and practical for main subjects in first, Second and Third year are shown in Table-I, II and III

**Table - I Distribution of Teaching Hours in First Year Subjects Main**

**subjects**

| Sl. No. | Subject                                                    | Theory No. of Hours | Practical No. of Hours | Total No. of Hours |
|---------|------------------------------------------------------------|---------------------|------------------------|--------------------|
| 1.      | Human Anatomy                                              | 70                  | 20                     | 90                 |
| 2.      | Physiology                                                 | 70                  | 20                     | 90                 |
| 3.      | Biochemistry                                               | 70                  | 20                     | 90                 |
| 4.      | Pathology-[Clinical pathology, Hematology & Blood -Banking | 70                  | 20                     | 90                 |
| 5.      | Microbiology                                               | 70                  | 20                     | 90                 |
|         | Total                                                      | 350                 | 100                    | 450                |

The classes in main and subsidiary subjects are to be held from Monday to Thursday. On Fridays and Saturdays students shall work in hospitals in the respective specialty or department chosen by them

**Subsidiary Subjects**

English 25 Hours

Kannada 25 Hours

Health-Care 40 Hours

Clinical/Lab posting –470 hours (Friday 9am – 1pm and 2pm - 4-30 pm

Saturday 9am - 1pm)

**Table - II Distribution of Teaching Hours in Second Year Subjects Main**

**Subjects**

| Sl. No. | Subject                                      | Theory         | Practical<br>No. of Hours | Clinical<br>posting | Total<br>No.<br>of<br>Hours |
|---------|----------------------------------------------|----------------|---------------------------|---------------------|-----------------------------|
|         |                                              | No of<br>Hours |                           |                     |                             |
| 1.      | Medicine relevant cardiac care to technology | 50             | --                        | --                  | 50                          |
| 2.      | Section A Applied Pathology                  | 30             | 30                        | --                  | 120                         |
|         | Section B Applied Microbiology               | 30             | 30                        |                     |                             |
| 3.      | Applied Pharmacology                         | 50             | --                        | --                  | 50                          |
| 4.      | Introduction to Cardiac care Technology      | 80             | 100                       | 650                 | 830                         |
|         | Total                                        | 240            | 160                       | 650                 |                             |

**Subsidiary Subjects:**

Subsidiary Subjects:

|                                |          |
|--------------------------------|----------|
| Sociology                      | 20 Hours |
| Constitution of India          | 10 Hours |
| Environmental Science & Health | 10 Hours |

**Table - III Distribution of Teaching Hours in Third Year Subjects Main****Subjects**

| Sl. No. | Subject                                  | Theory         | Practical<br>No. of<br>Hours | Clinical<br>posting | Total No.<br>of Hours |
|---------|------------------------------------------|----------------|------------------------------|---------------------|-----------------------|
|         |                                          | No of<br>Hours |                              |                     |                       |
| 1.      | Cardiac care<br>Technology<br>– Clinical | 50             | 50                           | 250                 | 350                   |
| 2.      | Cardiac care<br>Technology<br>- Applied  | 50             | 50                           | 250                 | 350                   |
| 3.      | Cardiac care<br>Technology –<br>Advanced | 50             | 50                           | 250                 | 350                   |
|         | Total                                    | 150            |                              |                     |                       |

**Subsidiary Subjects:**

Ethics, Database Management                      50 Hours

Research & Biostatistics                              20 Hours

Computer application                                  10 Hours

**8. Schedule of Examination:**

The university shall conduct two examinations annually at an interval of not less than 4 to 6 months as notified by the university from time to time. A candidate who satisfies the requirement of attendance, progress and conduct as stipulated by the university shall be eligible to appear for the university examination. Certificate to that effect shall be produced from the Head of the institution along with the application for examination and the prescribed fee.

**9. Scheme of Examination**

There shall be three examinations, one each at the end of I, II and III year. The examination for both main and subsidiary subjects for all courses in Allied Health Sciences shall be common in the first year.

Distribution of Subjects and marks for First Year, Second year & Third year University theory and practical Examinations are shown in the Table – IV, V & VI.

#### **First year examination:**

The University examination for 1st year shall consist of only theory examination and there shall be no University Practical Examination.

#### **Second & Third year examination:**

The University examination for 2nd and 3rd year shall consist of Written Paper & Practical. Written Examinations consists of 4 papers in the 2nd Year 3 papers in the 3rd Year:

#### **Practical examination:**

Three practical examinations, at the end 2nd Year and three practical examinations at the end of the 3rd year. One practical exam at the end of internship (4<sup>th</sup> year)

**TABLE-IV**

#### **Distribution of Subjects and marks for First Year University theory Examination**

| A | Main Subjects*                      | Written Paper |       | I A Theory | Total |
|---|-------------------------------------|---------------|-------|------------|-------|
|   |                                     | Duration      | Marks | Marks      | Marks |
| 1 | Basic Anatomy (Including Histology) | 3 Hours       | 80    | 20         | 100   |
| 2 | Physiology                          | 3 Hours       | 80    | 20         | 100   |
| 3 | Biochemistry                        | 3 Hours       | 80    | 20         | 100   |
| 4 | Pathology                           | 3 Hours       | 80    | 20         | 100   |
| 5 | Microbiology                        | 3 Hours       | 80    | 20         | 100   |
|   | Subsidiary Subject**                |               |       |            |       |
| 1 | English                             | 3 Hours       | 80    | 20         | 100   |
| 2 | Kannada                             | 3 Hours       | 80    | 20         | 100   |
| 3 | Health Care                         | 3 Hours       | 80    | 20         | 100   |

Note: I A = Internal Assessment

\*Main Subjects shall have University Examination.

There shall be no University Practical Examination.

\*\* Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.



**TABLE - V****Distribution of Subjects and marks for Second Year Examination.**

| <b>Theory</b>     |                                                                                   |               |            |                           |                        |                 | <b>Practical</b> |                        |
|-------------------|-----------------------------------------------------------------------------------|---------------|------------|---------------------------|------------------------|-----------------|------------------|------------------------|
| <b>Pap<br/>er</b> | <b>Subjects</b>                                                                   | <b>Theory</b> | <b>I.A</b> | <b>Sub<br/>Tot<br/>al</b> | <b>Practi<br/>cals</b> | <b>I.A</b>      | <b>Sub total</b> | <b>Grand<br/>Total</b> |
| i                 | Section A -<br>Applied<br>Pathology<br>Section B -<br>Applied<br>Microbiolog<br>y | 40<br>40      | 20         | 100                       | 40                     | 10              | 50               | 150                    |
| ii                | Introduction<br>to Cardiac<br>care<br>Technology                                  | 80            | 20         | 100                       | 40                     | 10              | 50               | 150                    |
| iii               | Applied<br>Pharmacology                                                           | 80            | 20         | 100                       |                        | No<br>Practical |                  | 100                    |
| iv                | Medicine relevant<br>to technology                                                | 80            | 20         | 100                       |                        | No<br>Practical |                  | 100                    |

**Distribution of Subsidiary Subjects and marks for Second Year Examination**

| <b>B</b> | <b>Subsidiary<br/>Subject**</b>   | <b>Duration</b> | <b>Marks</b> | <b>I .A<br/>Theory Marks</b> | <b>Total Marks</b> |
|----------|-----------------------------------|-----------------|--------------|------------------------------|--------------------|
| 1.       | Sociology                         | 3 hours         | 80           | 20                           | 100                |
| 2.       | Constitution of India             | 3 hours         | 80           | 20                           | 100                |
| 3.       | Environmental<br>Science & Health | 3 hours         | 80           | 20                           | 100                |

\*\* Subsidiary subjects: Examination for subsidiary Subjects shall be conducted by respective colleges

**TABLE - VI**

**Distribution of Subjects and marks for Third Year Examination.**

| SL NO | THEORY                           |        |     |          | PRACTICAL         |     |          |             |
|-------|----------------------------------|--------|-----|----------|-------------------|-----|----------|-------------|
| PAPER | SUBJECTS                         | THEORY | I.A | SUBTOTAL | PRACTICAL         | I.A | SUBTOTAL | GRAND TOTAL |
| 1     | Cardiac care technology clinical | 80     | 20  | 100      | 120<br>(40+40+40) | 30  | 150      | 450         |
| 2     | Cardiac care technology applied  | 80     | 20  | 100      |                   |     |          |             |
| 3     | Cardiac care technology advanced | 80     | 20  | 100      |                   |     |          |             |

\*\* Practical-One common practical for all the three papers with equal weightage of marks i.e. 40 practical mark and 10 I.A. marks for each paper.

**Distribution of Subsidiary Subjects and marks for Third Year Examination**

| B  | Subsidiary Subject**        | Duration | Marks | I.A Theory Marks | Total Marks |
|----|-----------------------------|----------|-------|------------------|-------------|
| 1. | Ethics, Database Management | 3 hours  | 80    | 20               | 100         |
| 2. | Research & Biostatistics    | 3 hours  | 80    | 20               | 100         |
| 3. | Computer application        |          |       |                  |             |

Subsidiary subjects : Examination for subsidiary subjects shall be conducted by respective college

## **10. PASS CRITERIA**

### **10.1. First year examination**

- a. Main Subjects: A candidate is declared to have passed in a subject, if he/she secures 50% of marks in University Theory exam and internal assessment added together.
- b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the Commencement of the University examination.

### **10.2. Second and Third year Examination**

- a. Main Subjects: A candidate is declared to have passed the examination in a subject if he/she secures 50% of the marks in Theory and 50% in practical separately. For a pass in theory, a candidate has to secure a minimum of 40% marks in the University conducted written examination, and 50% in aggregate in the University conducted written examination and internal assessment added together and for pass in Practical, a candidate has to secure a minimum of 40% marks in the university conducted Practical/Clinical examination and 50% in aggregate i.e. University conducted Practical/Clinical and Internal Assessment.
- b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

## **11. Carry over benefit**

### **11.1 First year examination:**

A candidate who fails in any two of the five main subjects of first year shall be permitted to carry over those subjects to second year. However, he/ she must pass the carry over subjects before appearing for second year examination.

### **11.2. Second year examination:**

A candidate is permitted to carry over any one main subject to the third year but shall pass this subject before appearing for the third year examination.

## **12. Declaration of Class:**

**a.** A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with Distinction.

**b.** A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 60% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in First Class.

**c.** A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than 60% of grand total marks prescribed will be declared to have passed the examination in Second Class.

**d.** A candidate passing the university examination in more than one attempt shall be placed in Pass class irrespective of the percentage of marks secured by him/her in the examination.

**e.** The marks obtained by a candidate in the subsidiary subjects shall not be considered for award of Class or Rank.

[Please note, fraction of marks should not be rounded off clauses (a), (b) and (c)]

### **13. Eligibility for the award of Degree:**

A candidate shall have passed in all the subjects of first, second and third year to be eligible for a compulsory one year of rotational internship. On completion of one year of the internship the candidate is then eligible for the award of degree.

## **INTERNSHIP**

One year compulsory rotational postings during which students have to work under the supervision of experienced staff

#### 14. Eligibility for the award of Degree:

A candidate shall have passed in all the subjects of first, second and third year to be eligible for a compulsory 12 months of rotational internship. On completion of 12 months of the internship with pass criteria in outgoing clinical assessment exams the candidate is then eligible for the award of degree

#### 15. Distribution of Type of Questions and Marks

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>First year</b> ) |                  |                          |
|------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                          | No. of Questions | Marks for Each Questions |
| Long Essay                                                 | 1                | 10                       |
| Short Essay                                                | 5                | 5                        |
| Short Notes Type                                           | 5                | 3                        |
| Short Answer Type                                          | 10               | 2                        |
| MCQ's                                                      | 10               | 1                        |

- |                                                     |                |
|-----------------------------------------------------|----------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks |
| <b>Total= 80</b>                                    |                |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Second and Third Year</b> ) |                  |                          |
|-----------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                     | No. of Questions | Marks for Each Questions |
| Long Essay                                                            | 1                | 10                       |
| Short Essay                                                           | 5                | 5                        |
| Short Notes Type                                                      | 5                | 3                        |
| Short Answer Type                                                     | 10               | 2                        |
| MCQ's                                                                 | 10               | 1                        |

- |                                                     |                |
|-----------------------------------------------------|----------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks |
| <b>Total= 80</b>                                    |                |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Subsidiary subjects</b> ) |                  |                          |
|---------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                   | No. of Questions | Marks for Each Questions |
| Essay Type                                                          | 3 (2 x 10)       | 10                       |
| Short Essay Type                                                    | 8 (6 x 5)        | 05                       |
| Short Answer Type                                                   | 12 (10 x 3)      | 03                       |

## **FIRST YEAR B.SC. CARDIAC CARE TECHNOLOGY**

### **ANATOMY**

No. of theory classes: 70 hours

No. of practical classes: 20 hours

#### **Chapter 1**

##### **Introduction:**

##### **Theory:**

- Definition of anatomy and its divisions
- Terms of location, positions and planes
- Epithelium-definition, classification, describe with examples, function
- Glands- classification, describe serous, mucous & mixed glands with examples
- Basic tissues – classification with examples

##### **Practical:**

- Histology of types of epithelium
- Histology of serous, mucous & mixed salivary gland

#### **Chapter 2 Connective tissue:**

##### **Theory:**

- Cartilage – types with example & histology theory
- Bone – Classification, names of bone cells, parts of long bone, microscopy of compact bone, names of all bones, vertebral column, intervertebral disc, fontanelles of fetal skull
- Joints – Classification of joints with examples, synovial joint (in detail for radiology)
- Muscular system: Classification of muscular tissue & histology
- Names of muscles of the body

##### **Practical:**

- Histology of the 3 types of cartilage
- Histology of compact bone (TS & LS)
- Histology of skeletal (TS & LS) & cardiac muscle
- Demo of all bones showing parts, radiographs of normal bones & joints
- Demonstration of important muscles of the body

### **3. Cardiovascular system:**

#### **Theory:**

- Heart-size, location, chambers, exterior & interior, pericardium
- Blood supply of heart
- Systemic & pulmonary circulation
  - Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery
- Inferior vena cava, portal vein, portosystemic anastomosis ,Great saphenous vein, Dural venous sinuses
- Lymphatic system- cisterna chyli & thoracic duct ,Histology of lymphatic tissues, Names of regional lymphatics, axillary and inguinal lymph nodes in brief

#### **Practical:**

- Demonstration of heart and vessels in the body
- Histology of large artery & vein, medium sized artery & vein
- Histology of lymph node, spleen, tonsil & thymus
- Radiology: Normal chest radiograph showing heart shadows

### **4. Gastro- intestinal system**

#### **Theory:**

- Parts of GIT: Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring), Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas, spleen, peritoneum & reflections

#### **Practical:**

- Demonstration of parts of GIT
- Radiographs of abdomen

### **5. Respiratory system**

- Parts of RS: nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments, diaphragm
- Histology of trachea, lung and pleura
- Names of paranasal air sinuses

#### **Practical:**

- Demonstration of parts of respiratory system.
- Normal radiographs of chest, X-ray paranasal sinuses
- Histology of lung and trachea

## **6. Urinary system**

### **Theory:**

- Kidney, ureter, urinary bladder, male and female urethra
- Histology of kidney, ureter and urinary bladder

### **Practical:**

- Demonstration of parts of urinary system
- Histology of kidney, ureter, urinary bladder
- Radiographs of abdomen-IVP, retrograde cystogram

## **7. Reproductive system**

### **Theory:**

- Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology)
- Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology)
- Mammary gland – gross

### **Practical:**

- Demonstration of section of male and female pelvis with organs in situ
- Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes, ovary
- Radiographs of pelvis – hysterosalpingogram

## **8. Endocrine glands**

### **Theory:**

- Names of all endocrine glands in detail on pituitary gland, thyroid gland & suprarenal gland – (gross & histology)

### **Practical:**

- Demonstration of the glands
- Histology of pituitary, thyroid, parathyroid, suprarenal glands

## **9. Nervous system**

### **Theory:**

- Neuron & Classification of NS
  - Cerebrum, cerebellum, midbrain, Pons, medulla oblongata, spinal cord with spinal nerve (gross & histology) Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei
- Blood supply of brain
- Cranial nerves
- Sympathetic trunk & names of parasympathetic ganglia

### **Practical:**

- Histology of peripheral nerve & optic nerve



- Demonstration of all plexuses and nerves in the body
- Demonstration of all part of brain
- Histology of cerebrum, cerebellum, spinal cord

## **10. Sensory organs**

### **Theory:**

- Skin: Skin-histology & Appendages of skin
- Eye: Parts of eye & lacrimal apparatus, Extra-ocular muscles & nerve supply
- Ear: parts of ear- external, middle and inner ear and contents

### **Practical:**

- Histology of thin and thick skin
- Demonstration and histology of eyeball
- Histology of cornea & retina

## **11. Embryology:**

### **Theory:**

- Spermatogenesis & oogenesis
- Ovulation, fertilization
- Fetal circulation
- Placenta

### **INTERNAL ASSESSMENT**

Theory-average of 2 exams conducted

20 Practicals: record and lab work\* 10

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

### **Distribution of Marks for University Theory and Practical Exam**

| <b>Theory</b> |  |    |           | <b>Practicals</b> |    |           | <b>Grand total</b> |
|---------------|--|----|-----------|-------------------|----|-----------|--------------------|
| Theory        |  | IA | Sub Total | Practicals        | IA | Sub Total | 100                |
| 80            |  | 20 | 100       | *                 |    |           | 100                |

### **REFERENCE BOOKS:**

1. William Davis (P) understanding Human Anatomy and Physiology – McGraw Hill
2. Chaursia- A Text Book of Anatomy
3. T. S. Ranganathan- A Text Book of Human Anatomy
4. Fattana, Human Anatomy (Description and applied)- Saunder's & C P Prism Publishers, Bangalore
5. ESTER. M. Grishcimer- Physiology & Anatomy with Practical Considerations, J. P. Lippin Cott. Philadelphia
6. Bhatnagar- Essentials of Human Embryology- Revised Edition. Orient Blackswan Pvt. Ltd.

# PHYSIOLOGY

Theory 70 hours Practical 20hours

## 1. General Physiology

Introduction to cell physiology, transport across cell membrane Homeostasis, Body Fluid compartment & measurement

## 2. Blood

Introduction - composition and function of blood Plasma. proteins, types and functions

Red blood cells - erythropoiesis, stages of differentiation, factors affecting it, function, normal count, physiological variation.

Hemoglobin- function, concentration, types & methods of Hb estimation, fate of hemoglobin Jaundice-types Anaemia, -types

ESR, PCV, osmotic fragility & blood indices

WBC- morphology, production, functions, normal count, differential count, variation, variation

Immunity (in brief) Platelets- origin, morphology, normal count, function-Platelet plug ,bleeding disorder

Haemostasis - definition, normal haemostasis, clotting factors, mechanism of clotting, anticoagulants disorders of clotting factors.

Blood group-ABO & Rh system, Rh incompatibility blood typing ,cross matching, hazards of mismatched blood transfusion

RES, spleen and lymph

## 3. Nerve-Muscle

Neuron structure, types, neuroglia-types, nerve fibre classification, properties of nerve fibres, RMP, action potential, wallerian degeneration

NMJ, blockers, Myasthenia gravis

Classification of muscle, structure of skeletal muscle, sarcomere, contractile proteins Excitation contraction coupling, mechanism of muscle contraction, types of contraction Motor unit, fatigue, rigor mortis Smooth muscle

## 4. Respiratory system

Physiological anatomy of respiratory system, muscles of respiration, respiratory & non respiratory functions of lungs, dead space

Mechanics of breathing, intrapulmonary & pleural pressures Compliance, Surfactant, Hyaline membrane disease

Lung volumes and capacities

Respiratory membrane , transport of O<sub>2</sub> & CO<sub>2</sub>

Chemical regulation of respiration Neural regulation of respiration Hypoxia, Acclimatization, Dysbarism. Artificial respiration

Definition-Periodic breathing ,dyspnoea, apnoea, asphyxia,, cyanosis

## **5. Cardiovascular system**

Introduction to CVS & general principles of circulation Properties of Cardiac muscle  
Cardiac cycle, heart sounds, Pulse Cardiac output, factors and measurement Heart rate  
BP-factors, measurement, Short term regulation Intermediate and long term regulation of BP  
ECG uses and significance, .normal waveform, heart block Coronary circulation, Cutaneous  
circulation-Triple response Shock  
Effects of exercise on CVS and Respiratory system

## **6. Renal system, Skin and body temperature**

Kidneys- functions, structure of nephron, type, juxtaglomerular apparatus-structure and function, non-excretory functions of kidney  
Glomerular filtration rate (GFR)- Definition ,normal value, factors affecting GFR Tubular reabsorption  
- sites, substance reabsorbed, mechanisms of reabsorption Tubular secretion- sites, substance secreted,  
mechanisms of reabsorption  
Counter current mechanism of concentration of urine Obligatory and Facultative reabsorption of water  
Micturition reflex, Diuretics  
Artificial kidney, renal function tests-clearance tests  
Skin -structure and function, body temperature measurement, physiological variation,  
Regulation of body Temperature by physical, chemical and nervous mechanisms-Role of  
Hypothalamus Hypothermia and fever

## **7. Digestive system**

Physiological anatomy, Enteric nervous system & functions of GIT Saliva- composition,  
regulation, disorder.  
Deglutition- stages & disorders  
Stomach-functions, composition and regulation of gastric juice Gastric motility, MMC, vomiting  
reflex.  
Pancreas- function, composition and regulation of pancreatic juice  
Liver & gall bladder-functions, bile- composition, secretion and regulation Small intestine- Succus  
entericus-composition, functions & movements Large intestine- functions, movements and defecation  
reflex  
Digestion & absorption of Carbohydrates, fats and proteins

## **8. Endocrine system**

Classification of Endocrine glands & their hormones & properties-chemistry and receptor, feedback  
mechanisms of hormone regulation.  
Anterior pituitary hormones- secretion, functions , disorders Posterior pituitary hormones- secretion ,  
functions , disorders Thyroid hormones- secretion, functions, disorders Parathyroid hormones-  
secretion, functions, disorders Calcium homeostasis & disorders  
Pancreatic hormones, -Insulin and Glucagon- . secretion, functions, disorders  
Adrenal cortex- Glucocorticoids & Mineralocorticoids, Androgen - secretion, functions, disorders  
Adrenal medulla- secretion, functions, disorders Thymus & Pineal gland

## 9. Reproductive system

Introduction to reproductive system, sex differentiation & Puberty Male reproductive system, functions of testosterone & Spermatogenesis

Female reproductive system, functions of Estrogen, Progesterone, Oogenesis Ovulation & Menstrual cycle

Physiological changes during pregnancy, pregnancy tests, parturition & lactation Male & Female contraceptive methods

## 10. Central nervous system

Introduction to CNS, Sensory receptors classification, properties Synapse– classification, properties

Sensory pathways: Anterior spino thalamic tract and Posterior column pathway

Lateral spino thalamic tract, Types of pain, Referred pain, Thalamus; nuclei and function

Classification of reflexes, Monosynaptic reflex- Stretch reflex , muscle spindle ,inverse stretch reflex.

Polysynaptic reflex-Withdrawal reflex

Motor pathways : Pyramidal pathway and functions, UMNL, LMNL Cerebral cortex (Sensory and motor)-functions, Medulla and Pons-functions Cerebellum –functions, disorders

Basal ganglia-functions, disorders Hypothalamus and Limbic system-functions CSF, lumbar puncture Sleep, EEG,

Autonomic Nervous System - Sympathetic and parasympathetic distribution and functions

## 11. Special senses

Vision –Functional anatomy of eye, visual pathway, lesion Refractive errors, color vision

Audition – Physiological anatomy of ear, Mechanism of hearing, auditory pathway, deafness Olfaction –modalities, receptor, function, abnormalities

Gustation-modalities, receptor, function, taste pathway, abnormalities

Practicals

Blood pressure Recording

Auscultation for Heart Sounds

Artificial Respiration

Determination of vital capacity

### INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work\* 10

\*There shall be no university practical examination and internal assessment marks secured in Practical need not be sent to the university.

## Distribution of Marks for University Theory and Practical Exam

| Theory |           |    |           | Practicals |     |           | Grand total |
|--------|-----------|----|-----------|------------|-----|-----------|-------------|
| Theory | Viva Voce | IA | Sub Total | Practicals | I A | Sub Total | 120         |
| 80     |           | 20 | 100       | *          |     |           | 100         |

### REFERENCE BOOKS:

Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism Publishers Chatterjee (CC) Human Physiology Latest Ed. Vol. 1 Medical Allied Agency Choudhari (Sujith K) Concise Medical Physiology Latest Ed. New Central Book

Ganong (William F) Review of Medical Physiology. Latest Ed. Appleton

## **BIOCHEMISTRY**

No. Theory classes: 70hours

No. of practical classes: 20 hours

### **1. Carbohydrate Chemistry [3 hours]**

- Classification (Definition/ examples for each class)
- Monosaccharides (classification depending upon number of carbon atoms and functional group with examples)
- Disaccharides (Sucrose/ lactose/ maltose and their composition)
- Polysaccharides :
  - a) Homopolysaccharides (Structure of starch and glycogen)
  - b) Heteropolysaccharides (Functions )

### **2. Lipid Chemistry [3 hours]**

- Definition of lipids
- Functions of lipids in the body
- Classification of lipids (subclasses with examples)
- Definition and Classification of fatty acids
- Essential fatty acids
- Phospholipids and their importance

### **3. Amino-acid and Protein Chemistry [3 hours]**

- General structure of D and L amino acids
- Amino acids; Definition and Classification of amino acids with examples.
- Peptides; definition & Biologically important peptides
- Classification of Proteins based on composition, functions and shape (with examples)
- Functions of amino acids and Proteins

### **4. Nucleotide and Nucleic acid Chemistry [ 3 hours]**

- Nucleosides & Nucleotides
- Nucleic acid Definition & types
- Composition & functions of DNA & RNA
- Structure of DNA (Watson and Crick model)
- Structure of tRNA, & functions of tRNA, rRNA, mRNA
- Difference between DNA and RNA

## **5. Enzymes [5 hours]**

- Definition & Classification of Enzymes with example
- Definitions of Active site, Cofactor (Coenzyme, Activator),
- Proenzyme; Definition and examples (Pepsin & trypsin)

## **6. Digestion and Absorption [ 3 Hours]**

- General characteristics of digestion and absorption,
- Digestion and absorption of carbohydrates, proteins and lipids.

## **7. Carbohydrate Metabolism [ 5 Hours]**

- Glycolysis ; Aerobic, Anaerobic, Definition , Site and subcellular site , Steps with all the enzymes and coenzymes at each step , mention the regulatory enzymes , Energetics,
- Citric acid cycle; Pyruvate dehydrogenase complex (reaction and coenzymes) , Site and subcellular site , Reactions with all the enzymes and coenzymes ,Regulatory enzymes , Energetics
- Significance of HMP Shunt pathway.
- Hyperglycemic and hypoglycemic hormones
- Blood Glucose Regulation.
- Diabetes mellitus (definition, classification, signs and symptoms)
- **Glycogen metabolism and gluconeogenesis**

## **8. Lipid Metabolism [ 4 Hours]**

- Introduction to lipid metabolism, Lipolysis
- Beta oxidation of fatty acids ; Definition ,Site and subcellular site , Activation of palmitic acid , Transport of activated palmitic acid into mitochondria , Reactions , Energetics.
- Name the different ketone bodies . Note on ketosis

## **9. Amino acid and Protein Metabolism [ 3 Hours]**

- Introduction, transamination, deamination, Fate of ammonia, transport of ammonia,
- Urea cycle.

## **10. Vitamins [5 Hours]**

- Definition and classification.
- RDA, sources, coenzyme forms, biochemical functions and disorders for the following water soluble vitamins: Thiamine, Niacin, Pyridoxine, Cobalamine, Folic acid, Ascorbic acid RDA, sources, coenzyme forms, biochemical functions and deficiency disorders for the following fat soluble vitamins; A and vitamin D

## **11. Mineral Metabolism [3 Hours]**

- Name the macro/ microminerals



- Iron: Sources ,RDA, Functions and Disorders of deficiency and excess
- Calcium and phosphorus: Sources ,RDA, functions, normal serum levels and hormones regulating their levels

## **12. Nutrition [6 hours]**

- Balanced diet (Definition)
- Caloric value ; Definition , Caloric values of carbohydrates, proteins and fats
- Total daily caloric requirements of an adult male and female,
- RDA (Definition, standard values for nutrients)
- Basal metabolic rate(BMR) ; Definition , Magnitude of BMR in men and women, Factors affecting BMR
- Thermic effect/ SDA of food (Definition, values for major macronutrients)
- Carbohydrates ;. Daily dietary requirement. 2. Dietary fibers (Definition, functions, importance and their daily requirements)
- Proteins ;. Daily requirement, Biological value. a. Definition b. Protein used as a standard for this, Protein sources with high and low biological value , Mutual supplementation of proteins (Definition, examples).
- Fats ; Daily requirement , Essential fatty acids (Definition, functions, daily requirement and deficiency manifestations) , Saturated and unsaturated fatty acids (Definition, sources, examples).
- Malnutrition

## **13. Renal Function Tests [ 2 hours]**

- Name the different tests to assess the kidney functions
- Explain Creatinine clearance & Inulin clearance
- Urinary acidification test

## **14. Radioactive Isotopes [1 hour]**

- Definition, clinical applications
- Biological effects of radiations

## **15. Clinical Biochemistry [ 5 hours ]**

A. Definitions of acid, base, pH and pKa [1 hour]

B. Buffers • Definition [2 hours]

- Henderson Hasselbalch equation,
- Principal buffer systems in the ECF ICF and urine

- Bicarbonate and phosphate buffer systems (pKa value, normal ratio of base/acid in the plasma)
  - Acidosis & Alkalosis (Definition, classification, causes and biochemical findings)
- C. Normal serum levels and condition where they are altered [2 hour]
- Glucose, Protein, urea, uric acid, and creatinine
  - Bilirubin, cholesterol
  - Serum Electrolytes

## **16. Fundamental Chemistry (1 hour)**

- Valency, Molecular weight & Equivalent weight of elements and compounds. Normality, Molarity, Molality.

## **17. Solutions: Definition, use, classification where appropriate, preparation and storage (5 hours)**

- Stock and working solutions.
- Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H<sub>2</sub>SO<sub>4</sub>, H<sub>3</sub>PO<sub>4</sub>, CH<sub>3</sub>COOH etc.,)
- Preparation of percent solutions – w/w, v/v w/v (solids, liquids and acids), Conversion of a percent solution into a molar solution
- Saturated and supersaturated solutions
- Standard solutions. Technique for preparation of standard solutions and Storage. E.g: glucose, albumin etc.
- Dilutions- Diluting Normal , Molar and percent solutions. Preparing working standard from stock standard.
- Part dilutions: Specimen dilutions. Serial dilutions. Reagent dilution. Dilution factors

## **ASSIGNMENT TOPICS**

- 1. Units of measurement**
2. Hazards - Physical, Chemical, Biological
3. Arterial blood gas analysis
4. Responsibilities of Health care personnel
5. Biomedical waste management

## **PRACTICAL DEMONSTRATION [20 hours]**

Color Reactions of Carbohydrates & amino acids.

Precipitation Reactions of proteins

Colorimetry Estimation of Blood glucose Folin Wu and enzymatic method

Estimation of Urea by DAM method

## **INTERNAL ASSESSMENT**

Theory-average of 2 exams conducted

20 Practicals: record and lab work\* 10

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

### **Distribution of Marks for University Theory and Practical Exam**

| <b>Theory</b> |           |    |           | <b>Practicals</b> |    |           | <b>Grand total</b> |
|---------------|-----------|----|-----------|-------------------|----|-----------|--------------------|
| Theory        | Viva Voce | IA | Sub Total | Practicals        | IA | Sub Total |                    |
| 80            | -         | 20 | 100       | *                 |    |           | 100                |

### **Text Book References**

- Biochemistry – 3<sup>rd</sup> revised edition by U Sathyanarayana & U Chakrapani
- Textbook of Medical Biochemistry-6<sup>th</sup> Edition by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology 2<sup>nd</sup> edition by Godkar and Godkar.
- Biochemistry-3<sup>rd</sup> edition by Pankaja Naik
- Medical Laboratory technology 6<sup>th</sup> edition by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students-3<sup>rd</sup> edition by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> editions

## **PATHOLOGY**

Histo Pathology ,Clinical Pathology, Haematology and Blood Banking

Theory – 70 hours

Practical – 20 hours

**Clinical Pathology, Hematology and Blood  
Banking Theory-70 hours  
Practicals-20 hours**

### **Clinical Pathology- Theory**

- Introduction to clinical pathology
- Collection , transport, preservation and processing of various clinical specimens
  - Urine examination- collection and preservation, Physical, chemical and microscopic examination for abnormal constituents
  - Examination of Body fluids
  - Examination of Cerebrospinal fluid (CSF)
  - Sputum examination
  - Examination of feces

### **II. Hematology – Theory**

- Introduction to hematology
- Normal constituents of Blood, their structure and functions
- Collection of Blood samples
- Various anticoagulants used in Hematology
- Hemoglobin estimation, different methods and normal values
- Packed cell volume
- Erythrocyte sedimentation rate
- Normal Haemostasis
- Bleeding time. Clotting time, prothrombin time, Activated partial Thromboplastin time

### **III. Blood Bank- Theory**

- Introduction blood banking
- Blood group system
- Collection and processing of blood for transfusion
- Compatibility testing
- Blood transfusion reactions
- **General Pathology:**
- **Cell injury:**
  - a. Definition, causes.
  - b. Cellular adaptations – Hypertrophy, hyperplasia, atrophy and metaplasia.
  - c. Types of cell injury – Reversible and irreversible; morphology of reversible injury.
  - d. Necrosis – Definition and patterns of tissue necrosis.
  - e. Intracellular accumulations – Lipids, cholesterol, proteins, glycogen and pigments; examples.
  - f. Pathologic calcification – Types and examples.
- **3) Inflammation:**
  - a. Definition and signs of inflammation.
  - b. Types – Acute and chronic inflammation.
  - c. Acute inflammation – Causes, morphological patterns and outcome.
  - d. Chronic inflammation – Causes, morphology and examples.
  - e. Regeneration and repair – Mechanism of cutaneous wound healing.
  - f. Factors affecting wound healing.
- **4) Hemodynamic disorders:**
  - a. Edema – Definition, pathogenesis and types: Renal, cardiac, pulmonary and cerebral.
  - b. Difference between transudate and exudate.

- c. Shock – Definition, types of shock with examples: Hypovolemic, cardiogenic and septic shock, stages of shock: Nonprogressive, progressive and irreversible.
- d. Thrombosis – Definition, mechanism of thrombus formation (Virchow's triad) and fate of thrombus.
- e. Embolism – Definition and types: Thromboembolism, fat, air and amniotic fluid embolism.
- f. Infarction – Definition and examples.
- **5) Immune system:**
  - a. Autoimmune diseases – General features, enumerate systemic and organ specific autoimmune diseases.
  - b. Systemic lupus erythematosus – Manifestations and diagnosis.
- **6) Neoplasia:**
  - a. Definition and nomenclature of tumors.
  - b. Differences between benign and malignant neoplasms.
  - c. Enumerate modes of carcinogenesis: Genes, physical, chemical and microbial agents of carcinogenesis.
  - d. Modes of spread of tumors.
  - e. Clinical aspects of neoplasia.
  - f. Grading and staging of cancers.
  - g. Laboratory diagnosis of cancer.

## **Practicals**

1. Urine analysis- Physical, Chemical, Microscopic
2. Blood grouping and Rh typing
3. Hb estimation , packed cell volume (PCV), Erythrocyte Sedimentation rate (ESR)
4. Bleeding time and Clotting time

## INTERNAL ASSESSMENT

Theory-average of 2 exams conducted

20 Practicals: record and lab work\*      10

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

### Distribution of Marks for University Theory and Practical Exam

| Theory |           |    |           | Practicals |    |           | Grand total |
|--------|-----------|----|-----------|------------|----|-----------|-------------|
| Theory | Viva Voce | IA | Sub Total | Practicals | IA | Sub Total |             |
| 80     | -         | 20 | 100       | *          |    |           | 100         |

### REFERENCE BOOKS:

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss- Cytology
4. Winifred Diagnostic cytopathology
5. Orell Cytopathology
6. Todd and Sanford- clinical diagnosis by Laboratory Medicine
7. Dacie and Lewis- Practical Hematology
8. Ramnik SOOD. Lab technology, Methods and interpretation, 4 th edition JP Bros New Delhi, 1996
9. Sathish Guptha , Short text book of Medical laboratory techniques for technicians
10. Sachdev K N. Clinical Pathology and Bacteriology, 8 th edi JP Bros, New Delhi, 1996

## **Microbiology I**

Theory: 70 Hours

Practicals: 20 Hours

### **1. Introduction (6 hrs)**

History of Microbiology - Louis Pasteur, Antony Van Leeuwenhoek, Robert Koch, Edward Jenner, Alexander Fleming.

Use of microscope in the study of bacteria - Types of microscopes - compound microscope, phase contrast microscope, electron microscope, fluorescent microscope, dark ground microscope.

Morphology of bacterial cell

### **2. Growth and Nutrition (6 hrs.)**

Nutrition, growth and multiplication of bacteria, bacterial growth curve, culture media, culture methods, anaerobic culture methods.

### **3. Sterilization and disinfection (8 hrs.)**

Principles and use of equipments of sterilization, chemicals used in disinfection, testing of disinfectants.

### **4. Biomedical waste management principle and practice Immunology ( 5hrs.)**

Immunity - mechanism of immunity, classification, types Vaccines

Immunization schedule

Definition of antigen, antibody, list of antigen antibody reaction (no need of detailed account of antigen antibody reactions)

Definition of hypersensitivity and classification (no need of detailed account of types of hypersensitivity)

### **5. Infection (5 hrs.)**

Definition, types and mode of transmission

Hospital acquired infection - causative agents, mode of transmission and prophylaxis. Antimicrobial sensitivity testing

### **6. Systematic bacteriology (15 hrs.)**

Disease caused and laboratory diagnosis of medically important bacteria (Staphylococcus, coagulase negative Staphylococcus, MRSA, Streptococcus pyogenes, Pneumococcus, gonococcus,



E.coli, diarrhoeagenic E.coli, Salmonella, Vibrio cholerae, ElTor vibrios, Halophilic vibrios, Shigella, Mycobacterium tuberculosis, Mycobacterium leprae, Atypical Mycobacteria, Treponema pallidum, leptospira)  
(no need of classification, antigenic structure, virulence mechanism)

## **7. Parasitology (10 hrs.)**

Introduction to Parasitology

List of medically important parasites and diseases (E.histolytica, Plasmodium, W.bancrofti, Ascaris, Ancylostoma, B.coli, G.lamblia, T.solium, T.saginata)

Laboratory diagnosis of parasitic infection (No need of including life cycles)

## **8. Virology (10 hrs.)**

Introduction to virology

List of medically important viruses and diseases (AIDS, Hepatitis, Rabies, Polio, Arbo viruses)

Cultivation of viruses and laboratory diagnosis of viral infections

## **9. Mycology (5 hrs.)**

Introduction to Mycology

Classification of medically important fungi - (based on morphology, spore production, disease production, taxonomy)

List of medically important fungi and diseases (Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis, Mucor Mycosis)

Laboratory diagnosis of fungal infections.

### **Practicals (20 hrs.)**

Compound microscope (Demonstration) Demonstration of sterilization equipments

Demonstration of culture media and culture methods Demonstration of antibiotic sensitivity testing Demonstration of serological tests - Widal, VDRL, ASO, CRP, RA Demonstration of gram stain and ZN staining

Demonstration of Helminthic ova Grams stain, Acid fast staining Stool exam for Helminthic ova

There shall be no university practical examination and Internal Assessment marks secured in practicals need not be sent to the university.

### **INTERNAL ASSESSMENT**

Theory-average of 2 exams

conducted 20 Practicals: record and lab work\*

10

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

## Distribution of Marks for University Theory and Practical Exam

| Theory |           |    |           | Practicals |    |           | Grand total |
|--------|-----------|----|-----------|------------|----|-----------|-------------|
| Theory | Viva Voce | IA | Sub Total | Practicals | IA | Sub Total |             |
| 180    | -         | 20 | 100       | *          |    |           | 100         |

### Reference Books-

1. Ananthanarayana & Panikar Medical Microbiology- University Press
2. Robert Cruickshank- Medical Microbiology- The Practice of Medical Microbiology
3. Chatterjee- Parasitology- Interpretation to Clinical Medicine
4. Rippon- Medical Mycology
5. Emmons- Medical Mycology
6. Basic Laboratory methods in Parasitology, J P Bros, New Delhi
7. Basic Laboratory procedures in clinical bacteriology, J P Bros, New Delhi
8. Medical Parasitology- Ajit Damle
9. Introduction to medical microbiology- Ananthanarayana- Orient Longman Pvt. Ltd

## **SUBSIDIARY SUBJECTS**

### **ENGLISH**

#### **COURSE OUTLINE**

**COURSE DESCRIPTION:** This course is designed to help the student acquire a good command and comprehension of the English language through individual papers and conferences.

#### **BEHAVIOURAL OBJECTIVES:**

The student at the end of training is able to

1. Read and comprehend English language
2. Speak and write grammatically correct English
3. Appreciates the value of English literature in personal and professional life.

#### **UNIT - I: INTRODUCTION:**

Study Techniques

Organisation of effective note taking and logical processes of analysis and synthesis Use of the dictionary

Enlargement of  
vocabulary

Effective diction

#### **UNIT - II: APPLIED GRAMMAR:**

Correct usage

The structure of sentences

The structure of  
paragraphs

Enlargements of  
Vocabulary

#### **UNIT - III: WRITTEN COMPOSITION:**

Precise writing and  
summarizing Writing  
of bibliography

Enlargement of  
Vocabulary

#### **UNIT - IV: READING AND COMPREHENSION:**

Review of selected materials and express oneself in  
one's words. Enlargement of Vocabulary.

#### **UNIT - V: THE STUDY OF THE VARIOUS FORMS OF COMPOSITION:**

Paragraph, Essay, Letter, Summary, Practice in writing

#### **UNIT - VI: VERBAL COMMUNICATION:**

Discussions and summarization, Debates, Oral reports, use in teaching  
Scheme of Examination

Written (Theory): Maximum Marks: –80 marks. No Practical or

Viva voce examination

This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%

## **REFERENCE**

1. English Grammar Collins, Birmingham University, International Language Data Base, Rupa & Co. 1993
2. Wren and Martin - Grammar and Composition, 1989, Chanda & Co, Delhi
3. Letters for all Occasions. A S Myers. Pub - Harper Perennial
4. Spoken English V. Shasikumar and P V Dhanija. Pub. By: Tata Mcgraw Hill, New Delhi
5. Journalism Made Simple D Wainwright
6. Writers Basic Bookself Series, Writers Digest series
7. Interviewing by Joan Clayton Platkon
8. Penguin Book of Interviews.

## **HEALTH CARE**

Teaching Hours : 40

Introduction to Health

Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept. National Health Policy

National Health Programmes ( Briefly Objectives and scope) Population of India and Family welfare programme in India

### **Introduction to Nursing**

What is Nursing ? Nursing principles. Inter-Personnel relationships. Bandaging : Basic turns; Bandaging extremities; Triangular Bandages and their application.

Nursing Position, Bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's positions, comfort measures, Aids and rest and sleep.

Lifting And Transporting Patients: Lifting patients up in the bed. Transferring from bed to wheel chair. Transferring from bed to stretcher.

Bed Side Management: Giving and taking Bed pan, Urinal : Observation of stools, urine.

Observation of sputum, Understand use and care of catheters, enema giving. Methods Of Giving Nourishment: Feeding, Tube feeding, drips, transfusion Care of Rubber Goods

Recording of body temperature, respiration and pulse, Simple aseptic technique, sterilization and disinfection. Surgical Dressing: Observation of dressing procedures

First Aid:

Syllabus as for Certificate Course of Red Cross Society of St. John's Ambulance Brigade.

### **Reference Books:**

**Preventive and Social Medicine** by J.Park

Text Book of P & SM by Park and Park

Counseling & Communicate skills for medical and health, Bayne- Orient Longman Pvt. Ltd.

### **Scheme of Examination**

Written (Theory): Maximum Marks: –80 marks.

No Practical or Viva voce examination

This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%

## SECOND YEAR B.SC CARDIAC CARE TECHNOLOGY

### APPLIED PHARMACOLOGY

- General concepts about pharmacodynamic and Pharmacokinetic Principles involved in drug activity.

Autonomic nerves system.

Anatomy & functional organisation.

- List of drugs acting on ANS including dose, route of administration, indications, contraindications and adverse effects.

II. Cardiovascular drugs - Enumerate the mode of action, side effects and therapeutic uses of the following drugs.

Antihypertensive

Beta Adrenergic antagonists

Alpha Adrenergic antagonists

Peripheral Vasodilators

Calcium channel blockers

Antiarrhythmic drugs

Cardiac glycosides

Sympathetic and non-sympathetic inotropic agents.

Coronary vasodilators.

Antianginal and anti failure agents

Lipid lowering & anti atherosclerotic drugs.

Drugs used in Haemostasis - anticoagulants Thrombolytics and antithrombolytics.

Cardioplegic drugs - History, Principles and types of cardioplegia.

Primary solutions - History, principles & types.

Drugs used in the treatment of shock.

III. Anaesthetic agents.

- Definition of general and local anaesthetics.
- Classification of general anaesthetics.
- Pharmacokinetics and Pharmacodynamics of inhaled anaesthetic agents.
- Intravenous general anaesthetic agents.
- Local anaesthetics - classification, mechanism of action, duration of action and methods to prolong the duration of action. Preparation, dose and routes of administration.

#### IV. Analgesics

- Definition and classification
- Routes of administration, dose, frequency of administration, Side effects and management of non opioid and opioidanalgesics

#### V. Antihistamines and antiemetics-

- Classification, Mechanism of action, adverse effects, Preparations, dose and routes and administration.

#### VI. CNS stimulants and depressants

- Alcohol
- Sedatives, hypnotics and narcotics
- CNS stimulants
- Neuromuscular blocking agents and muscle relaxants.

#### VII. Pharmacological protection of organs during CPB

#### VIII. Inhalational gases and emergency drugs.

#### IX. Pharmacotherapy of respiratory disorders

- Introduction - Modulators of bronchial smooth muscle tone and pulmonary vascular smooth muscle tone
- Pharmacotherapy of bronchial asthma
- Pharmacotherapy of cough
- Mucokinetic and mucolytic agents
- Use of bland aerosols in respiratory care.

#### X. Corticosteroids - Classification, mechanism of action, adverse effects and complications.

Preparation, dose and routes of administration.

#### XI Diuretics

- Renal physiology
- Side of action of diuretics
- Adverse effects
- Preparations, dose and routes of administration.

#### XII. Chemotherapy of infections

- Definition
- Classification and mechanism of action of antimicrobial agents

- Combination of antimicrobial agents
- Chemoprophylaxis.
- Classification, spectrum of activity, dose, routes of administration and adverse effects of penicillin, cephalosporins, aminoglycosides, tetracyclines, chloramphenicol, antitubercular drugs.

### XIII. Miscellaneous.

IV fluids- various preparations and their usage.

Electrolyte supplements

Immunosuppressive agents

New drugs included in perfusion technology.

Drugs used in metabolic and electrolyte imbalance.

### **PRACTICALS:**

Preparation and prescription of drugs of relevance.

2. Experimental pharmacology directed to show the effects of commonly used drugs of relevance and interpretation of few charts.

NO PRACTICAL EXAMINATION



### **Recommended Books.**

1. R. S. Satoskar, S.D. Bhandarkar, S. S. Ainapure, Pharmacology and Pharmacotherapeutics, 18th Edition, single Volume, M/S Popular Prakashan, 350, Madan Mohan Marg, Tardeo, Bombay - 400 034.
2. K.D. Tripathi, Essentials of Medical Pharmacology, V. Edition, M/s. Jaypee Brothers, Post Box, 7193, G-16, EMCA House, 23/23, Bansari Road, Daryaganj, New Delhi.  
  
Laurence and Bennet, Clinical Pharmacology, ELBS Edition, 9th Edition.
4. Experimental Pharmacology for Under Graduates, Prabhakar, , Orient Longman PVT Ltd.

### **APPLIED PATHOLOGY**

#### **CARDIOVASCULAR SYSTEM**

- Atherosclerosis- Definition, risk factors, briefly Pathogenesis & morphology, clinical significance and prevention.

- Hypertension- Definition, types and briefly Pathogenesis and effects of Hypertension.

Aneurysms - Definition, classification, Pathology and complications.

Pathophysiology of Heart failure.

- Cardiac hypertrophy - causes, Pathophysiology & Progression to Heart Failure.
- Ischaemic heart diseases- Definition, Types. Briefly Pathophysiology, Pathology & Complications of various types of IHD.
- Valvular Heart diseases- causes, Pathology & complication. Complications of artificial valves.
- Cardiomyopathy - Definition, Types, causes and significance.
- Pericardial effusion- causes, effects and diagnosis.

- Congenital heart diseases - Basic defect and effects of important types of congenital heart diseases.

## II. HAEMATOLOGY

- Anaemia - Definition, morphological types and diagnosis of anaemia. Brief concept about Haemolytic anaemia and polycythaemia.
- Leukocyte disorders- Briefly leukaemia, leukocytosis, agranulocytosis etc.,
- Bleeding disorders- Definition, classification, causes & effects of important types of bleeding disorders. Briefly various laboratory tests used to diagnose bleeding disorders.

## III. RESPIRATORY SYSTEM

- Chronic obstructive airway diseases - Definition and types. Briefly causes, Pathology and complications of each type of COPD.
- Briefly concept about obstructive versus restrictive pulmonary disease.
- Pneumoconiosis- Definition, types, Pathology and effects in brief.
- Pulmonary congestion and oedema.
- Pleural effusion - causes, effects and diagnosis.

## IV. RENAL SYSTEM

- Clinical manifestations of renal diseases. Briefly causes, mechanism, effects and laboratory diagnosis of ARF& CRS. Briefly Glomerulonephritis and Pyelonephritis.
- Endstage renal disease- Definition, causes, effects and role of dialysis and renal transplantation in its management.
- Brief concept about obstructive uropathy.

## PRACTICALS

1. Description & diagnosis of the following gross specimens.

A. Atherosclerosis.

B. Aortic aneurysm.

c. Myocardial infarction.

d. Emphysema

- e. Chronic glomerulonephritis.
  - f. Chronic pyelonephritis.
2. Interpretation & diagnosis of the following charts.
    - a. hematology Chart - AML, CML, Hemophilia, neutrophilia, eosinophilia.
    - b. Urine Chart - ARF, CRF, Acute glomerulonephritis.
  3. Estimation of Hemoglobin.  
Estimation Bleeding & Clotting time.

### **PRACTICAL EXAMINATION**

**40 Marks**

There will be a Combined Practical examination for Applied Pathology & Applied Microbiology.

|   |                                             |    |
|---|---------------------------------------------|----|
|   | Hematology Chart                            |    |
| 2 | Interpretation of Urine Chart               | 05 |
| 3 | Estimation of Hemoglobin                    | 05 |
| 4 | Estimation of Bleeding time & Clotting time | 05 |
|   | TOTAL                                       | 20 |

## APPLIED MICROBIOLOGY

### THEORY - 40 HOURS

1. Health care associated infections and Antimicrobial resistance: Infections that patients acquire during the course of receiving treatment for other conditions within a healthcare setting like Methicillin Resistant Staphylococcus aureus infections, Infections caused by Clostridium difficile, Vancomycin resistant enterococci etc. Catheter related blood stream infections, Ventilator associated pneumonia, Catheter Related urinary tract infections, Surveillance of emerging resistance and changing flora. The impact and cost attributed to Hospital Associated infection.  
6 Hours
2. Disease communicable to Healthcare workers in hospital set up and its preventive measure: Occupationally acquired infections in healthcare professionals by respiratory route ( tuberculosis, varicella- zoster, respiratory syncytial virus etc ), blood borne transmission ( HIV, Hepatitis B, Hepatitis C, Cytomegalovirus, Ebola virus etc), oro faecal route ( Salmonella, Hepatitis A etc), direct contact ( Herpes Simplex Virus etc). Preventive measures to combat the spread of these infections by monitoring and control  
6 Hours
3. Microbiological surveillance and sampling: Required to determine the frequency of potential bacterial pathogens including Streptococcus pneumoniae, Haemophilus influenzae, and Moraxella catarrhalis and also to assess the antimicrobial resistance  
.Sampling: rinse technique, direct surface agar plating technique. 6 Hours  
Importance of sterilization:
  - a. Disinfection of instruments used in patient care: Classification, different methods, advantages and disadvantages of the various methods.  
Disinfection of the patient care unit  
Infection control measures for ICU's 10 Hours

**Sterilization:**

  - a. Rooms: Gaseous sterilization, one atmosphere uniform glow discharge plasma (OAUGDP).
  - b. Equipments: classification of the instruments and appropriate methods of sterilization.
  - c. Central supply department: the four areas and the floor plan for instrument cleaning, high-level disinfecting and sterilizing areas  
8 Hours

7. Preparation of materials for autoclaving: Packing of different types of materials, loading, holding time and unloading.

4 Hours

## **PRACTICALS - 30 HOURS**

Principles of autoclaving & quality control of Sterilization.

2. Collection of specimen from outpatient units, inpatient units, minor operation theater and major operation theater for sterility testing.

The various methods employed for sterility testing.

Interpretation of results of sterility testing.

Disinfection of wards, OT and Laboratory.

### **Scheme of Examination Theory**

There shall be one theory paper with 2 section of three hours duration carrying 50

marks each Distribution of type of questions and marks for Applied Microbiology

shall be as given under

| SUBJECTS HAVING MAXIMUM MARKS= 50 MARKS |                  |                          |
|-----------------------------------------|------------------|--------------------------|
| Type of Questions                       | No. of Questions | Marks for Each Questions |
| Long Essay                              | 1                | 10                       |
| Short Essay                             | 05               | 05                       |
| Short Answer                            | 05               | 03                       |

1. Long essay- 1 Questions (No choice)
2. Short essay- 05 Questions (Choice is in Questions no 3)
3. Short answer- 05 Questions (Choice is in Questions no 3)

1x10= 10 marks

05x5= 25 marks

05x3= 15 marks

**Total= 50**

**PRACTICAL EXAMINATION****40 Marks**

There will be a Combined Practical examination for Applied Pathology & Applied Microbiology.

| SL NO | TEST MARKS                                                                                                                  |    |
|-------|-----------------------------------------------------------------------------------------------------------------------------|----|
| 1     | Dry heat / Moist heat: Temperature recording charts interpretation                                                          | 05 |
| 2     | Dry heat / Moist heat: Colour change indicators interpretation Air sampling culture plates interpretation of Colony forming | 05 |
| 3     | units based on air flow rate and sampling time Interpretation of Sterility of Hemodialysis water                            | 05 |
| 4     | Distilled water /Deionised water based on growth of colonies in BHI agar to be reported as X CFU/mL                         | 05 |
|       | Total                                                                                                                       | 20 |

## **MEDICINE RELEVANT TO CARDIAC CARE TECHNOLOGY**

### **Cardiovascular System**

Ischemic heart diseases Rheumatic heart disease Congenital heart disease Hypertension  
Aortic Aneurysms Cardiomyopathy Peripheral vascular disease Pulmonary oedema and LV failure

### **Hematology**

Anaemia  
Bleeding disorders  
Laboratory tests used to diagnose bleeding disorders (in brief)

### **Respiratory System**

Chronic obstructive airway diseases (COPD) Concept of obstructive versus restrictive pulmonary disease PFT and its interpretation

### **Renal System**

#### **ARF & CRF**

End stage renal disease  
Role of dialysis and renal transplantation in its management

### **CNS**

Automatic nervous system  
(Sympathetic & Parasympathetic system)  
Brief mention of CNS disorders & their etiology

### **Others**

DM  
Obesity Pregnancy  
Paediatric Patient (neonate/Infant)  
Elderly patient

### **Scheme of Examination Theory**

There shall be one theory paper of three hours duration carrying 100 marks. Distribution of type of questions and marks for Medicine relevant to Cardiac Care Technology shall be as given under.

## **INTRODUCTION TO CARDIAC CARE TECHNOLOGY**

Electrocardiography (ECG)

Basic Principles

a. The Electrocardiographic paper

b. The electrocardiograph

c. The Electrical field of Heart

The leads: Standard limb, Precardial lead, 'V' leads & 'AV' lead Basic ECG deflections

Basic action of electrocardiograph

Normal ECG

The 'P' wave the 'qrs' complex

The genesis of 'qrs' complex T wave; the S-T segment The 'U' wave

Rate & rhythm The Q-T interval

The Electrical axis

Precardial pattern of ECG

5. Chamber enlargement - atrial enlargement, LV hypertrophy & RV hypertrophy



6. Bundle branch block General principles Right  
Bundle branch block Left bundle branch block The  
Hemi blocks (Fascicular block)

### **AV Blocks-basics**

Exercise stress Testing

Exercise

Exercise protocols

Electrocardiography measurements

Exercise testing - Indication and techniques

### III .Echocardiography

1. Principles of Echocardiography
  - Basic principles of ultrasound
  - M-Mode of Echocardiography
  - Two dimensional Echocardiography
  - Doppler Echocardiography; colour flow
  - Transoesophageal Echocardiography
2. Instrumentation
  - Basic pulse Echo system
  - Transducers
  - Pulse generation
  - Echo detection
  - A mode, B-Mode, M-Mode

- Display & recording

### 3. Echocardiographic Examination

- Selecting transducers
- Position of the patient
- Placement of the transducer
- Setting control
- M-Mode labelling
- 2 D Echo
- Normal variants
- Terminology
- Identification of segments

### 4. Doppler Echocardiography

Introduction to Doppler colour Echocardiography The Doppler principles Doppler ultrasound techniques Colour Doppler flow imaging Clinical application of Doppler Echocardiograph

- Physical principles & instrumentation in spectral & colour Doppler flow imaging
- Physical principles and Doppler effect. The Doppler Echocardiography system display
- Blood flow pattern - Laminar & non-laminar flow
- Doppler Echo cardiograph modes
  - Continuous wave Doppler system
  - Pulsed Doppler system
  - High pulse repetition frequency
  - Problems of colour imaging

5. Contrast Echo
  6. Echo measurements of chambers -'ASE' recommendation
- IV. Cathlab
1. Basics:- Machine, Radiation
  2. Generation of X-Ray
  3. Hazards of radiation

#### REFERENCE

Feigenbaum's Echocardiography- Latest edition

The Echo Manual- From the Mayo clinic- Latest edition

Leo Schamroth- An Introduction to Electrocardiography

Marriott's practical Electrocardiography

5. Gross man & Bains cardiac catheterization, Angiography and Intervention

6. Braunwald's Heart Disease: A text book of cardiovascular medicine- Latest edition

## **PRACTICAL EXAMINATION**

40 Marks

-Basic knowledge about ultrasound machine, cathlab machine

Basics views in echocardiography

Interpretation of ECG / TMT reports

## **Subsidiary Subject:**

## **SOCIOLOGY**

Teaching Hours: 20 Course

Description:

This course will introduce student to the basic sociology concepts, principles and social process, social institutions [in relation to the individual, family and community and the various social factors affecting the family in rural and urban communities in India will be studied.

### **Introduction**

Meaning - Definition and scope of sociology Its relation to Anthropology, Psychology, Social Psychology  
Methods of Sociological investigations - Case study, social survey, questionnaire, interview and opinion poll  
methods. Importance of its study with special reference to healthcare professionals Social Factors in Health and  
Disease: Meaning of social factors  
Role of social factors in health and disease

### **Socialization:**

Meaning and nature of socialization

Primary, Secondary and Anticipatory socialization Agencies of socialization Social Groups:

Concepts of social groups, influence of formal and informal groups on health and sickness. The role of primary group and secondary groups in the hospital and rehabilitation setup.

## Family:

The family, meaning and definitions Function softy pes of family Changing family patterns Influence of family on individual's health, family and nutrition, the effects of sickness in the family and psychosomatic disease and their importance to physiotherapy

## Community:

Rural community: Meaning and features-Health hazards to rural communities, health hazards to tribal community.

Urban community-Meaning and features-Health hazard so furbanities Culture and

## Health:

Concept of Health Concept of culture Culture and Health Culture and Health Disorders

## Social Change:

Meaning of social changes Factors of social changes Human adaptation and social change Social change and stress Social change and deviance Social change and health programme The role of social planning in the improvement of health and rehabilitation Social Problems of disabled: Consequences of the following social problem sinrelation to sickness and disability remedies to prevent the seproblems Population explosion Poverty and unemployment Beggary Juvenile delinquency Prostitution Alcoholism

Problems of women in employment Social Security:

Social Security and social legislation in relation to the disabled Social Work:

Meaning of Social Work

The role of a Medical Social Worker

## INDIAN CONSTITUTION

Prescribed for the First Year students of all degree classes Unit-I: Meaning of the team 'Constitution' making of the Indian Constitution 1946-1940.

Unit-II: The democratic institutions created by the constitution Bicameral system of Legislature at the Centre and in the States.

Unit-III: Fundamental Rights and Duties their content and significance.

Unit - IV: Directive Principles of States Policies the need to balance Fundamental Rights with Directive Principles.

Unit - V: Special Rights created in the Constitution for: Dalits, Back wards, Women and Children and the Religious and Linguistic Minorities.

Unit-VI: Doctrine of Separation of Powers legislative, Executive and Judicial and their functioning in India.

Unit- VII: The Election Commission and State Public Service commissions. Unit- VIII: Method of amending the Constitution.

Unit - IX: Enforcing rights through Writs:

Unit - X: Constitution and Sustainable Development in India.

Books:

1. J.C. Johari: The Constitution of India- A Politico-Legal Study-Sterling Publication, Pvt. Ltd. New Delhi.
2. J.N. Pandey: Constitution Law of India, Allahbad, Central Law Agency, 1998.
3. Granville Austin: The Indian Constitution-Corner Stone of a Nation-Oxford, New Delhi, 2000.

## **ENVIRONMENT SCIENCE & HEALTH**

Introduction to Environment and Health

Sources, health hazards and control of environmental pollution Water

The concept of safe and wholesome water. The requirements of sanitary sources of water. Understanding the methods of purification of water on small scale and large scale. Various biological standards, including WHO guidelines for third world countries. Concept and methods for assessing quality of water.

Domestic refuse, sullage, human excreta and sewage their effects on environment and health, methods and issues related to their disposal.

Awareness of standard so of housing and the effect of poor housing on health. Role of arthropods in the causation of diseases, mode of transmission of arthropods borne diseases, methods of control

Recommended Books

## **REFERENCES:**

Environment Science & Health

1. Text Book of Environmental Studies for undergraduate courses By Erach Bharucha Reprinted in 2006, Orient Longman Private Limited/Universities Press India Pvt. Ltd.
2. English Kannada Encyclopedia Dictionary, Orient Longman PVT Ltd.

Course Contents Third Year Main Subjects

Paper- I Cardiac Care Technology - Clinical

1. Echo in rheumatic heart disease-Echo in mitral stenosis, mitral incompetence, aortic stenosis, aortic incompetence, Tricuspid valve diseases, pulmonary hypertension. Post AVR, post MVR. Prosthetic valve malfunction, LA/LAA clot
2. Echo in congenital heart disease-Echo in ASD, VSD, PDA pulmonary stenosis, aortic stenosis, contraction of aorta, TOF. Dextrocardia.
3. Echo in ischemic heart disease-Echo in acute myocardial infarction, old myocardial infarction and other ischemic heart disease related conditions, LV aneurysm, VSR, Ischemic MR

4. Echo in other vascular disease- Echo in various types of cardio myopathy infective endocarditis diseases of aorta, mitral valve prolapse, myxoma and other cardiovascular diseases.
  5. Assessment of Cardiac function- measurements of all cardiac chambers and assessment of cardiac function (Diastolic, Systolic)
  6. Echo in pericardial disease- pericardial effusion, cardiac tamponade, constrictive pericarditis
  7. Cardiac catheterisation laboratory- general details of cardiac catheterisation equipment, how to handle the machine, common problems one may come across and how to overcome it, radiation hazards
  8. Radiation physics- basics, generation of radiations, effect on patients/staffs
  9. Materials used in the cathlab- all catheters, balloons, guidewires, pacemakers contrast material and other material used in the cardiac catheterisation laboratory and sterilization of all these materials
  10. Right heart catheterisation- procedure, cath position, oxymetry at various levels, angiogram done and its interpretation
  11. Left heart catheterisation - procedure, cath position, oxymetry at various levels, angiogram done and its interpretation
  12. Coronary angiogram- procedure, materials used, type and amount of dye used, indications and contraindications, various pictures recorded in various angles and gross interpretation.
- Peripheral angiogram- procedure, indication and contraindication

## REFERENCE

1. Feigenbaum's Echocardiography- Latest edition
2. The Echo Manual- From the Mayo Clinic- Latest edition
3. Leo Schamroth- An Introduction to Electrocardiography
4. Marriott's practical Electrocardiography
5. Grossman & Baim's cardiac catheterization, Angiography and Intervention
6. Braunwald's Heart Disease: A textbook of cardiovascular medicine- Latest edition

Practical exam: 80 marks

One common practical for all the papers with equal weightage of marks i.e. 40 practical marks for each paper.

## Paper - II Cardiac Care Technology - Applied

1. Interpretation of normal ECG
  1. ECG in myocardial infarction- definition of myocardial infarction, diagnosis of myocardial infarction, ECG criteria for myocardial infarction, ECG in anterior wall, inferior wall, true posterior wall and sub endocardial infarction and RV infarction
  2. ECG in rheumatic heart disease- definition of rheumatic heart disease, valvular involvement in rheumatic heart disease, ECG in mitral stenosis, mitral incompetence, aortic stenosis and aortic incompetence
  3. ECG in hypertension- definition of hypertension, how to record blood pressure, ECG in hypertension
  4. ECG in congenital heart disease- common congenital heart disease ASD, VSD, PDA, pulmonary stenosis, aortic stenosis, coarctation of aorta, TOF, definition of all these conditions, ECG changes in all these conditions
  5. ECG in other conditions- ECG in various types of cardiomyopathy, myxoedema, pericardial effusion, acute pericarditis and other vascular diseases. Bundle branch block, WPW syndrome, dextrocardia
  6. Trans esophageal echocardiogram - indications, procedure, usefulness and complications one may encounter and its management
    - Stress Echo- procedure and indications
    - Foetal echocardiogram - Procedure, basic interpretation
    - Contrast echocardiogram- procedure and usefulness of contrast echocardiogram
    - Myocardial contrast echo- Basic knowledge



7. Peripheral Doppler - Procedure and usefulness of peripheral Doppler
8. Coronary angioplasty- procedure, materials used, complication one may encounter and how to manage it  
Peripheral angioplasty- materials used and procedure. Angioplasty of coarctation of aorta
9. Rota ablation/ FFR/ IVUS/ OCT- Basic knowledge
10. IABP- Uses, basic principle, indication, contraindication, complications

#### **REFERENCE**

1. Feigenbaum's Echocardiography- Latest edition
- The Echo Manual- From the Mayo Clinic- Latest edition
3. Leo Schamroth- An Introduction to Electrocardiography
4. Marriott's practical Electrocardiography
- Grossman & Baim's cardiac catheterization, Angiography and Intervention
- Braunwald's Heart Disease: A text book of cardiovascular medicine- Latest edition

## Practical exam: 80 marks

One common practical for all the papers with equal weightage of marks i.e. 40 practical marks for each paper.

### Paper -III Cardiac Care Technology - Advanced

1. Cardiac Monitoring - definition, purpose of cardiac monitoring, how to Recognise various arrhythmias how to set up a intensive coronary care unit and usefulness of ICCU
2. Interpretation of TMT report - criteria for TMT positive test contraindication for TMT conditions where TMT is not useful, complications that may occur in TMT room and its management
3. Use of defibrillator- indications, how to use the defibrillator, complications during the procedure and its management

Management of cardiac arrest - definition, causes external cardiac massage, artificial respiration and other drugs and procedures used in the management of Cardiac arrest (ACLS, BLS) Myocardial perfusion scan - procedures and usefulness of myocardial perfusion scan

Cardiac arrhythmias - ***bradyarrhythmia and tachy arrhythmias and ECG diagnosis of all rhythm disturbances.***

Electrolyte disturbances - ECG in hypokalemia, hyperkalemia etc.

Holter monitoring - procedure and usefulness

4. Valvoplasties- procedure, indications, complications and treatment of balloons, mitral valvuloplasty, balloon aortic valvuloplasty balloon pulmonary valvuloplasty and balloon tricuspid valvuloplasty.

Coil closure and device closure of PDA - procedure, indications and materials used for coil and device closure of PDA

5. Device closure of ASD - procedure, indications and materials used for device closure of ASD

Device closure of VSD - procedure, indications and materials used for device closure of VSD

Electrophysiological studies - basic knowledge of EP studies mapping and ablation

6. Oxymetry - handling of the instrument and usefulness of the instrument, normal and abnormal values.
7. Pressure recording- handling of the instrument and pressures in various chambers, normal and abnormal values.
8. Temporary and permanent pacing - materials used, procedure, complications one may encounter and management. Implantable Cardioverter defibrillator device

CD recording and storage- recording and storage of all the procedures over CD

Procedure during pregnancy- precautions to be followed.

9. Nuclear Cardiology - instrumentation, radiopharmaceuticals, patient imaging techniques.

Cardiac drugs

Septal ablation therapy- indication, procedure, complications

Advanced echo- 3D, Speckle tracking- Basic knowledge

## REFERENCE

Feigenbaum's Echocardiography- Latest edition

1. The Echo Manual- From the Mayo clinic- Latest edition 3. Leo Schamroth- An Introduction to Electrocardiography 4. Marriott's
2. *practical Electrocardiography*
3. *Gross man & Baim's cardiac catheterization, Angiography and Intervention*
4. *Braunwald's Heart Disease: A text book of cardiovascular medicine- Latest edition*

**PRACTICALEXAMINATION**

**40 Marks each paper**

***ECHO evaluation of Case with complete diagnosis Spotters***

***Interpretation of ECG/ TMT reports***

## Subsidiary subjects

### BIO STATISTICS

Time Allotted: 20 Hours

#### Course Description:

Introduction to basic statistical concepts: methods of statistical analysis; and interpretation of data

#### Behavioural Objectives:

Understands statistical terms.

Possesses knowledge and skill in the use of basic statistical and research methodology.

#### Unit - I : Introduction

Meaning, definition, characteristics of statistics. Importance of the study of statistics.

Branches of statistics.

Statistics and health science including nursing. Parameters and estimates.

Descriptive and inferential statistics. Variables and their types.

Measurement scales

#### Unit - II: Tabulation of Data

Raw data, the array, frequency distribution. Basic principles of graphical representation.

Types of diagrams - histograms, frequency polygons, smooth frequency polygon, cumulative frequency curve, ogive. Normal probability curve.

#### Unit - III : Measure of Central Tendency

Need for measures of central tendency

Definition and calculation of mean - ungrouped and grouped

Meaning, interpretation and calculation of median ungrouped and grouped. Meaning and calculation of mode.

Comparison of the mean, and mode.

Guidelines for the use of various measures of central tendency.

#### Unit - IV : Measure of Variability

Need for measure of dispersion. The range, the average deviation. The variance and standard deviation.

Calculation of variance and standard deviation ungrouped and grouped. Properties and uses of

variance and SO

### **Unit -V : Probability and Standard Distributions.**

Meaning of probability of standard distribution. The Binominal distribution.

The normal distribution.

Divergence from normality - skewness, kurtosis.

### **Unit - VI : Sampling Techniques**

Need for sampling - Criteria for good samples. Application of sampling in Community.

Procedures of sampling and sampling designs errors. Sampling variation and tests of significance.

### **Unit - VII : Health Indicator**

Importance of health Indicator.

Indicators of population, morbidity, mortality, health services. Calculation of rates and ratios of health.

### **Recommended Books.**

B.K. Mahajan & M. Gupta (1995) Text Book of Preventive & Social Medicine, 2002, 17th Edition Jaypee Brothers.

## **BASICS IN COMPUTER APPLICATIONS**

The course enables the students to understand the fundamentals of computer and its applications.

### **Introduction to Data processing :**

Features of computers, Advantages of using computers. Getting data into / out of computers. Role of computers. What is Data processing? Application areas of computers involved in Data processing. Common activities in processing. Types of Data processing, Characteristics of information. What are Hardware and Software?

### **Hardware Concepts :**

Architecture of computers, Classification of computers, Concept of damage. Types of storage devices. Characteristics of disks, tapes, Terminals, Printers, Network. Applications of networking concept of PC System care, Floppy care, Data care.

### **Concept of Software.**

Classification of software : System software. Application of software. Operating system.

Computer system. Computer virus. Precautions against viruses. Dealing with viruses.

Computers in medical electronics Basic Anatomy of Computers Principles of programming

Computer application - principles in scientific research ; work processing, medicine, libraries, museum , education, information system. Data processing

Computers in physical therapy - principles in EMG, Exercise testing equipment, Laser.

Scheme of Examination for MEDICAL ELECTRONICS including COMPUTER APPLICATIONS One Written (Theory) paper: Maximum Marks: -80 marks. No Practical or Viva voce examination

## SECTION III

### CLINICAL TRAINING

#### Content and purpose

The clinical component has been designed to complement the academic program and runs throughout the course. The placement have to be designed so that the students will be able to observe the practical application of the academic course wherever possible. Content can be tailored to meet either National or Local needs as is deemed to be most appropriate.

#### 1st year: Introduction to the Hospital Setting

##### The purpose of this phase is:

- i. For the students to become familiar with some of the practical applications of the academic course
- ii. To introduce the wider hospital setting
- iii. To help the students to identify the various disciplines within a hospital, their role and the importance of cooperation.
- iv. To introduce patients in a clinical setting and begin to acquire basic communication skills.

#### 2nd year: Skills Necessary to work in a Hospital

To be completed very early in the training. The following procedures will be demonstrated to the students who will be expected to observe or participate as appropriate.

##### General procedures to be observed when patients attend for appointment:

- Lifting and moving techniques.
- Administration of bedpans, vomit bowls, etc.,
- Care and management of drugs in the hospital setting.

##### Correct procedures when dealing with patients with infectious diseases

- University precautions.

##### Correct procedures when dealing with immuno-compromised patients:

- Hygiene practices
- Simple dressings
- Sterile procedures
- Oxygen administration



**Care of patients with:**

Breathing difficulties  
Terminal illness  
Mental impairment  
Physical disability  
Special care of the geriatric and paediatric patient  
Stoma care  
Handling of patients with bone metastases  
Care of the patient following an anaesthetic  
Care of lines in the incubated patient  
Communication skills with patients and relatives  
Terminally ill and Hospice

**2nd & 3rd year: Skills Related to working in a department**

Introduction to the department. Time will be spent on each unit within the department. The purpose of this phase is to:

**In the department:**

- i. Familiarize the students with the different units within the department and the procedures carried out on each unit.
- ii. Enable the student to recognize and relate to the basic terminology introduced in the academic program.
- iii. Help to establish a sense of identity within the student group and to understand the role of the Technology in the management of various cases.

Introduce the students to the staff of the department.

Help the student to understand team roles.

Familiarize the students with written QA programs within the department.

**Equipment's and Integration:**

Begin to become competent in the manipulation of the equipment.

Be able to communicate effectively with patients.

Begin to integrate into the department as part in specific and multidisciplinary teams.

- iv. Begin to empathize with patients and to appreciate their own feelings in the clinical situation.

Being able to handle and achieve proficiency in mould room techniques.

## **Safety & Precautions in Practice:**

Identifying the functions of various equipment and safe handling.

1. Identifying the functions on a control panel, indicating their purpose and safely using these when appropriate.
2. Safely using the accessory equipment in the correct context.
3. Correctly and safely using equipment related to patient immobilization.
4. Demonstrating the correct procedure for various techniques

## **To Achieve Clinical Competence**

**The purpose of this phase is for the students to:**

- i. Demonstrate competence in the manipulation of equipment.
- ii. Demonstrate an ability to anticipate the physical and psychological needs of the patient and respond to them.
- iii. Demonstrate the ability to communicate with ease with other staff involved in the multidisciplinary treatment of the patient.
- iv. Increasingly participate as a team member in all aspects of the patient's management.
- v. Demonstrate competence in simulator procedures.
- vi. Acquire basic computer skills.
- vii. Participate in the development / revision of formal written quality assurance procedures / programme.
- viii. Set up a patient on their first visit.

**To achieve final competency substantial time will be spent:**

- i. Setting up multi field techniques under supervision.
- ii. Participating in the quality control procedures in the department in accordance with the protocols.
- iii. Simulating and localizing a target volume.
- iv. Discussing the role of local rules and outline those in place in the different departments.

## **Graded Responsibility (structured training schedule)**

**I year:** Theory classes, observation in treatment planning and treatment execution.

**II year:** Theory classes, participation in OPD, mould room techniques, treatment planning, treatment execution under the supervision of consultant, senior technologist, project work.

**III year:** Theory classes, participation in OPD, Treatment planning and execution under supervision of consultant & Senior Technologist. Submission of Project Work, Mould Room Techniques, Quality Assurance.

## **Rotation posting**

Students may be posted to other relevant departments or other centres with better and latest equipment's for a minimum period of 1 to 2 months, for completion of training in recent advance in the specialty. The student on completion of the training shall submit a report duly signed by the concerned department to the HOD.

## **Monitoring Learning Progress**

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only also helps teachers to evaluate students but also students to evaluate themselves. The monitoring be done by the staff of the department based on participation of students in various teaching / learning activities. It may be structured and assessment be done using sample checklist provided (Assessment forms).

### **The learning out comes to be assessed should included:**

Personal Attitudes  
Acquisition of knowledge  
Clinical and operative skills  
Teaching skills

**Candidate should be encouraged to participate in teaching activities, seminars and literature reviews.**

### **Periodic tests :**

The departments may conduct periodic tests (Internal Assessment), the tests may include written papers, practical with viva voce.

Work diary / Log, Personal Attitudes.

### **The essential items are:**

Caring attitudes  
Initiative  
Organizational ability  
Potential to cope with stressful situations and undertake responsibility  
Trust worthiness and reliability  
To understand and communicate intelligibly with patients and other

To behave in manner which establishes professional relationships with patients and colleagues Ability to work in team

- A critical enquiring approach to the acquisition of knowledge the methods used mainly consist of observation. It is appreciated that these items require a degree subjective assessment by the guide, supervisors and peers.

## **Acquisition of Knowledge :**

The methods used comprise of 'Log Book' which records participation in various teaching / learning activities by the students. The number of activities attended and the number in which presentations are made are to be recorded. The log book should periodically be validated by the supervisors, some of the activities are listed.

The list is not complete. Institutions may include additional activities, if so, desired.

### **1. Technical skills**

Day to day work: Skills on the machines should be assessed periodically. The assessment should include the candidates' sincerity and punctuality, analytical ability and communication skills.

Clinical and procedural skills: The candidate should be given graded responsibility to enable learning by apprenticeship. The performance is assessed by the guide by direct observation. Particulars are recorded by the student in the log book.

### **2. Teaching Skills:**

#### **Book:**

Every candidate shall maintain a work diary and record his / her participation in the training programs conducted by the department such as practical, literature reviews, seminars, etc. Special mention may be made of the presentations, by the candidate as well as details of practical or laboratory procedures, if any conducted by the candidate.

### **3. Records:**

Records, log books, project report and marks obtained in tests will be maintained by the Head of the Department and will be made available to the University as indicated. The record books maintained by the student should be submitted to the Head of the Department 6 months prior to completion of the course and the head of the department makes a certification of the of the academic progress an assessment of student performance throughout the said course shall be made by the HOD.

The log book is a record of the important activities of the candidates during his training internal assessment should be based on the evaluation of the log book collectively, log books are a tool for the evaluation of the training programme of the institution by external agencies. The record includes academic activities as well as the presentations and procedures carried out by the candidate.

# **REGULATIONS & CURRICULUM OF GRADUATE PARAMEDICAL COURSE**

## **BACHELOR OF SCIENCE IN**

## **PERFUSION TECHNOLOGY**

**2020**



### **Sri Siddhartha Academy of Higher Education Deemed-to-be-University**

**Established under Section 3 of the UGC Act, 1956  
MHRD, GOI No. F.9-31/2006-U.3 (A) Dtd. 30th May 2008**

**Agalakote, B.H. Road, Tumkur – 572107, Karnataka, India**

# SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

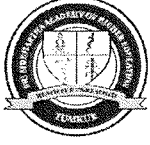
(DEEMED TO BE UNIVERSITY)

Declared under Section 3 of the UGC Act, 1956, MHRD GOI No. F.9-31/2006-U.3 (A) Dated: 30/05/2008

Accredited 'A' Grade by NAAC

Agalakote, B.H.Road, Tumkur – 572 107.KARNATAKA, INDIA.

Ph. 0816- 2275516, Fax : 0816-2275510 website: sahetumkur.ac.in email: info@sahe.in



No. SSAHE/ACA-S&C(AHSP)/14/2022

Date: 01/09/2022

## NOTIFICATION

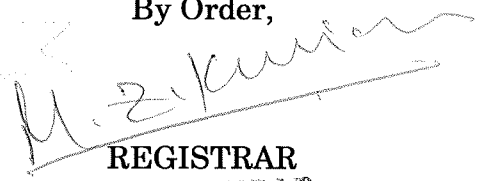
Sub: Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Perfusion Technology.

- Ref: 1). Proceedings of BOS Allied Health Sciences Programmes held on 06/04/2021  
2). Proceedings of the Academic Council meeting held on 19/08/2021  
3). Proceedings of the Board of Management held on 29/08/2022

In exercise of the powers vested under section 6 of 6.4 of MoA / Rules of SSAHE, the Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Perfusion Technology is notified herewith as per Annexure.

The above Regulations shall be applicable to the students admitted to the said course from the academic year 2020-21 onwards.

By Order,

  
REGISTRAR

REGISTRAR

Sri Siddhartha Academy of Higher Education  
TUMKUR - 572 107, Karnataka.

To,  
Dean / Principal, Sri Siddhartha Medical College & Hospital,

Copy to

- 1) Office of the Chancellor, SSAHE, for kind information,
- 2) PA to Vice-Chancellor / PA to Registrar / Controller of Examinations / Finance Officer, SSAHE
- 3) The Director (AHSP), SSAHE
- 4) All Officers of the Academy Examination Branch / Academic Section
- 5) Guard File / Office copy.

**ORDINANCE GOVERNING REGULATIONS & CURRICULUM OF B. Sc.  
PERFUSION TECHNOLOGY - 2020**

**1. Eligibility for admission:**

A candidate seeking admission to the B.Sc. Perfusion Technology shall have studied English as one of the principal subject during the tenure of the course and shall have passed:

1. Two year Pre-University examination or equivalent as recognized by Sri Siddhartha Academy of Higher Education with, Physics, Chemistry and Biology as subjects of study.

OR

2. Pre-Degree course from a recognized University considered as equivalent by SSAHE, (Two years after ten years of schooling) with Physics, Chemistry and Biology as subjects of study.

OR

3. Any equivalent examination recognized by the Sri Siddhartha Academy of Higher Education, Tumkur for the above purpose with Physics, Chemistry and Biology as subjects of study.

OR

4. The vocational higher secondary education course conducted by Vocational Higher Secondary Education, Government of Kerala with five subjects including Physics, Chemistry, Biology and English in addition to vocational subjects conducted is considered equivalent to plus TWO examinations of Government of Karnataka Pre University Course.

OR

5. Candidates with two years diploma from a recognized Government Board in Perfusion technology shall have passed class 12 [10+2] with Physics, Chemistry and Biology, as subjects or candidates with 3 years diploma from a recognized Government Board in Perfusion technology should have studied Physics, Biology and Chemistry as subjects during the tenure of the course.

6. Lateral entry to second year of B.Sc. Perfusion Technology for candidates who have passed diploma program from the Government Boards and recognized by SSAHE, fulfilling the conditions specified above under Sl. No. 5 and these students are eligible to take admission on lateral entry system only in the same subject studied at diploma level for the academic year



**Note:**

- a. The candidate shall have passed individually in each of the subjects.
- b. Candidates who have completed diploma or vocational course through Correspondence shall not be eligible for any of the courses mentioned above.

**2. Duration of the course:**

Duration shall be for a period of four years including one year of Internship.

**3. Medium of instruction:**

The medium of instruction and examination shall be in English.

**4. Scheme of examination:**

There shall be three examinations one each at the end of 1 st, 2nd and 3rd year.

**5. Attendance**

Every candidate should have attended at least 80% of the total number of classes conducted in an academic year from the date of commencement of the term to the last working day as notified by university in each of the subjects prescribed for that year separately in theory and practical. Only such candidates are eligible to appear for the university examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A candidate lacking in prescribed percentage of attendance in any subjects either in theory or practical in the first appearance will not be eligible to appear for the University Examination in that subject

- The marks of the internal assessment must be displayed on the notice board of the respective colleges with in a fortnight from the date test is held.
- If a candidate is absent for any one of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

## 6. Internal Assessment (IA):

### 1st Year B.Sc. Perfusion Technology

Theory - 20 marks

Practicals - 10 marks\*. [Lab work- 06 marks and Record-04 marks]

### 2nd & 3rd year B.Sc. Perfusion Technology

Theory – 20 Marks

Practicals – 20 Marks

There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an academic year. The average marks of the two tests will be calculated and reduced to 20. The marks of IA shall be communicated to the University at least 15 days before the commencement of the University examination. The University shall have access to the records of such periodical tests. The marks of the internal assessment must be displayed on the notice board of the respective colleges with in a fortnight from the date test is held. If a candidate is absent for any one of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

\* There shall be no University Practical Examination in First year.

## 7. Subject and hours of teaching for Theory and Practicals

The number of hours of teaching theory and practical, subject wise in first year, second year and third year are shown in Table-I, Table-II and Table-III

Main and Subsidiary subjects are common in first year for all the courses in Allied Health Science.

The number of hours for teaching theory and practical for main subjects in first, Second and Third year are shown in Table-I, II and III.

**Table - I Distribution of Teaching Hours in First Year Subjects**

### **Main subjects**

| Sl. no | Subject Theory No. of                                         | Hours | Practical No. of Hours | Total No. of Hours |
|--------|---------------------------------------------------------------|-------|------------------------|--------------------|
| 1      | Human Anatomy                                                 | 70    | 20                     | 90                 |
| 2      | Physiology                                                    | 70    | 20                     | 90                 |
| 3      | Biochemistry I                                                | 70    | 20                     | 90                 |
| 4      | Pathology I (Clinical Pathology, Haematology & Blood Banking) | 70    | 20                     | 90                 |
| 5      | Microbiology                                                  | 70    | 20                     | 90                 |
|        | Total                                                         | 350   | 100                    | 450                |

The classes in main and subsidiary subjects are to be held from Monday to Thursday. On Fridays and Saturdays students shall work in hospitals in the respective specialty or department chosen by them

### Subsidiary Subjects

1. English
2. Health Care

**Table - II Distribution of Teaching Hours in Second Year Subjects.**

#### Main Subjects

| Sl. no | Subject Theory                            | No. of Hours | Practical No. of Hours | Clinical Postings | Total No. of Hours |
|--------|-------------------------------------------|--------------|------------------------|-------------------|--------------------|
| 1      | Applied Pharmacology                      | 50           | --                     | --                | 50                 |
| 2      | Applied Pathology                         | 30           | 30                     | --                | 60                 |
| 3      | Applied Microbiology                      | 30           | 30                     | --                | 60                 |
| 4      | Medicine Relevant to Perfusion Technology | 50           | --                     | --                | 50                 |
| 5      | Introduction to Perfusion Technology      | 80           | 100                    | 650               | 830                |
|        | Total                                     | 240          | 160                    | 650               | 1050               |

### Subsidiary Subjects

1. Sociology
2. Indian constitution
3. Environment science and health

**Table - III Distribution of Teaching Hours in Third Year Subjects**

#### Main Subjects

| Sl. no | Subjects                                  | Theory No.of Hours | Practical No. of Hours | Clinical Posting | Total No. of Hours |
|--------|-------------------------------------------|--------------------|------------------------|------------------|--------------------|
| 1      | Paper-I Perfusion Technology Clinical     | 50                 | 50                     | 250              | 350                |
| 2      | Paper-II Perfusion Technology – Applied   | 50                 | 50                     | 250              | 350                |
| 3      | Paper-III Perfusion Technology – Advanced | 50                 | 50                     | 250              | 350                |
|        | Total                                     | 150                | 150                    | 750              | 1050               |

## **Subsidiary Subjects**

1. Research & Biostatistics
2. Basics Computer application

## **Schedule of Examination:**

The university shall conduct two examinations annually at an interval of not less than 4 to 6 months as notified by the university from time to time. A candidate who satisfies the requirement of attendance, progress and conduct as stipulated by the university shall be eligible to appear for the university examination. Certificate to that effect shall be produced from the Head of the institution along with the application for examination and the prescribed fee.

## **8. Scheme of Examination**

There shall be three examinations, one each at the end of I, II and III year. The examination for both main and subsidiary subjects for all courses in Allied Health Sciences shall be common in the first year. Distribution of Subjects and marks for First Year, Second year & Third year University theory and practical Examinations are shown in the Table – IV, V & VI.

### **First year examination:**

The University examination for 1st year shall consist of only theory examination and there shall be no University Practical Examination.

### **Second & Third year examination:**

The University examination for 2nd and 3rd year shall consist of Written Examination & Practical.

### **Written Examinations consists of**

05 papers in the 1<sup>st</sup> year

04 papers in the 2nd Year

03 papers in the 3rd Year.

### **Practical examination:**

Two practical examinations, at the end 2<sup>nd</sup> Year and three practical examinations at the end of the 3<sup>rd</sup> year.

**TABLE-IV****Distribution of Subjects and marks for First Year University theory Examination**

| A | Main Subjects *                     | Written Paper |       | I A Theory | Total |
|---|-------------------------------------|---------------|-------|------------|-------|
|   |                                     | Duration      | Marks | Marks      | Marks |
| 1 | Basic Anatomy (Including Histology) | 3 Hours       | 80    | 20         | 100   |
| 2 | Physiology                          | 3 Hours       | 80    | 20         | 100   |
| 3 | Biochemistry                        | 3 Hours       | 80    | 20         | 100   |
| 4 | Pathology                           | 3 Hours       | 80    | 20         | 100   |
| 5 | Microbiology                        | 3 Hours       | 80    | 20         | 100   |
|   | Subsidiary Subject **               |               |       |            |       |
| 1 | English                             | 3 Hours       | 80    | 20         | 100   |
| 2 | Kannada                             | 3 Hours       | 80    | 20         | 100   |
| 3 | Health care                         | 3 Hours       | 80    | 20         | 100   |

Note: I A = Internal Assessment

\*Main Subjects shall have University Examination.

There shall be no University Practical Examination.

\*\*Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

**TABLE – V****Distribution of Subjects and marks for Second Year Examination of B.Sc. Perfusion Technology**

| Paper | Subject                                   | Theory        |    |              | Practicals    |    |              |                |
|-------|-------------------------------------------|---------------|----|--------------|---------------|----|--------------|----------------|
|       |                                           | Univ.<br>exam | IA | Sub<br>Total | Univ.<br>Prac | IA | Sub<br>Total | Grand<br>Total |
| I     | Applied Pharmacology                      | 80            | 20 | 100          | ---           |    |              | 100            |
| II    | Applied Pathology                         | 40            | 20 | 100          | 40            | 10 | 50           | 150            |
| II    | Applied Microbiology                      | 40            |    |              |               |    |              |                |
| III   | Medicine Relevant to Perfusion Technology | 80            | 20 | 100          | ---           |    |              | 100            |
| IV    | Introduction to Perfusion Technology      | 80            | 20 | 100          | 40            | 10 | 50           | 150            |

**TABLE – VI****Distribution of Subjects and marks for Third Year Examination of B.Sc. Perfusion Technology**

| Paper | Theory                                             |            |    |           | Practical         |                      |           |             |
|-------|----------------------------------------------------|------------|----|-----------|-------------------|----------------------|-----------|-------------|
|       | Subject                                            | Univ. exam | IA | Sub Total | Univ .<br>Prac    | IA                   | Sub Total | Grand Total |
| I     | Paper-I<br>Perfusion<br>Technology<br>Clinical     | 80         | 20 | 100       | 120(40<br>+40+40) | 30<br>(10+10+<br>10) | 150       | 450         |
| II    | Paper-II<br>Perfusion<br>Technology -<br>Applied   | 80         | 20 | 100       |                   |                      |           |             |
| III   | Paper-III<br>Perfusion<br>Technology -<br>Advanced | 80         | 20 | 100       |                   |                      |           |             |

**9. Pass criteria****9.1. First year examination**

a. Main Subjects: A candidate is declared to have passed in a subject, if he/she secures, 50% of marks in University Theory exam and internal assessment added together.

b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the Commencement of the University examination.

**9.2. Second and Third year Examination**

a. Main Subjects: A candidate is declared to have passed the examination in a subject if he/she secures 50% of the marks in Theory and 50% in practical separately. For a pass in theory, a candidate has to secure a minimum of 40% marks in the University conducted written examination, and 50% in aggregate in the University conducted written examination and internal assessment added together and for pass in Practical, a candidate has to secure a minimum of 40% marks in the university conducted Practical/Clinical examination and 50% in aggregate i.e. University conducted Practical/Clinical and Internal Assessment.

b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

## **10. Carry over benefit**

### **10.1 First year examination:**

A candidate who fails in any two of the five main subjects of first year shall be permitted to carry over those subjects to second year. However, he/ she must pass the carry over subjects before appearing for second year examination.

### **10.2. Second year examination:**

A candidate is permitted to carry over any one main subject to the third year but shall pass this subject before appearing for the third year examination.

## **11. Declaration of Class**

**a.** A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with Distinction.

**b.** A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 60% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in First Class.

**c.** A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than 60% of grand total marks prescribed will be declared to have passed the examination in Second Class.

**d.** A candidate passing the university examination in more than one attempt shall be placed in Pass class irrespective of the percentage of marks secured by him/her in the examination.

**e.** The marks obtained by a candidate in the subsidiary subjects shall not be considered for award of Class or Rank.

[Please note, fraction of marks should not be rounded off clauses (a), (b) and (c)]

## **12. Eligibility for the award of Degree:**

A candidate shall have passed in all the subjects of first, second and third year to be eligible for a compulsory 12 months of rotational internship. On completion of 12 months of the internship with pass criteria in outgoing clinical assessment exams the candidate is then eligible for the award of degree.

### 13. Distribution of Type of Questions and Marks for Various Subjects

#### THEORY

#### 9. Distribution of Type of Questions and Marks

| SUBJECTS HAVING MAXIMUM MARKS= 100 (for <b>First year</b> ) |                  |                          |
|-------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                           | No. of Questions | Marks for Each Questions |
| Long Essay                                                  | 2                | 10                       |
| Short Essay                                                 | 10               | 05                       |
| Short Answer                                                | 10               | 03                       |

1. Long essay- 2 Questions (second question choice)  $2 \times 10 = 20$  marks
  2. Short essay- 10 Questions (Questions no 5 & 10 choice)  $10 \times 5 = 50$  marks
  3. Short answer- 10 Questions (Questions no 15 & 20 choice)  $10 \times 3 = 30$  marks
- Total= 100**

| SUBJECTS HAVING MAXIMUM MARKS= 100 (for <b>Second and Third Year</b> ) |                  |                          |
|------------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                      | No. of Questions | Marks for Each Questions |
| Long Essay                                                             | 2                | 10                       |
| Short Essay                                                            | 10               | 05                       |
| Short Answer                                                           | 10               | 03                       |

1. Long essay- 2 Questions (second question choice)  $2 \times 10 = 20$  marks
  2. Short essay- 10 Questions (Questions no 5 & 10 choice)  $10 \times 5 = 50$  marks
  3. Short answer- 10 Questions (No choice)  $10 \times 3 = 30$  marks
- Total= 100**

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Subsidiary subjects</b> ) |                  |                          |
|---------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                   | NO. of questions | Marks for Each Questions |
| Essay Type                                                          | 3 (2 x 10)       | 10                       |
| Short Essay Type                                                    | 8 (6 x 5)        | 05                       |
| Short Answer Type                                                   | 12 (10 x 3)      | 03                       |

1. Long essay- 1 Questions (No choice)  $2 \times 10 = 20$  marks
  2. Short essay- 05 Questions (Choice is on Questions no 03)  $06 \times 5 = 30$  marks
  3. Short answer- 05 Questions (Choice is on Questions no 03)  $10 \times 3 = 30$  marks
- Total= 80**

| SUBJECTS HAVING MAXIMUM MARKS= 50 |                  |                          |
|-----------------------------------|------------------|--------------------------|
| Type of Questions                 | No. of Questions | Marks for Each Questions |
| Long Essay                        | 1                | 10                       |
| Short Essay                       | 05               | 05                       |
| Short Answer                      | 05               | 03                       |

4. Long essay- 1 Questions (No choice)  $1 \times 10 = 10$  marks
  5. Short essay- 05 Questions (Choice is on Questions no 03)  $05 \times 5 = 25$  marks
  6. Short answer- 05 Questions (Choice is on Questions no 03)  $05 \times 3 = 15$  marks
- Total= 50**



# FIRST YEAR B.SC PERFUSION TECHNOLOGY

## ANATOMY

No. of theory classes: 70 hours

No. of practical classes: 20 hours

Theory: 70hrs

Practicals: 20hrs

### **Chapter 1**

#### **Introduction:**

##### **Theory:**

- Definition of anatomy and its divisions
- Terms of location, positions and planes
- Epithelium-definition, classification, describe with examples, function
- Glands- classification, describe serous, mucous & mixed glands with examples
- Basic tissues – classification with examples

##### **Practical:**

- Histology of types of epithelium
- Histology of serous, mucous & mixed salivary gland

### **Chapter 2**

#### **Connective tissue:**

##### **Theory:**

- Cartilage – types with example & histology theory
- Bone – Classification, names of bone cells, parts of long bone, microscopy of compact
- bone, names of all bones, vertebral column, intervertebral disc, fontanelles of fetal skull
- Joints – Classification of joints with examples, synovial joint (in detail for radiology)
- Muscular system: Classification of muscular tissue & histology
- Names of muscles of the body

##### **Practical:**

- Histology of the 3 types of cartilage
- Histology of compact bone (TS & LS)
- Histology of skeletal (TS & LS) & cardiac muscle

- Demo of all bones showing parts, radiographs of normal bones & joints
- Demonstration of important muscles of the body

### **3. Cardiovascular system:**

#### **Theory:**

- Heart-size, location, chambers, exterior & interior, pericardium
- Blood supply of heart
- Systemic & pulmonary circulation
- Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery
- Inferior vena cava, portal vein, portosystemic anastomosis, Great saphenous vein, Dural venous sinuses
- Lymphatic system- cisterna chyli & thoracic duct, Histology of lymphatic tissues, Names of regional lymphatics, axillary and inguinal lymph nodes in brief

#### **Practical:**

- Demonstration of heart and vessels in the body
- Histology of large artery & vein, medium sized artery & vein
- Histology of lymph node, spleen, tonsil & thymus
- Radiology: Normal chest radiograph showing heart shadows

### **4. Gastro-intestinal system**

#### **Theory:**

- Parts of GIT: Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring), Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas, spleen, peritoneum & reflections

#### **Practical:**

- Demonstration of parts of GIT
- Radiographs of abdomen

### **5. Respiratory system**

- Parts of RS: nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments, diaphragm
- Histology of trachea, lung and pleura
- Names of paranasal air sinuses

#### **Practical:**

- Demonstration of parts of respiratory system.
- Normal radiographs of chest, X-ray paranasal sinuses
- Histology of lung and trachea

## **6. Urinary system**

### **Theory:**

- Kidney, ureter, urinary bladder, male and female urethra
- Histology of kidney, ureter and urinary bladder

### **Practical:**

- Demonstration of parts of urinary system
- Histology of kidney, ureter, urinary bladder
- Radiographs of abdomen-IVP, retrograde cystogram

## **7. Reproductive system**

### **Theory:**

- Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology)
- Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology)
- Mammary gland – gross

### **Practical:**

- Demonstration of section of male and female pelvis with organs in situ
- Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes, ovary
- Radiographs of pelvis – hysterosalpingogram

## **8. Endocrine glands**

### **Theory:**

- Names of all endocrine glands in detail on pituitary gland, thyroid gland & suprarenal gland – (gross & histology)

### **Practical:**

- Demonstration of the glands
- Histology of pituitary, thyroid, parathyroid, suprarenal glands

## **9. Nervous system**

### **Theory:**

- Neuron & Classification of NS
- Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve

(gross & histology) Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei

- Blood supply of brain
- Cranial nerves
- Sympathetic trunk & names of parasympathetic ganglia

**Practical:**

- Histology of peripheral nerve & optic nerve
- Demonstration of all plexuses and nerves in the body
- Demonstration of all part of brain
- Histology of cerebrum, cerebellum, spinal cord

**10. Sensory organs****Theory:**

- Skin: Skin-histology & Appendages of skin
- Eye: Parts of eye & lacrimal apparatus, Extra-ocular muscles & nerve supply
- Ear: parts of ear- external, middle and inner ear and contents

**Practical:**

- Histology of thin and thick skin
- Demonstration and histology of eyeball
- Histology of cornea & retina

**11. Embryology:****Theory:**

- Spermatogenesis & oogenesis
- Ovulation, fertilization
- Fetal circulation
- Placenta

**INTERNAL ASSESSMENT**

Theory-average of 2 exams conducted 20

Practicals: record and lab work\* 10

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

**Distribution of Marks for University Theory and Practical Exam**

| <b>Practicals</b> |    |       |            | <b>Grand total</b> |           |     |
|-------------------|----|-------|------------|--------------------|-----------|-----|
| Theory            | IA | Sub   | Practicals | IA                 | Sub Total |     |
|                   |    | Total |            |                    |           |     |
| 80                | 20 | 100   | *          |                    |           | 100 |

**REFERENCE BOOKS:**

1. William Davis (P) understanding Human Anatomy and Physiology – McGraw Hill
2. Chaurasia- A Text Book of Anatomy
3. T. S. Ranganathan- A Text Book of Human Anatomy
4. Fattana, Human Anatomy (Description and applied)- Saunder's & C P Prism Publishers, Bangalore
5. ESTER. M. Grishcimer- Physiology & Anatomy with Practical Considerations, J. P. Lippin Cott. Philadelphia
6. Bhatnagar- Essentials of Human Embryology- Revised Edition. Orient Blackswan Pvt. Ltd.

# PHYSIOLOGY

Theory 70 hours

Practical 20hours

## 1. General Physiology

Introduction to cell physiology, transport across cell membrane

Homeostasis, Body Fluid compartment & measurement

## 2. Blood

Introduction - composition and function of blood

Plasma. proteins, types and functions

Red blood cells - erythropoiesis, stages of differentiation, factors affecting it, function, normal count, physiological variation.

Hemoglobin- function, concentration, types & methods of Hb estimation, fate of hemoglobin

Jaundice-types Anaemia,-types

ESR, PCV, osmotic fragility & blood indices

WBC- morphology, production, functions, normal count, differential count, variation, variation Immunity (in brief)

Platelets- origin, morphology, normal count, function-Platelet plug ,bleeding disorder

Haemostasis - definition, normal haemostasis, clotting factors, mechanism of clotting, anticoagulants disorders of clotting factors.

Blood group-ABO & Rh system, Rh incompatibility blood typing ,cross matching, hazards of mismatched blood transfusion

RES, spleen and lymph

## 3. Nerve-Muscle

Neuron structure, types, neuroglia-types, nerve fibre classification, properties of nerve fibres,

RMP,action potential, wallerian degeneration

NMJ, blockers, Myasthenia gravis

Classification of muscle, structure of skeletal muscle, sarcomere, contractile proteins

Excitation contraction coupling, mechanism of muscle contraction, types of contraction

Motor unit, fatigue, rigor mortis Smooth muscle

## 4. Respiratory system

Physiological anatomy of respiratory system, muscles of respiration, respiratory & non respiratory functions of lungs, dead space

Mechanics of breathing, intrapulmonary & pleural pressures

Compliance, Surfactant, Hyaline membrane disease

Lung volumes and capacities

Respiratory membrane , transport of O<sub>2</sub> & CO<sub>2</sub>

Chemical regulation of respiration

Neural regulation of respiration

Hypoxia, Acclimatization,

Dysbarism. Artificial respiration

Definition-Periodic breathing ,dyspnoea, apnoea, asphyxia,, cyanosis

## 5. Cardiovascular system

Introduction to CVS & general principles of circulation

Properties of Cardiac muscle

Cardiac cycle, heart sounds, Pulse

Cardiac output, factors and measurement

Heart rate

BP-factors, measurement, Short term regulation

Intermediate and long term regulation of BP

ECG uses and significance, .normal waveform, heart block

Coronary circulation, Cutaneous circulation-Triple response

Shock

Effects of exercise on CVS and Respiratory system

## **6. Renal system, Skin and body temperature**

Kidneys- functions, structure of nephron, type, juxtaglomerular apparatus-structure and function, non-excretory functions of kidney

Glomerular filtration rate (GFR)- Definition ,normal value, factors affecting GFR

Tubular reabsorption - sites, substance reabsorbed, mechanisms of reabsorption

Tubular secretion- sites, substance secreted, mechanisms of reabsorption

Counter current mechanism of concentration of urine

Obligatory and Facultative reabsorption of water

Micturition reflex, Diuretics

Artificial kidney, renal function tests-clearance tests

Skin -structure and function, body temperature measurement, physiological variation,

Regulation of body Temperature by physical chemical and nervous mechanisms-Role of Hypothalamus

Hypothermia and fever

## **7. Digestive system**

Physiological anatomy, Enteric nervous system & functions of GIT

Saliva- composition, regulation, disorder.

Deglutition- stages & disorders

Stomach-functions, composition and regulation of gastric juice

Gastric motility, MMC, vomiting reflex.

Pancreas- function, composition and regulation of pancreatic juice

Liver & gall bladder-functions, bile- composition, secretion and regulation

Small intestine- Succus entericus-composition, functions & movements

Large intestine- functions, movements and defecation reflex

Digestion & absorption of Carbohydrates, fats and proteins

## **8. Endocrine system**

Classification of Endocrine glands & their hormones & properties-chemistry and receptor, feedback mechanisms of hormone regulation.

Anterior pituitary hormones- secretion, functions , disorders

Posterior pituitary hormones- secretion , functions , disorders

Thyroid hormones- secretion, functions, disorders

Parathyroid hormones- secretion, functions, disorders

Calcium homeostasis & disorders

Pancreatic hormones, -Insulin and Glucagon- . secretion, functions, disorders

Adrenal cortex- Glucocorticoids & Mineralocorticoids, Androgen - secretion, functions, disorders

Adrenal medulla- secretion, functions, disorders Thymus & Pineal gland

## **9. Reproductive system**

Introduction to reproductive system, sex differentiation & Puberty

Male reproductive system, functions of testosterone & Spermatogenesis

Female reproductive system, functions of Estrogen, Progesterone,

Oogenesis Ovulation & Menstrual cycle

Physiological changes during pregnancy, pregnancy tests, parturition & lactation

Male & Female contraceptive methods

## **10. Central nervous system**

Introduction to CNS, Sensory receptors classification, properties

Synapse– classification, properties

Sensory pathways: Anterior spino thalamic tract and Posterior column pathway

Lateral spino thalamic tract, Types of pain, Referred pain, Thalamus; nuclei and function

Classification of reflexes, Monosynaptic reflex- Stretch reflex , muscle spindle ,inverse stretch reflex.

Polysynaptic reflex-Withdrawal reflex

Motor pathways : Pyramidal pathway and functions, UMNL, LMNL

Cerebral cortex (Sensory and motor)-functions, Medulla and Pons-functions

Cerebellum –functions, disorders

Basal ganglia-functions, disorders

Hypothalamus and Limbic system-functions

CSF, lumbar puncture

Sleep, EEG,

Autonomic Nervous System - Sympathetic and parasympathetic distribution and functions

## **11. Special senses**

**Vision –Functional anatomy of eye, visual pathway, lesion**

Refractive errors, color vision

Audition – Physiological anatomy of ear, Mechanism of hearing, auditory pathway, deafness

Olfaction –modalities, receptor, function, abnormalities

Gustation-modalities, receptor, function, taste pathway, abnormalities

## **Practicals**

**Blood pressure Recording**

**Auscultation for Heart Sounds**

**Artificial Respiration**

**Determination of vital capacity**

## **INTERNAL ASSESSMENT**

**Theory-average of 2 exams**                      **20**  
**conducted**

**Practicals: record and lab work\***                      **10**

**\*There shall be no university practical examination and internal assessment marks secured in  
Practicals need not be sent to the university.**



## **NO PRACTICAL EXAMINATION**

### **REFERENCE BOOKS:**

1. **Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism Publishers**
2. **Chatterjee (CC) Human Physiology Latest Ed. Vol. 1, Medical Allied Agency**
3. **Choudhari (Sujith K) Concise Medical Physiology Latest Ed. New Central Book**
4. **Ganong (William F) Review of Medical Physiology. Latest Ed. Appleton**

# BIOCHEMISTRY

No. Theory classes: 70hours

No. of practical classes: 20 hours

## 1. Carbohydrate Chemistry [3 hours]

- Classification (Definition/ examples for each class)
- Monosaccharides (classification depending upon number of carbon atoms and functional group with examples)
- Disaccharides (Sucrose/ lactose/ maltose and their composition)
- Polysaccharides :
  - a) Homopolysaccharides (Structure of starch and glycogen)
  - b) Heteropolysaccharides (Functions )

## 2. Lipid Chemistry [3 hours]

- Definition of lipids
- Functions of lipids in the body
- Classification of lipids (subclasses with examples)
- Definition and Classification of fatty acids
- Essential fatty acids
- Phospholipids and their importance

## 3. Amino- acid and Protein Chemistry [3 hours]

- General structure of D and L amino acids
- Amino acids; Definition and Classification of amino acids with examples.
- Peptides; definition & Biologically important peptides
- Classification of Proteins based on composition, functions and shape (with examples)
- Functions of amino acids and Proteins

## 4. Nucleotide and Nucleic acid Chemistry [ 3 hours]

- Nucleosides & Nucleotides
- Nucleic acid Definition & types
- Composition & functions of DNA & RNA

- Structure of DNA (Watson and Crick model)
- Structure of tRNA, & functions of tRNA, rRNA, mRNA
- Difference between DNA and RNA

#### 5. Enzymes [5 hours]

- Definition & Classification of Enzymes with example
- Definitions of Active site, Cofactor (Coenzyme, Activator),
- Proenzyme; Definition and examples (Pepsin & trypsin)

#### 6. Digestion and Absorption [ 3 Hours]

- General characteristics of digestion and absorption,
- Digestion and absorption of carbohydrates, proteins and lipids.

#### 7. Carbohydrate Metabolism [ 5 Hours]

- Glycolysis ; Aerobic, Anaerobic, Definition , Site and subcellular site , Steps with all the enzymes and coenzymes at each step , mention the regulatory enzymes , Energetics,
- Citric acid cycle; Pyruvate dehydrogenase complex (reaction and coenzymes) , Site and subcellular site , Reactions with all the enzymes and coenzymes ,Regulatory enzymes , Energetics
- Significance of HMP Shunt pathway.
- Hyperglycemic and hypoglycemic hormones
- Blood Glucose Regulation.
- Diabetes mellitus (definition, classification, signs and symptoms)
- **Glycogen metabolism and gluconeogenesis**

#### 8. Lipid Metabolism [ 4 Hours]

- Introduction to lipid metabolism, Lipolysis
- Beta oxidation of fatty acids ; Definition ,Site and subcellular site , Activation of palmitic acid , Transport of activated palmitic acid into mitochondria , Reactions , Energetics.
- Name the different ketone bodies . Note on ketosis

#### 9. Amino acid and Protein Metabolism [ 3 Hours]

- Introduction, transamination, deamination, Fate of ammonia, transport of ammonia,
- Urea cycle.

#### 10. Vitamins [5 Hours]

- Definition and classification .
- RDA, sources, coenzyme forms, biochemical functions and disorders for the following water soluble vitamins: Thiamine, Niacin, Pyridoxine, Cobalamine, Folic acid, Ascorbic acid
- RDA, sources, coenzyme forms, biochemical functions and deficiency disorders for the following fat soluble vitamins; A and vitamin D

#### 11. Mineral Metabolism [3 Hours]

- Name the macro/ microminerals
- Iron: Sources ,RDA, Functions and Disorders of deficiency and excess
- Calcium and phosphorus: Sources ,RDA, functions, normal serum levels and hormones reulating their levels

#### 12. Nutrition [6 hours]

- Balanced diet (Definition)
- Caloric value ; Definition , Caloric values of carbohydrates, proteins and fats
- Total daily caloric requirements of an adult male and female,
- RDA (Definition, standard values for nutrients)
- Basal metabolic rate(BMR) ; Definition , Magnitude of BMR in men and women, Factors affecting BMR
- Thermic effect/ SDA of food (Definition, values for major macronutrients)
- **Carbohydrates ;. Daily dietary requirement. 2. Dietary fibers (Definition, functions, importance and their daily requirements)**
- **Proteins ;. Daily requirement , Biological value. a. Definition b. Protein used as a standard for this, Protein sources with high and low biological value , Mutual supplementation of proteins (Definition, examples).**
- **Fats ; Daily requirement , Essential fatty acids (Definition, functions, daily requirement and deficiency manifestations) , Saturated and unsaturated fatty acids (Definition, sources, examples).**
- **Malnutrition**

#### 13. Renal Function Tests [ 2 hours]

- Name the different tests to access the kidney functions

- Explain Creatinine clearance & Inulin clearance

- Urinary acidification test

#### 14. Radioactive Isotopes [1 hour]

- Definition, clinical applications
- Biological effects of radiations

#### 15. Clinical Biochemistry [ 5 hours ]

##### A. Definitions of acid, base, pH and pKa [1 hour]

##### B. Buffers • Definition [2 hours]

- Henderson Hasselbalch equation,
- Principal buffer systems in the ECF ICF and urine
- Bicarbonate and phosphate buffer systems (pKa value, normal ratio of base/acid in the plasma)
- Acidosis & Alkalosis (Definition, classification, causes and biochemical findings)

##### C. Normal serum levels and condition where they are altered [2 hour]

- Glucose, Protein, urea, uric acid, and creatinine
- Bilirubin, cholesterol
- Serum Electrolytes

#### 16. Fundamental Chemistry (1 hour)

- Valency, Molecular weight & Equivalent weight of elements and compounds. Normality, Molarity, Molality.

#### 17. Solutions: Definition, use, classification where appropriate, preparation and storage (5 hours)

- Stock and working solutions.
- Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H<sub>2</sub>SO<sub>4</sub>, H<sub>3</sub>PO<sub>4</sub>, CH<sub>3</sub>COOH etc.,)
- Preparation of percent solutions – w/w, v/v w/v (solids, liquids and acids), Conversion of a percent solution into a molar solution
- Saturated and supersaturated solutions
- Standard solutions. Technique for preparation of standard solutions and Storage. E.g: glucose, albumin etc.
- Dilutions- Diluting Normal , Molar and percent solutions. Preparing working standard from stock standard.
- Part dilutions: Specimen dilutions. Serial dilutions. Reagent dilution. Dilution factors

## **ASSIGNMENT TOPICS**

- 1. Units of measurement**
2. Hazards - Physical, Chemical, Biological
3. Arterial blood gas analysis
4. Responsibilities of Health care personnel
5. Biomedical waste management

**Total theory hours = 70**

## **PRACTICAL DEMONSTRATION [20 hours]**

- Color Reactions of Carbohydrates & amino acids.
- Precipitation Reactions of proteins
- Colorimetry
- Estimation of Blood glucose Folin Wu and enzymatic method
- Estimation of Urea by DAM method

## **INTERNAL ASSESSMENT**

Theory-average of 2 exams conducted 20

Practicals: record and lab work\* 10

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

## **NO PRACTICAL EXAMINATION**

### **Text Book References**

- Biochemistry – 3<sup>rd</sup> revised edition by U Sathyanarayana & U Chakrapani
- Textbook of Medical Biochemistry-6<sup>th</sup> Edition by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology 2<sup>nd</sup> edition by Godkar and Godkar.
- Biochemistry- 3<sup>rd</sup> edition by Pankaja Naik
- Medical Laboratory technology 6<sup>th</sup> edition by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students- 3<sup>rd</sup> edition by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> editions

# **PATHOLOGY**

## **Clinical Pathology, Hematology and Blood**

**Banking Theory-70 hours**

**Practicals-20 hours**

### **I. Clinical Pathology- Theory**

- Introduction to clinical pathology
- Collection , transport, preservation and processing of various clinical specimens
- Urine examination- collection and preservation, Physical, chemical and microscopic examination for abnormal constituents
- Examination of Body fluids
- Examination of Cerebrospinal fluid (CSF)
- Sputum examination
- Examination of feces

### **II. Hematology – Theory**

- Introduction to hematology
- Normal constituents of Blood, their structure and functions
- Collection of Blood samples
- Various anticoagulants used in Hematology
- Hemoglobin estimation, different methods and normal values
- Packed cell volume
- Erythrocyte sedimentation rate
- Normal Haemostasis
- Bleeding time. Clotting time, prothrombin time, Activated partial Thromboplastin time

### **III. Blood Bank- Theory**

- Introduction blood banking
- Blood group system
- Collection and processing of blood for transfusion
- Compatibility testing
- Blood transfusion reactions

- **General Pathology:**

- **Cell injury:**

- a. Definition, causes.

- b. Cellular adaptations – Hypertrophy, hyperplasia, atrophy and metaplasia.

- c. Types of cell injury – Reversible and irreversible; morphology of reversible injury.
- d. Necrosis – Definition and patterns of tissue necrosis.
- e. Intracellular accumulations – Lipids, cholesterol, proteins, glycogen and pigments; examples.
- f. Pathologic calcification – Types and examples.

- **3) Inflammation:**

- a. Definition and signs of inflammation.
- b. Types – Acute and chronic inflammation.
- c. Acute inflammation – Causes, morphological patterns and outcome.
- d. Chronic inflammation – Causes, morphology and examples.
- e. Regeneration and repair – Mechanism of cutaneous wound healing.
- f. Factors affecting wound healing.

- **4) Hemodynamic disorders:**

- a. Edema – Definition, pathogenesis and types: Renal, cardiac, pulmonary and cerebral.
- b. Difference between transudate and exudate.
- c. Shock – Definition, types of shock with examples: Hypovolemic, cardiogenic and septic shock, stages of shock: Non progressive, progressive and irreversible.
- d. Thrombosis – Definition, mechanism of thrombus formation (Virchow's triad) and fate of thrombus.
- e. Embolism – Definition and types: Thromboembolism, fat, air and amniotic fluid embolism.
- f. Infarction – Definition and examples.

- **5) Immune system:**

- a. Autoimmune diseases – General features, enumerate systemic and organ specific autoimmune diseases.
- b. Systemic lupus erythematosus – Manifestations and diagnosis.



- **6) Neoplasia:**
  - a. Definition and nomenclature of tumors.
  - b. Differences between benign and malignant neoplasms.
  - c. Enumerate modes of carcinogenesis: Genes, physical, chemical and microbial agents of carcinogenesis.
  - d. Modes of spread of tumors.
  - e. Clinical aspects of neoplasia.
  - f. Grading and staging of cancers.
  - g. Laboratory diagnosis of cancer.

### **Practicals**

1. Urine analysis- Physical, Chemical, Microscopic
2. Blood grouping and Rh typing
3. Hb estimation , packed cell volume (PCV), Erythrocyte Sedimentation rate (ESR)
4. Bleeding time and Clotting time
5. Histopathology- section cutting and H & E Staining ( for BSc MLT only)

### **INTERNAL ASSESSMENT**

Theory-average of 2 exams conducted 20

Practicals: record and lab work\* 10

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

## NO PRACTICAL EXAMINATION

### REFERENCE BOOKS:

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss- Cytology
4. Winifred Diagnostic cytopathology
5. Oral Cytopathology
6. Todd and Sanford- clinical diagnosis by Laboratory Medicine
7. Dacie and Lewis- Practical Hematology
8. Ramnik SOOD. Lab technology, Methods and interpretation, 4 th edition JP Bros New Delhi, 1996
9. Sathish Guptha , Short text book of Medical laboratory techniques for technicians
10. Sachdev K N. Clinical Pathology and Bacteriology, 8 th edi JP Bros, New Delhi, 1996

# MICROBIOLOGY

Theory: 70 Hours

Practicals: 20 Hours

## 1. Introduction (6 hrs)

History of Microbiology - Louis Pasteur, Antony Van Leeuwenhoek, Robert Koch, Edward Jenner, Alexander Fleming.

Use of microscope in the study of bacteria - Types of microscopes - compound microscope, phase contrast microscope, electron microscope, fluorescent microscope, dark ground microscope.

Morphology of bacterial cell

## 2. Growth and Nutrition (6 hrs.)

Nutrition, growth and multiplication of bacteria, bacterial growth curve, culture media, culture methods, anaerobic culture methods.

## 3. Sterilization and disinfection (8 hrs.)

Principles and use of equipments of sterilization, chemicals used in disinfection, testing of disinfectants.

## 4. Biomedical waste management principle and practice

## 5. Immunology ( 5hrs.)

Immunity - mechanism of immunity, classification, types

Vaccines

Immunization schedule

Definition of antigen, antibody, list of antigen antibody reaction (no need of detailed account of antigen antibody reactions)

Definition of hypersensitivity and classification (no need of detailed account of types of hypersensitivity)

## 6. Infection (5 hrs.)

Definition, types and mode of transmission

Hospital acquired infection - causative agents, mode of transmission and prophylaxis.

Antimicrobial sensitivity testing

## 7. Systematic bacteriology (15 hrs.)

Disease caused and laboratory diagnosis of medically important bacteria (Staphylococcus, coagulase negative Staphylococcus, MRSA, Streptococcus pyogenes, Pneumococcus, gonococcus, E.coli, diarrhoeagenic E.coli, Salmonella, Vibrio cholerae, ElTor vibrios, Halophilic vibrios, Shigella, Mycobacterium tuberculosis, Mycobacterium leprae, Atypical Mycobacteria, Treponema pallidum, leptospira)

(no need of classification, antigenic structure, virulence mechanism)

## 8. Parasitology (10 hrs.)

Introduction to Parasitology

List of medically important parasites and diseases (E.histolytica, Plasmodium, W.bancrofti, Ascaris, Ancylostoma, B.coli, G.lambliia, T.solium, T.saginata)

Laboratory diagnosis of parasitic infection (No need of including life cycles)

### **9. Virology (10 hrs.)**

Introduction to virology

List of medically important viruses and diseases (AIDS, Hepatitis, Rabies, Polio, Arbo viruses)

Cultivation of viruses and laboratory diagnosis of viral infections

### **10. Mycology (5 hrs.)**

Introduction to Mycology

Classification of medically important fungi - (based on morphology, spore production, disease production, taxonomy)

List of medically important fungi and diseases (Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis, Mucor Mycosis)

Laboratory diagnosis of fungal infections.

### **Practicals (20 hrs.)**

Compound microscope (Demonstration)

Demonstration of sterilization equipments

Demonstration of culture media and culture methods

Demonstration of antibiotic sensitivity testing

Demonstration of serological tests - Widal, VDRL, ASO, CRP, RA

Demonstration of gram stain and ZN staining

Demonstration of Helminthic ova

Grams stain, Acid fast staining

Stool exam for Helminthic ova

There shall be no university practical examination and Internal Assessment marks secured in practicals need not be sent to the university.

### **INTERNAL ASSESSMENT**

|                                     |    |
|-------------------------------------|----|
| Theory-average of 2 exams conducted | 20 |
|-------------------------------------|----|

|                                  |    |
|----------------------------------|----|
| Practicals: record and lab work* | 10 |
|----------------------------------|----|

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

## NO PRACTICAL EXAMINATION

### Reference Books-

1. Ananthanarayana & Panikar Medical Microbiology- University Press
2. Robert Cruickshank- Medical Microbiology- The Practice of Medical Microbiology
3. Chatterjee- Parasitology- Interpretation to Clinical Medicine
4. Rippon- Medical Mycology
5. Emmons- Medical Mycology
6. Basic Laboratory methods in Parasitology, J P Bros, New Delhi
7. Basic Laboratory procedures in clinical bacteriology, J P Bros, New Delhi
8. Medical Parasitology- Ajit Damle
9. Introduction to medical microbiology- Ananthanarayana- Orient Longman Pvt. Ltd

# **SUBSIDIARY SUBJECTS**

## **ENGLISH**

### **COURSE OUTLINE**

**COURSE DESCRIPTION:** This course is designed to help the student acquire a good command and comprehension of the English language through individual papers and conferences.

### **BEHAVIOURAL OBJECTIVES:**

The student at the end of training is able to

1. Read and comprehend English language
2. Speak and write grammatically correct English
3. Appreciates the value of English literature in personal and professional life.

### **UNIT - I: INTRODUCTION:**

Study Techniques

Organisation of effective note taking and logical processes of analysis and synthesis

Use of the dictionary

Enlargement of vocabulary

Effective diction

### **UNIT - II: APPLIED GRAMMAR:**

Correct usage

The structure of sentences

The structure of paragraphs

Enlargements of Vocabulary

### **UNIT - III: WRITTEN COMPOSITION:**

Precise writing and summarizing

Writing of bibliography

Enlargement of Vocabulary

### **UNIT - IV: READING AND COMPREHENSION:**

Review of selected materials and express oneself in one's words.

Enlargement of Vocabulary.

### **UNIT - V: THE STUDY OF THE VARIOUS FORMS OF COMPOSITION:**

Paragraph, Essay, Letter, Summary, Practice in writing

### **UNIT - VI: VERBAL COMMUNICATION:**

Discussions and summarization, Debates, Oral reports, use in teaching

### **REFERENCE**

1. English Grammar Collins, Birmingham University, International Language Data Base, Rupa & Co. 1993
2. Wren and Martin - Grammar and Composition, 1989, Chanda & Co, Delhi
3. Letters for all Occasions. A S Myers. Pub - Harper Perennial
4. Spoken English V. Shasikumar and P V Dhanija. Pub. By: Tata Mcgraw Hill, New Delhi
5. Journalism Made Simple D Wainwright
6. Writers Basic Bookself Series, Writers Digest series
7. Interviewing by Joan Clayton Platkon
8. Penguin Book of Interviews.

## HEALTH CARE

Teaching Hours : 40

### **Introduction to Health**

Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept.

National Health Policy

National Health Programmes ( Briefly Objectives and scope)

Population of India and Family welfare programme in India

Introduction to Nursing

What is Nursing ? Nursing principles. Inter-Personnel relationships. Bandaging : Basic turns; Bandaging extremities; Triangular Bandages and their application.

Nursing Position, Bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's positions, comfort measures, Aids and rest and sleep.

Lifting And Transporting Patients: Lifting patients up in the bed. Transferring from bed to wheel chair. Transferring from bed to stretcher.

Bed Side Management: Giving and taking Bed pan, Urinal : Observation of stools, urine.

Observation of sputum, Understand use and care of catheters, enema giving.

Methods of Giving Nourishment: Feeding, Tube feeding, drips, transfusion

Care of Rubber Goods

Recording of body temperature, respiration and pulse,

Simple aseptic technique, sterilization and disinfection.

Surgical Dressing: Observation of dressing procedures

### **First Aid :**

Syllabus as for Certificate Course of Red Cross Society of St. John's Ambulance Brigade.

### **Reference Books:**

**Preventive and Social Medicine** by J.Park

Text Book of P & SM by Park and Park

Counseling & Communicate skills for medical and health, Bayne- Orient Longman Pvt. Ltd.

No Practical or Viva voce examination

This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%



## **SECOND YEAR B.SC PERFUSION TECHNOLOGY**

### **APPLIED PHARMACOLOGY**

- General concepts about pharmacodynamic and Pharmacokinetic Principles involved in drug activity.

#### **I. Autonomic nerves system.**

- Anatomy & functional organisation.
  - List of drugs acting on ANS including dose, route of administration, indications, contra indications and adverse effects.
- #### **II. Cardiovascular drugs- Enumerate the mode of action, side effects And therapeutic uses of the following drugs.**

##### **a. Antihypertensives**

- Beta Adrenergic antagonists
- Alpha Adrenergic antagonists
- Peripheral Vasodilators
- Calcium channel blockers

##### **b. Antiarrhythmic drugs**

##### **c. Cardiac glycosides**

##### **d. Sympathetic and non sympathetic inotropic agents.**

##### **e. Coronary vasodilators.**

##### **f. Antianginal and anti failure agents**

##### **g. Lipid lowering & anti atherosclerotic drugs.**

##### **h. Drugs used in Haemostasis – anticoagulants Thrombolytics and antithrombolytics.**

##### **i. Cardioplegic drugs- History, Principles and types of cardioplegia.**

##### **j. Primary solutions – History, principles & types.**

##### **k. Drugs used in the treatment of shock.**

#### **III. Anaesthetic agents.**

- Definition of general and local anaesthetics.
- Classification of general anaesthetics.
- Pharmacokinetics and Pharmacodynamics of inhaled anaesthetic agents.
- Intravenous general anaesthetic agents.
- Local anaesthetics – classification mechanism of action, duration of action and methods to prolong the duration of action. Preparation, dose and routes of administration.

#### IV Analgesics

- Definition and classification
- Routes of administration, dose, frequency of administration, Side effects and management of non opioid and opioid analgesics

#### V. Antihistamines and antiemetics-

- Classification, Mechanism of action, adverse effects, Preparations, dose and routes and administration.

#### VI. CNS stimulants and depressants

- Alcohol
- Sedatives, hypnotics and narcotics
- CNS stimulants
- Neuromuscular blocking agents and muscle relaxants.

#### VII. Pharmacological protection of organs during CPB

#### VIII. Inhalational gases and emergency drugs.

#### IX. Pharmacotherapy of respiratory disorders

- Introduction – Modulators of bronchial smooth muscle tone and pulmonary vascular smooth muscle tone
- Pharmacotherapy of bronchial asthma
- Pharmacotherapy of cough
- Mucokinetic and mucolytic agents
- Use of bland aerosols in respiratory care.
- 

#### X. Corticosteroids – Classification, mechanism of action, adverse effects and complications. Preparation, dose and routes of administration.

#### XI Diuretics

- Renal physiology
- Side of action of diuretics
- Adverse effects
- Preparations, dose and routes of administration.

#### XII. Chemotherapy of infections

- Definition
- Classification and mechanism of action of antimicrobial agents
- Combination of antimicrobial agents
- Chemoprophylaxis.
- Classification, spectrum of activity, dose, routes of administration and adverse effects of penicillin, cephalosporins, aminoglycosides, tetracyclines, chloramphenicol, antitubercular drugs.

#### XIII. Miscellaneous.

- IV fluids- various preparations and their usage.
- Electrolyte supplements
- Immunosuppressive agents
- New drugs included in perfusion technology.
- Drugs used in metabolic and electrolyte imbalance.

## NO PRACTICAL EXAMINATION

### APPLIED PATHOLOGY

#### I. CARDIOVASCULAR SYSTEM

- Atherosclerosis- Definition, risk factors, briefly Pathogenesis & morphology, clinical significance and prevention.
- Hypertension- Definition, types and briefly Pathogenesis and effects of Hypertension.
- Aneurysms – Definition, classification, Pathology and complications.
- Pathophysiology of Heart failure.
- Cardiac hypertrophy – causes, Pathophysiology & Progression to Heart Failure.
- Ischemic heart diseases- Definition, Types. Briefly Pathophysiology, Pathology & Complications of various types of IHD.
- Valvular Heart diseases- causes, Pathology & complication. Complications of artificial valves.
- Cardiomyopathy – Definition, Types, causes and significance.
- Pericardial effusion- causes, effects and diagnosis.
- Congenital heart diseases – Basic defect and effects of important types of congenital heart diseases.

#### II. HAEMATOLOGY

- Anaemia – Definition, morphological types and diagnosis of anaemia. Brief concept about Haemolytic anaemia and polycythaemia.
  - Leukocyte disorders- Briefly leukaemia, leukocytosis, agranulocytosis etc.,
  - Bleeding disorders- Definition, classification, causes & effects of important types of bleeding disorders. Briefly various laboratory tests used to diagnose bleeding disorders.

### III. RESPIRATORY SYSTEM

- Chronic obstructive airway diseases – Definition and types. Briefly causes, Pathology and complications of each type of COPD.
- Briefly concept about obstructive versus restrictive pulmonary disease.
- Pneumoconiosis- Definition, types, Pathology and effects in brief.
- Pulmonary congestion and edema.
- Pleural effusion – causes, effects and diagnosis.

### IV. RENAL SYSTEM

- Clinical manifestations of renal diseases. Briefly causes, mechanism, effects and laboratory diagnosis of ARF & CRS. Briefly Glomerulonephritis and Pyelonephritis.
- End stage renal disease – Definition, causes, effects and role of dialysis and renal transplantation in its management.
- Brief concept about obstructive uropathy.

NO PRACTICAL EXAMINATION

## **APPLIED MICROBIOLOGY**

### **THEORY- 40 HOURS**

1. Health care associated infections and Antimicrobial resistance: Infections that patients acquire during the course of receiving treatment for other conditions within a healthcare setting like Methicillin Resistant Staphylococcus aureus infections, Infections caused by Clostridium difficile, Vancomycin resistant enterococci etc. Catheter related blood stream infections, Ventilator associated pneumonia, Catheter Related urinary tract infections, Surveillance of emerging resistance and changing flora. The impact and cost attributed to Hospital Associated infection.

6 Hours

2. Disease communicable to Healthcare workers in hospital set up and its preventive measure: Occupationally acquired infections in healthcare professionals by respiratory route ( tuberculosis, varicella-zoster, respiratory syncytial virus etc ), blood borne transmission ( HIV, Hepatitis B, Hepatitis C, Cytomegalovirus, Ebola virus etc), oro faecal route ( Salmonella, Hepatitis A etc), direct contact ( Herpes Simplex Virus etc). Preventive measures to combat the spread of these infections by monitoring and Control

3. Microbiological surveillance and sampling: Required to determine the frequency of potential bacterial pathogens including Streptococcus pneumoniae, Haemophilus influenzae, and Moraxella catarrhalis and also to assess the antimicrobial resistance. Sampling: rinse technique, direct surface agar plating technique.

4. Importance of sterilization:

a. Disinfection of instruments used in patient care: Classification, different methods, advantages and disadvantages of the various methods.

b. Disinfection of the patient care unit

c. Infection control measures for ICU's

5. Sterilization:

a. Rooms: Gaseous sterilization, one atmosphere uniform glow discharge plasma (OAUGDP).

b. Equipments: classification of the instruments and appropriate methods of sterilization.

c. Central supply department: the four areas and the floor plan for instrument cleaning, high-level disinfecting and sterilizing areas.

6. Preparation of materials for autoclaving: Packing of different types of materials, loading, holding time and unloading.

### **PRACTICALS- 30 HOURS**

1. Principles of autoclaving & quality control of Sterilization.

2. Collection of specimen from outpatient units, inpatient units, minor operation theater and major operation theater for sterility testing.

3. The various methods employed for sterility testing.

4. Interpretation of results of sterility testing.

5. Disinfection of wards, OT and Laboratory.

## **MEDICINE RELEVANT TO PERFUSION TECHNOLOGY**

Cardiovascular System

Ischaemic heart diseases

Rheumatic heart disease

Congenital heart disease

Hypertension

Aortic Aneurysms

Cardiomyopathy Peripheral

vascular disease

Pulmonary edema and LV failure

Hematology

Anaemia

Bleeding disorders

Laboratory tests used to diagnose bleeding disorders (in brief)

Respiratory System

Chronic obstructive airway diseases (COPD)

Concept of obstructive versus restrictive pulmonary disease PFT and its interpretation

Renal System

ARF & CRF

End stage renal disease

Role of dialysis and renal transplantation in its management CNS

Automatic nervous system

(Sympathetic & Parasympathetic system)

Brief mention of CNS disorders & their etiology Others

DM

Obesity

Pregnancy

Paediatric Patient (neonate/Infant)

Elderly patient

### **Scheme of examination theory**

There shall be one theory paper of three hours duration carrying 100 marks. Distribution of type of questions and marks for MEDICINE RELEVANT TO PERFUSION TECHNOLOGY

| SUBJECTS HAVING MAXIMUM MARKS= 100 |                  |                          |
|------------------------------------|------------------|--------------------------|
| Type of Questions                  | No. of Questions | Marks for Each Questions |
| Long Essay                         | 2                | 10                       |
| Short Essay                        | 10               | 05                       |
| Short Answer                       | 10               | 03                       |

- |                                                           |                   |
|-----------------------------------------------------------|-------------------|
| 1. Long essay- 2 Questions (second question choice)       | 2x10= 20 marks    |
| 2. Short essay- 10 Questions (Questions no 5 & 10 choice) | 10x5= 50 marks    |
| 3. Short answer- 10 Questions (No choice)                 | 10x3= 30 marks    |
|                                                           | <b>Total= 100</b> |

## **INTRODUCTION TO PERFUSION TECHNOLOGY**

Basics of diagnostic techniques:

Chest of X-ray

ECG

Echo

Angiography

Nuclear Cardiology

Laboratory investigations in relation to perfusion technology

Cardiopulmonary bypass and perfusion technology

History of Cardiac surgery and perfusion

- Specific reference of Gibbon Lillehei, Carrel
- Pre CPB surgery
- Azygous Flow principle.
- Hypothermic/nonhypothermic non-CPB surgery including Gross's Well technique and controlled cross circulation.

Monitoring and instrumentation

- Concepts of monitoring – instrumentation technology of ECG machine,
- pressure transducer, syringe and peristaltic pumps, monitors, ventilators, pulse oximeters, temperature probes and

thermo regulatory monitoring, defibrillators and fibrillators. Piped and non-piped gas delivery systems and connections. Basic physics related to medically used gases.

- Haemodynamic monitoring
- Haemostatic monitoring
- Haematologic monitoring

- Maintenance of oxygen, carbon dioxide and acid-base status and their monitoring
- Neurological monitoring (SSPE, EEG and cerebral function monitor)
- Aseptic technique.
- Cardiac surgery team, profession and terminology, scope of perfusion technology

#### Physiology of Extracorporeal circulation Heart

– Lung machine

- Principles of extracorporeal circulation
- Materials used in EC circuit
- Principles of extracorporeal gas exchange

#### Various types of oxygenators

- Bubble oxygenators
- Rotating spiral/cylinder/disc oxygenators
- Membrane oxygenators

• Mechanism of action components defoaming, rated flow. Theory of blood pumps

• Ideal blood pump, pulsatile versus non-pulsatile flow, occlusive and non-occlusive pumps, various types of pumps roller, bellow, sigmoid motor, diaphragm, ventricular and centrifugal pumps.

Element of extracorporeal circulation/hazards of:

- a. blood failure
- b. Bubble trap
- c. Flow meters
- d. Temperatures
- e. Heat exchanger
- f. Regulating devices

Connection of the vascular system with extracorporeal circulation:

- Arterial and venous cannulae.
- Connecting tubes and connectors
- Vents
- Suckers
- Cardioplegia delivery system
- Venous drainage.

Haemodynamic of arterial return, venous drainage, cardioplegia Delivery and venting.

Blood banking, handling of blood products and their management. Blood components and their use.



PRACTICAL EXAMINATION 40 MARKS

## SUBSIDIARY SUBJECTS

### SOCIOLOGY

**Teaching Hours : 20**

**Course Description**

This course will introduce student to the basic sociology concepts, principles and social process, social institutions [in relation to the individual, family and community and the various social factors affecting the family in rural and urban communities in India will be studied.

Introduction :

**Meaning** – Definition and scope of sociology

Its relation to Anthropology, Psychology, Social Psychology

**Methods of Sociological investigations** – Case study, social survey, questionnaire, interview and opinion poll methods.

Importance of its study with special reference to health care professionals

Social Factors in Health and Disease:

Meaning of social factors

Role of social factors in health and disease

**Socialization:**

Meaning and nature of socialization

Primary, Secondary and Anticipatory socialization

Agencies of socialization

**Social Groups:**

1. Concepts of social groups, influence of formal and informal groups on health and sickness.
2. The role of primary groups and secondary groups in the hospital and rehabilitation setup.

**Family :**

The family, meaning and definitions

Functions of types of family

Changing family patterns

Influence of family on individual's health, family and nutrition, the effects of sickness in the family and psychosomatic disease and their importance to physiotherapy

**Community :**

Rural community: Meaning and features – Health hazards to rural communities, health hazards to tribal community.

Urban community – Meaning and features – Health hazards of urbanities

**Culture and Health :**

Concept of Health

Concept of culture

Culture and Health

Culture and Health Disorders

**Social Change :**

Meaning of social changes

Factors of social changes

Human adaptation and social change

Social change and stress

Social change and deviance

Social change and health programme

The role of social planning in the improvement of health and rehabilitation

Social Problems of disabled :

Consequences of the following social problems in relation to sickness and disability remedies to prevent these problems

Population explosion

Poverty and unemployment Beggary

Juvenile delinquency

Prostitution

Alcoholism

Problems of women in employment

**Social Security :**

Social Security and social legislation in relation to the disabled

**Social Work :**

Meaning of Social Work

The role of a Medical Social Worker

**INDIAN CONSTITUTION**

Prescribed for the First Year students of all degree classes

Unit-I: Meaning of the term 'Constitution' making of the Indian Constitution 1946-1949.

Unit-II: The democratic institutions created by the constitution Bicameral system of Legislature at the Centre and in the States.

Unit-III: Fundamental Rights and Duties their content and significance.

Unit – IV: Directive Principles of States Policies the need to balance Fundamental Rights with Directive Principles.

Unit – V: Special Rights created in the Constitution for: Dalits, Backwards, Women and Children and the Religious and Linguistic Minorities.

Unit-VI: Doctrine of Separation of Powers legislative, Executive and Judicial and their functioning in India.

Unit – VII: The Election Commission and State Public Service commissions.

Unit – VIII: Method of amending the Constitution.

Unit – IX: Enforcing rights through Writs:

Unit – X: Constitution and Sustainable Development in India.

Books: 1. J.C. Johari: The Constitution of India- A Politico-Legal Study-Sterling Publication, Pvt. Ltd. New Delhi.

2. J.N . Pandey: Constitution Law of India, Allahbad, Central Law Agency, 1998.
3. Granville Austin: The Indian Constitution – Corner Stone of a Nation-Oxford, New Delhi, 2000.

## **ENVIRONMENT SCIENCE AND HEALTH**

### **Introduction to Environment and Health**

Sources, health hazards and control of environmental pollution Water

The concept of safe and wholesome water.

The requirements of sanitary sources of water.

Understanding the methods of purification of water on small scale and large scale.

Various biological standards, including WHO guidelines for third world countries.

Concept and methods for assessing quality of water.

Domestic refuse, sullage, human excreta and sewage their effects on environment and health, methods and issues related to their disposal.

Awareness of standards of housing and the effect of poor housing on health.

Role of arthropods in the causation of diseases, mode of transmission of arthropods borne diseases, methods of control

### **Recommended Books.**

1. Text Book of Environmental Studies for under graduate courses By Erach Bharucha Reprinted in 2006, Orient Longman Private Limited /Universities Press India Pvt. Ltd.

## **THIRD YEAR B.SC PERFUSION TECHNOLOGY**

### **Paper-I Perfusion Technology Clinical**

1. Pharmacokinetics and Pharmacodynamics of Cardiopulmonary bypass
2. Drugs (including anesthetic drugs) used in cardiopulmonary bypass
3. Conduct and monitoring of Cardiopulmonary bypass
4. Adequacy of perfusion – General considerations, specific aspects of perfusion, monitoring, other concomitants which may affect its adequacy
5. Pulsatile perfusion – Introduction, theory & physiology of pulsatile flow, hemodynamic, metabolic effects, Clinical use, hematological effects
6. Cannulation techniques during cardiopulmonary bypass
7. Termination of cardiopulmonary bypass – principles and methodology
8. Myocardial protection and cardioplegia- pretreatment of the Myocardium, cardioplegia, hypothermia, controlled reperfusion, myocardial protection for specific clinical problems, Complications of cardioplegia. Non cardioplegic methods during cardiac surgery on cardiopulmonary bypass
9. Oxygenation – general consideration, bubble & membrane (including assessment and comparison of oxygenator function)
10. Heat exchangers-principles function of heat exchangers & their assessment. Complications related to heat exchange and their management
11. Priming fluids and hemodilution

### **PRACTICAL EXAMINATION**

One common practical for all the three papers with equal weightage of marks i.e. 40 marks for each paper

## **PAPER-II PERFUSION TECHNOLOGY - APPLIED**

1. Blood cell trauma – analysis of forces of fluid motion, effects of physical forces on blood cell, clinical effect. Complications of blood transfusion.
2. Anticoagulation on bypass, its monitoring, its reversal and complications. Heparinless bypass. Platelet aggregation and platelet dysfunction. Coagulopathies due to cardiopulmonary bypass and its management.
3. Inflammatory response to cardiopulmonary bypass & its clinical effects. Methods to minimise the same. Immune response, neuroendocrine, renal, metabolic splanchnic response, pulmonary response and electrolyte response to cardiopulmonary bypass
4. Blood conservation hemofiltration & dialysis during cardiopulmonary bypass including modified ultra filtration reverse autologous priming and other methods
5. Micro emboli- gaseous and particulate, filters used in cardiopulmonary bypass circuit.
6. Micro pore filtration during cardiopulmonary bypass
7. Counter pulsation techniques and assist devices

### **PRACTICAL EXAMINATION**

One common practical for all the three papers with equal weightage of marks i.e. 40 marks for each paper

### **PAPER-III PERFUSION TECHNOLOGY - ADVANCED**

1. Perfusion techniques for Paediatric cardiac surgery
2. ECMO- special perfusion techniques for special cardiac surgeries and medical conditions (including thoracic aortic surgeries deep hypothermia and circulatory arrest). Perfusion for non cardiac surgery, invasive cardiology and outside the operation suite.
3. Perfusion as a method of cardiopulmonary bypass
4. Complications and safety during cardiopulmonary bypass – bypass safety, organizational aspects, accidents, coagulopathies, mechanical and electrical failures, perfusion management, perfusion systems, safety for the perfusionist and surgical team management of perfusion accidents.
5. Minimally invasive surgery and the perfusionist
6. Recent advances in perfusion techniques
7. Experimental perfusion

#### **PRACTICAL EXAMINATION**

One common practical for all the three papers with equal weightage of marks i.e. 40 marks for each Paper

# **SUBSIDIARY SUBJECTS**

## **BIO STATISTICS**

Time Allotted: 20 Hours

Course Description:

Introduction to basic statistical concepts: methods of statistical analysis; and interpretation of data

Behavioural Objectives:

Understands statistical terms.

Possesses knowledge and skill in the use of basic statistical and research methodology.

Unit – I : Introduction

Meaning, definition, characteristics of statistics.

Importance of the study of statistics.

Branches of statistics.

Statistics and health science including nursing.

Parameters and estimates.

Descriptive and inferential statistics. Variables and their types.

Measurement scales

Unit – II : Tabulation of Data

Raw data, the array, frequency distribution.

Basic principles of graphical representation.

Types of diagrams - histograms, frequency polygons, smooth frequency polygon, commulative frequency curve, ogive.

Normal probability curve.

Unit - III : Measure of Central Tendency

Need for measures of central tendency

Definition and calculation of mean - ungrouped and grouped

Meaning, interpretation and calculation of median ungrouped and grouped.

Meaning and calculation of mode.

Comparison of the mean, and mode.

Guidelines for the use of various measures of central tendency.

Unit - IV : Measure of Variability

Need for measure of dispersion.

The range, the average deviation.

The variance and standard deviation.

Calculation of variance and standard deviation ungrouped and grouped.

Properties and uses of variance and SO



Unit -V : Probability and Standard Distributions.

Meaning of probability of standard distribution.

The Binominal distribution.

The normal distribution.

Divergence from normality - skewness, kurtosis.

Samling Technique , sampling - Criteria for good samples. Application of sampling in Community.

Procedures of sampling and sampling designs errors.

Sampling variation and tests of significance.

Unit - VII : Health Indicator

Importance of health Indicator.

Indicators of population, morbidity, mortality, health services.

Calculation of rates and rations of health.

Recommended Books.

B.K. Mahajan & M. Gupta (1995) Text Book of Preventive & Social Medicine, 2002, 17th Edition  
Jaypee Broth

## **BASICS IN COMPUTER APPLICATIONS**

The course enables the students to understand the fundamentals of computer and its applications.

### **Introduction to Data processing :**

Features of computers, Advantages of using computers. Getting data into / out of computers. Role of computers. What is Data processing? Application areas of computers involved in Data processing. Common activities in processing. Types of Data processing, Characteristics of information. What are Hardware and Software?

### **Hardware Concepts :**

Architecture of computers, Classification of computers, Concept of damage. Types of storage devices. Characteristics of disks, tapes, Terminals, Printers, Network. Applications of networking concept of PC System care, Floppy care, Data care.

Concept of Software.

Classification of software : System software. Application of software. Operating system. Computer system. Computer virus. Precautions against viruses. Dealing with viruses. Computers in medical electronics

Basic Anatomy of Computers

Principles of programming

Computer application - principles in scientific research ; work processing, medicine, libraries, museum , education, information system.

Data processing

Computers in physical therapy - principles in EMG, Exercise testing equipment, Laser.

**REGULATIONS & CURRICULUM OF  
GRADUATE PARAMEDICAL COURSE  
  
BACHELOR OF SCIENCE IN  
  
NEURO SCIENCE TECHNOLOGY  
  
2020**



**Sri Siddhartha  
Academy of Higher Education  
Deemed-to-be-University**

**Established under Section 3 of the UGC Act, 1956  
MHRD, GOI No. F.9-31/2006-U.3 (A) Dtd. 30th May 2008**

**Agalakote, B.H. Road, Tumkur – 572107, Karnataka, India**

# SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

(DEEMED TO BE UNIVERSITY)

Declared under Section 3 of the UGC Act, 1956, MHRD GOI No. F.9-31/2006-U.3 (A) Dated: 30/05/2008

Accredited 'A' Grade by NAAC

Agalakote, B.H.Road, Tumkur – 572 107. KARNATAKA, INDIA.

Ph. 0816- 2275516, Fax : 0816-2275510 website: sahetumkur.ac.in email: info@sahe.in



No. SSAHE/ACA-S&C(AHSP)/15/2022

Date: 01/09/2022

## NOTIFICATION

Sub: Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Neuro Science Technology.

- Ref: 1). Proceedings of BOS Allied Health Sciences Programmes held on 06/04/2021  
2). Proceedings of the Academic Council meeting held on 19/08/2021  
3). Proceedings of the Board of Management held on 29/08/2022

In exercise of the powers vested under section 6 of 6.4 of MoA / Rules of SSAHE, the Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Neuro Science Technology is notified herewith as per Annexure.

The above Regulations shall be applicable to the students admitted to the said course from the academic year 2020-21 onwards.

By Order,

REGISTRAR  
REGISTRAR

Sri Siddhartha Academy of Higher Education  
TUMKUR - 572 107, Karnataka.

To,  
Dean / Principal, Sri Siddhartha Medical College & Hospital,

Copy to

- 1) Office of the Chancellor, SSAHE, for kind information,
- 2) PA to Vice-Chancellor / PA to Registrar / Controller of Examinations / Finance Officer, SSAHE
- 3) The Director (AHSP), SSAHE
- 4) All Officers of the Academy Examination Branch / Academic Section
- 5) Guard File / Office copy.

**ORDINANCE GOVERNING  
REGULATIONS & CURRICULUM OF B.Sc. NEURO  
SCIENCE TECHNOLOGY - 2020**

**1. Eligibility for admission:**

A candidate seeking admission to the BSc. Neuro Science Technology shall have studied English as one of the principal subject during the tenure of the course and shall have passed:

1. Two year Pre-University examination or equivalent as recognized by Sri Siddhartha Academy of Higher Education with, Physics, Chemistry and Biology as subjects of study.

OR

2. Pre-Degree course from a recognized University considered as equivalent by SSAHE, (Two years after ten years of schooling) with Physics, Chemistry and Biology as subjects of study.

OR

3. Any equivalent examination recognized by the Sri Siddhartha Academy of Higher Education, Tumkur for the above purpose with Physics, Chemistry and Biology as subjects of study.

OR

4. The vocational higher secondary education course conducted by Vocational Higher Secondary Education, Government of Kerala with five subjects including Physics, Chemistry, Biology and English in addition to vocational subjects conducted is considered equivalent to plus TWO examinations of Government of Karnataka Pre University Course.

OR

5. Candidates with two years diploma from a recognized Government Board in Neuro ScienceTechnology shall have passed class 12 [10+2] with Physics, Chemistry and Biology, as subjects or candidates with 3 years diploma from a recognized Government Board in Neuro ScienceTechnology should have studied Physics, Biology and Chemistry as subjects during the tenure of the course.

6. Lateral entry to second year of B.Sc.Neuro ScienceTechnology for candidates who have passed diploma program from the Government Boards and recognized by SSAHE, fulfilling the conditions specified above under Sl. No. 5 and these students are eligible to take admission on lateral entry system only in the same subject studied at diploma level for the academic year.

**Note:**

- a. The candidate shall have passed individually in each of the subjects.
- b. Candidates who have completed diploma or vocational course through Correspondence shall not be eligible for any of the courses mentioned above.

**2. Duration of the course:**

Duration shall be for a period of four years including one year of Internship.

**3. Medium of instruction:**

The medium of instruction and examination shall be in English.

**4. Scheme of examination:**

There shall be three theory examinations one each at the end of 1 st, 2nd and 3rd year.

## **5. Attendance**

Every candidate should have attended at least 80% of the total number of classes conducted in an academic year from the date of commencement of the term to the last working day as notified by university in each of the subjects prescribed for that year separately in theory and practical. Only such candidates are eligible to appear for the university examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A candidate lacking in prescribed percentage of attendance in any subjects either in theory or practical in the first appearance will not be eligible to appear for the University Examination in that subject

## **6. Internal Assessment (IA):**

### 1st Year B.Sc. NEUROSCIENCE TECHNOLOGY

Theory - 20 marks

Practicals - 10 marks\*. [Lab work- 06 marks and Record-04 marks]

### 2nd & 3rd year B.Sc. NEUROSCIENCE TECHNOLOGY

Theory – 20 Marks

Practicals – 20 Marks

There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an academic year. The average marks of the two tests will be calculated and reduced to 20. The marks of IA shall be communicated to the University at least 15 days before the commencement of the University examination. The University shall have access to the records of such periodical tests. The marks of the internal assessment must be displayed on the notice board of the respective colleges within a fortnight from the date test is held. If a candidate is absent for any one of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

\* There shall be no University Practical Examination in First year.

## 7. Subject and hours of teaching for Theory and Practicals

The number of hours of teaching theory and practical, subject wise in first year, second year and third year are shown in Table-I, Table-II and Table-III

Main and Subsidiary subjects are common in first year for all the courses in Allied Health Science.

The number of hours for teaching theory and practical for main subjects in first, Second and Third year are shown in Table-I, II and III.

**Table - I Distribution of Teaching Hours in First Year Subjects**

### Main subjects

| Sl. no | Subject                                                       | Theory No. of Hours | Practical No. of Hours | Total No. of Hours |
|--------|---------------------------------------------------------------|---------------------|------------------------|--------------------|
| 1      | Human Anatomy                                                 | 70                  | 20                     | 90                 |
| 2      | Physiology                                                    | 70                  | 20                     | 90                 |
| 3      | Biochemistry I                                                | 70                  | 20                     | 90                 |
| 4      | Pathology I (Clinical Pathology, Haematology & Blood Banking) | 70                  | 20                     | 90                 |
| 5      | Microbiology                                                  | 70                  | 20                     | 90                 |
|        | Total                                                         | 350                 | 100                    | 450                |

The classes in main and subsidiary subjects are to be held from Monday to Thursday. On Fridays and Saturdays students shall work in hospitals in the respective specialty or department chosen by them

### Subsidiary Subjects

English            25 Hours

Kannada           25 Hours

Health-Care       40 Hours

Clinical/Lab posting –470 hours (Friday 9am – 1pm and 2pm - 4-30 pm

Saturday 9am - 1pm)



**Table - II Distribution of Teaching Hours in Second Year Subjects****Main Subjects**

| Sl. no | Subject                                                         | Theory No. of Hours | Practical No. of Hours | Clinical Postings | Total No. of Hours |
|--------|-----------------------------------------------------------------|---------------------|------------------------|-------------------|--------------------|
| 1      | Basic Electroencephalography                                    | 70                  | 30<br>(15+15)          | --                | 100                |
| 2      | Basics of Nerve Conduction Study (NCS)                          | 70                  | 30<br>(15+15)          | -                 | 100                |
| 3      | Applied Anatomy & Physiology Related to Neuroscience Technology | 70                  | 30<br>(15+15)          | -                 | 100                |
| 4      | Pharmacology related to Neuroscience technology                 | 50                  | -                      | --                | 50                 |
|        | Total                                                           | 260                 | 90                     |                   | 350                |

**Subsidiary Subjects:**

Medical Psychology

20Hours

**Table - III Distribution of Teaching Hours in Third Year Subjects****Main Subjects**

| Sl. no | Subjects              | Theory No of Hours | Practical No. of Hours | Clinical Posting | Total No. of Hours |
|--------|-----------------------|--------------------|------------------------|------------------|--------------------|
| 1      | Advanced Technique I  | 70                 | 30                     | 310              | 410                |
| 2      | Advanced Technique II | 70                 | 30                     | 310              | 410                |
| 3      | Systemic Disease      | 50                 |                        |                  | 50                 |
|        | Total                 | 190                | 60                     | 620              | 870                |

**Subsidiary Subjects:**

Research &amp; Biostatistics

20Hours

**8. Schedule of Examination:**

The university shall conduct two examinations annually at an interval of not less than 4 to 6 months as notified by the university from time to time. A candidate who satisfies the requirement of attendance, progress and conduct as stipulated by the university shall be eligible to appear for the university examination. Certificate to that effect shall be produced from the Head of the institution along with the application for examination and the prescribed fee.

**9. Scheme of Examination**

There shall be three examinations, one each at the end of I, II and III year. The examination for both main and subsidiary subjects for all courses in Allied Health Sciences shall be common in the first year. Distribution of Subjects and marks for First Year, Second year & Third year University theory and practical Examinations are shown in the Table – IV, V & VI.

**First year examination:**

The University examination for 1st year shall consist of only theory examination and there shall be no University Practical Examination.

**Second & Third year examination:**

The University examination for 2nd and 3rd year shall consist of Written Examination & Practical.

**Written Examinations consists of**

05 papers in the 1<sup>st</sup> year  
03 papers in the 2nd Year  
03 papers in the 3rd Year.

**Practical examination:**

Three practical examinations, at the end 2nd Year, three practical examinations at the end of the 3rd year and 1 practical exam at the end of 4<sup>th</sup> year.

**TABLE-IV****Distribution of Subjects and marks for First Year University theory Examination  
B.Sc. NEUROSCIENCE TECHNOLOGY**

| A | Main Subjects*                      | Written Paper |       | I A Theory | Total |
|---|-------------------------------------|---------------|-------|------------|-------|
|   |                                     | Duration      | Marks | Marks      | Marks |
| 1 | Basic Anatomy (Including Histology) | 3 Hours       | 80    | 20         | 100   |
| 2 | Physiology                          | 3 Hours       | 80    | 20         | 100   |
| 3 | Biochemistry                        | 3 Hours       | 80    | 20         | 100   |
| 4 | Pathology                           | 3 Hours       | 80    | 20         | 100   |
| 5 | Microbiology                        | 3 Hours       | 80    | 20         | 100   |
|   | Subsidiary Subject**                |               |       |            |       |
| 1 | English                             | 3 Hours       | 80    | 20         | 100   |
| 2 | Kannada                             | 3 Hours       | 80    | 20         | 100   |
| 3 | Health Care                         | 3 Hours       | 80    | 20         | 100   |

Note: I A = Internal Assessment

\*Main Subjects shall have University Examination.

There shall be no University Practical Examination.

\*\*Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges

**TABLE – V**

**Distribution of Subjects and marks for Second Year Examination of B.Sc.  
NEUROSCIENCE TECHNOLOGY**

| Paper | Subject                                              | Theory     |    |           | Practicals    |               |           | Grand Total |
|-------|------------------------------------------------------|------------|----|-----------|---------------|---------------|-----------|-------------|
|       |                                                      | Univ. exam | IA | Sub Total | Univ. Prac    | IA            | Sub Total |             |
| I     | Basic Electroencephalography (EEG)                   | 80         | 20 | 100       | 80<br>(40+40) | 20<br>(10+10) | 100       | 300         |
| II    | Basic Nerve Conduction Study (NCS)                   | 80         | 20 | 100       |               |               |           |             |
| III   | Applied Anatomy & Physiology Related to Neuroscience | 80         | 20 | 100       | No Practical  | --            | --        | 100         |
| IV    | Pharmacology                                         | 80         | 20 | 100       | No Practical  | --            | --        | 100         |

\*\*Practical-One common practical for the two papers with equal weightage of marks i.e.40 practical mark and 10 I.A .marks for each paper.

**Distribution of Subsidiary Subjects and marks for Second Year Examination of B.Sc. NEUROSCIENCE TECHNOLOGY**

| B | Subsidiary Subject** | Duration | Marks | I A Theory Marks | Total Marks |
|---|----------------------|----------|-------|------------------|-------------|
| 1 | Medical Psychology   | 3 Hours  | 80    | 20               | 100         |

\*\* Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges

**TABLE – VI**

**Distribution of Subjects and marks for Third Year Examination of B.Sc NEUROSCIENCE TECHNOLOGY**

|       | Theory               |            | Practical |           |                 |               |           |             |
|-------|----------------------|------------|-----------|-----------|-----------------|---------------|-----------|-------------|
| Paper | Subject              | Univ. exam | IA        | Sub Total | Univ. Prac      | IA            | Sub Total | Grand Total |
| I     | Advanced Technique 1 | 80         | 20        | 100       | 80<br>(40 + 40) | 20<br>(10+10) | 100       | 300         |
| II    | Advanced Technique 2 | 80         | 20        | 100       |                 |               |           |             |
| III   | Systemic Diseases    | 80         | 20        | 100       | No practical    |               |           | 100         |

## **Distribution of Subsidiary Subjects and marks for Third Year Examination of**

### **B.Sc. NEUROSCIENCE TECHNOLOGY**

| B | Subsidiary Subject**     | Duration | Marks | I A Theory Marks | Total Marks |
|---|--------------------------|----------|-------|------------------|-------------|
| 1 | Research & Biostatistics | 3 Hours  | 80    | 20               | 100         |

\*\* Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges

## **10. Pass criteria**

### **10.1. First year examination**

a. Main Subjects: A candidate is declared to have passed in a subject, if he/she secures, 50% of marks in University Theory exam and internal assessment added together.

b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the Commencement of the University examination.

### **10.2. Second and Third year Examination**

a. Main Subjects: A candidate is declared to have passed the examination in a subject if he/she secures 50% of the marks in Theory and 50% in practical separately. For a pass in theory, a candidate has to secure a minimum of 40% marks in the University conducted written examination, and 50% in aggregate in the University conducted written examination and internal assessment added together and for pass in Practical, a candidate has to secure a minimum of 40% marks in the university conducted Practical/Clinical examination and 50% in aggregate i.e. University conducted Practical/Clinical and Internal Assessment.

b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

## **11. Carry over benefit**

### **11.1 First year examination:**

A candidate who fails in any two of the five main subjects of first year shall be permitted to carry over those subjects to second year. However, he/ she must pass the carry over subjects before appearing for second year examination.

### **11.2. Second year examination:**

A candidate is permitted to carry over any one main subject to the third year but shall pass this subject before appearing for the third year examination.

## **12. Declaration of Class**

**a.** A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with Distinction.

**b.** A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 60% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in First Class.

**c.** A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than 60% of grand total marks prescribed will be declared to have passed the examination in Second Class.

**d.** A candidate passing the university examination in more than one attempt shall be placed in Pass class irrespective of the percentage of marks secured by him/her in the examination.

**e.** The marks obtained by a candidate in the subsidiary subjects shall not be considered for award of Class or Rank.

[Please note, fraction of marks should not be rounded off clauses (a), (b) and (c)]

#### 14. Eligibility for the award of Degree:

A candidate shall have passed in all the subjects of first, second and third year to be eligible for a compulsory 12 months of rotational internship. On completion of 12 months of the internship with pass criteria in outgoing clinical assessment exams the candidate is then eligible for the award of degree

#### 15. Distribution of Type of Questions and Marks

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>First year</b> ) |                  |                          |
|------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                          | No. of Questions | Marks for Each Questions |
| Long Essay                                                 | 1                | 10                       |
| Short Essay                                                | 5                | 5                        |
| Short Notes Type                                           | 5                | 3                        |
| Short Answer Type                                          | 10               | 2                        |
| MCQ's                                                      | 10               | 1                        |

- |                                                     |                  |
|-----------------------------------------------------|------------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks   |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks   |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks   |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks   |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks   |
|                                                     | <b>Total= 80</b> |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Second and Third Year</b> ) |                  |                          |
|-----------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                     | No. of Questions | Marks for Each Questions |
| Long Essay                                                            | 1                | 10                       |
| Short Essay                                                           | 5                | 5                        |
| Short Notes Type                                                      | 5                | 3                        |
| Short Answer Type                                                     | 10               | 2                        |
| MCQ's                                                                 | 10               | 1                        |

- |                                                     |                  |
|-----------------------------------------------------|------------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks   |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks   |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks   |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks   |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks   |
|                                                     | <b>Total= 80</b> |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Subsidiary subjects</b> ) |                  |                          |
|---------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                   | No. of Questions | Marks for Each Questions |
| Essay Type                                                          | 3 (2 x 10)       | 10                       |
| Short Essay Type                                                    | 8 (6 x 5)        | 05                       |
| Short Answer Type                                                   | 12 (10 x 3)      | 03                       |



## **INTERNSHIP**

12 months compulsory rotational postings during which students have to work under the supervision of experienced staff.

1 practical university examination towards the end of internship

# FIRST YEAR B.Sc. NEUROSCIENCE TECHNOLOGY

## ANATOMY

Theory: 70hrs

Practical's: 20hrs

### **Chapter 1**

#### **Introduction:**

##### **Theory:**

- Definition of anatomy and its divisions
- Terms of location, positions and planes
- Epithelium-definition, classification, describe with examples, function
- Glands- classification, describe serous, mucous & mixed glands with examples
- Basic tissues – classification with examples

##### **Practical:**

- Histology of types of epithelium
- Histology of serous, mucous & mixed salivary gland

### **Chapter 2**

#### **Connective tissue:**

##### **Theory:**

- Cartilage – types with example & histology theory
- Bone – Classification, names of bone cells, parts of long bone, microscopy of compact
- bone, names of all bones, vertebral column, intervertebral disc, fontanelles of fetal skull
- Joints – Classification of joints with examples, synovial joint (in detail for radiology)
- Muscular system: Classification of muscular tissue & histology
- Names of muscles of the body

##### **Practical:**

- Histology of the 3 types of cartilage
- Histology of compact bone (TS & LS)

- Histology of skeletal (TS & LS) & cardiac muscle
- Demo of all bones showing parts, radiographs of normal bones & joints
- Demonstration of important muscles of the body

### **3. Cardiovascular system:**

#### **Theory:**

- Heart-size, location, chambers, exterior & interior, pericardium
- Blood supply of heart
- Systemic & pulmonary circulation
- Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery
- Inferior vena cava, portal vein, portosystemic anastomosis, Great saphenous vein, Dural venous sinuses
- Lymphatic system- cisterna chyli & thoracic duct, Histology of lymphatic tissues, Names of regional lymphatics, axillary and inguinal lymph nodes in brief

#### **Practical:**

- Demonstration of heart and vessels in the body
- Histology of large artery & vein, medium sized artery & vein
- Histology of lymph node, spleen, tonsil & thymus
- Radiology: Normal chest radiograph showing heart shadows

### **4. Gastro-intestinal system**

#### **Theory:**

- Parts of GIT: Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring), Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas, spleen, peritoneum & reflections

#### **Practical:**

- Demonstration of parts of GIT
- Radiographs of abdomen

### **5. Respiratory system**

- Parts of RS: nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments, diaphragm
- Histology of trachea, lung and pleura
- Names of paranasal air sinuses

**Practical:**

- Demonstration of parts of respiratory system.
- Normal radiographs of chest, X-ray paranasal sinuses
- Histology of lung and trachea

**6. Urinary system****Theory:**

- Kidney, ureter, urinary bladder, male and female urethra
- Histology of kidney, ureter and urinary bladder

**Practical:**

- Demonstration of parts of urinary system
- Histology of kidney, ureter, urinary bladder
- Radiographs of abdomen-IVP, retrograde cystogram

**7. Reproductive system****Theory:**

- Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology)
- Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology)
- Mammary gland – gross

**Practical:**

- Demonstration of section of male and female pelvis with organs in situ
- Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes, ovary
- Radiographs of pelvis – hysterosalpingogram

**8. Endocrine glands****Theory:**

- Names of all endocrine glands in detail on pituitary gland, thyroid gland & suprarenal gland – (gross & histology)

**Practical:**

- Demonstration of the glands
- Histology of pituitary, thyroid, parathyroid, suprarenal glands

## **9. Nervous system**

### **Theory:**

- Neuron & Classification of NS
- Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve  
(gross & histology) Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei
- Blood supply of brain
- Cranial nerves
- Sympathetic trunk & names of parasympathetic ganglia

### **Practical:**

- Histology of peripheral nerve & optic nerve
- Demonstration of all plexuses and nerves in the body
- Demonstration of all part of brain
- Histology of cerebrum, cerebellum, spinal cord

## **10. Sensory organs**

### **Theory:**

- Skin: Skin-histology & Appendages of skin
- Eye: Parts of eye & lacrimal apparatus, Extra-ocular muscles & nerve supply
- Ear: parts of ear- external, middle and inner ear and contents

### **Practical:**

- Histology of thin and thick skin
- Demonstration and histology of eyeball
- Histology of cornea & retina

## **11. Embryology:**

### **Theory:**

- Spermatogenesis & oogenesis
- Ovulation, fertilization
- Fetal circulation
- Placenta

## INTERNAL ASSESSMENT

Theory-average of 2 exams conducted      20  
Practicals: record and lab work\*              10

\*There shall be no university practical examination and internal assessment marks secured in Practical need not be sent to the university.

### Distribution of Marks for University Theory and Practical Exam

| Theory |    |           | Practicals |    |           | Grand total |
|--------|----|-----------|------------|----|-----------|-------------|
| Theory | IA | Sub Total | Practicals | IA | Sub Total |             |
| 80     | 20 | 100       | *          |    |           | 100         |

### REFERENCE BOOKS:

1. William Davis (P) understanding Human Anatomy and Physiology – McGraw Hill
2. Chaurasia- A Text Book of Anatomy
3. T. S. Ranganathan- A Text Book of Human Anatomy
4. Fattana, Human Anatomy (Description and applied)- Saunderson's & C P Prism Publishers, Bangalore
5. ESTER. M. Grishcimer- Physiology & Anatomy with Practical Considerations, J. P. Lippin Cott. Philadelphia
6. Bhatnagar- Essentials of Human Embryology- Revised Edition. Orient Blackswan Pvt. Ltd.

# PHYSIOLOGY

Theory 70 hours

Practical 20hours

## 1. General Physiology

Introduction to cell physiology, transport across cell membrane

Homeostasis, Body Fluid compartment & measurement

## 2. Blood

Introduction - composition and function of blood

Plasma. proteins, types and functions

Red blood cells - erythropoiesis, stages of differentiation, factors affecting it, function, normal count, physiological variation.

Hemoglobin- function, concentration, types & methods of Hb estimation, fate of hemoglobin

Jaundice-types Anaemia,-types

ESR, PCV, osmotic fragility & blood indices

WBC- morphology, production, functions, normal count, differential count, variation, variation Immunity (in brief)

Platelets- origin, morphology, normal count, function-Platelet plug ,bleeding disorder

Haemostasis - definition, normal haemostasis, clotting factors, mechanism of clotting, anticoagulants disorders of clotting factors.

Blood group-ABO & Rh system, Rh incompatibility blood typing ,cross matching, hazards of mismatched blood transfusion

RES, spleen and lymph

## 3. Nerve-Muscle

Neuron structure, types, neuroglia-types, nerve fibre classification, properties of nerve fibres, RMP,action potential, wallerian degeneration

NMJ, blockers, Myasthenia gravis

Classification of muscle, structure of skeletal muscle, sarcomere, contractile proteins

Excitation contraction coupling, mechanism of muscle contraction, types of contraction

Motor unit, fatigue, rigor mortis Smooth muscle

## 4. Respiratory system

Physiological anatomy of respiratory system, muscles of respiration, respiratory & non respiratory functions of lungs, dead space

Mechanics of breathing, intrapulmonary & pleural pressures

Compliance, Surfactant, Hyaline membrane disease

Lung volumes and capacities

Respiratory membrane , transport of O<sub>2</sub> & CO<sub>2</sub>

Chemical regulation of respiration  
Neural regulation of respiration  
Hypoxia, Acclimatization,  
Dysbarism. Artificial respiration  
Definition-Periodic breathing ,dyspnoea, apnoea, asphyxia,, cyanosis

#### 5. Cardiovascular system

Introduction to CVS & general principles of circulation  
Properties of Cardiac muscle  
Cardiac cycle, heart sounds, Pulse  
Cardiac output, factors and measurement  
Heart rate  
BP-factors, measurement, Short term regulation  
Intermediate and long term regulation of BP  
ECG uses and significance, .normal waveform, heart block  
Coronary circulation, Cutaneous circulation-Triple response  
Shock  
Effects of exercise on CVS and Respiratory system

#### 6. Renal system, Skin and body temperature

Kidneys- functions, structure of nephron, type, juxtaglomerular apparatus-structure and function, non-excretory functions of kidney  
Glomerular filtration rate (GFR)- Definition ,normal value, factors affecting GFR  
Tubular reabsorption - sites, substance reabsorbed, mechanisms of reabsorption  
Tubular secretion- sites, substance secreted, mechanisms of reabsorption  
Counter current mechanism of concentration of urine  
Obligatory and Facultative reabsorption of water  
Micturition reflex, Diuretics  
Artificial kidney, renal function tests-clearance tests  
Skin -structure and function, body temperature measurement, physiological variation,  
Regulation of body Temperature by physical, chemical and nervous mechanisms-Role of Hypothalamus  
Hypothermia and fever

#### 7. Digestive system

Physiological anatomy, Enteric nervous system & functions of GIT  
Saliva- composition, regulation, disorder.  
Deglutition- stages & disorders  
Stomach-functions, composition and regulation of gastric juice  
Gastric motility, MMC, vomiting reflex.  
Pancreas- function, composition and regulation of pancreatic juice  
Liver & gall bladder-functions, bile- composition, secretion and regulation  
Small intestine- Succus entericus-composition, functions & movements  
Large intestine- functions, movements and defecation reflex  
Digestion & absorption of Carbohydrates, fats and proteins



## 8. Endocrine system

Classification of Endocrine glands & their hormones & properties-chemistry and receptor, feedback mechanisms of hormone regulation.

Anterior pituitary hormones- secretion, functions , disorders

Posterior pituitary hormones- secretion , functions , disorders

Thyroid hormones- secretion, functions, disorders

Parathyroid hormones- secretion, functions, disorders

Calcium homeostasis & disorders

Pancreatic hormones, -Insulin and Glucagon- . secretion, functions, disorders

Adrenal cortex- Glucocorticoids & Mineralocorticoids, Androgen - secretion, functions, disorders

Adrenal medulla- secretion, functions, disorders Thymus & Pineal gland

## 9. Reproductive system

Introduction to reproductive system, sex differentiation & Puberty

Male reproductive system, functions of testosterone & Spermatogenesis

Female reproductive system, functions of Estrogen, Progesterone, Oogenesis

Ovulation & Menstrual cycle

Physiological changes during pregnancy, pregnancy tests, parturition & lactation

Male & Female contraceptive methods

## 10. Central nervous system

Introduction to CNS, Sensory receptors classification, properties

Synapse– classification, properties

Sensory pathways: Anterior spino thalamic tract and Posterior column pathway

Lateral spino thalamic tract, Types of pain, Referred pain, Thalamus; nuclei and function

Classification of reflexes, Monosynaptic reflex- Stretch reflex , muscle spindle ,inverse stretch reflex. Polysynaptic reflex-Withdrawal reflex

Motor pathways : Pyramidal pathway and functions, UMNL, LMNL

Cerebral cortex (Sensory and motor)-functions, Medulla and Pons-functions

Cerebellum –functions, disorders

Basal ganglia-functions, disorders

Hypothalamus and Limbic system-functions

CSF, lumbar puncture

Sleep, EEG,

Autonomic Nervous System - Sympathetic and parasympathetic distribution and functions

## 11. Special senses

Vision –Functional anatomy of eye, visual pathway, lesion

Refractive errors, color vision

Audition – Physiological anatomy of ear, Mechanism of hearing, auditory pathway, deafness

Olfaction –modalities, receptor, function, abnormalities

Gustation-modalities, receptor, function, taste pathway, abnormalities .Practicals

Blood pressure Recording  
 Auscultation for Heart Sounds  
 Artificial Respiration  
 Determination of vital capacity

### **INTERNAL ASSESSMENT**

Theory-average of 2 exams conducted      20  
 Practicals: record and lab work\*              10

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

### **Distribution of Marks for University Theory and Practical Exam**

| Theory |    |           | Practicals |    |           | Grand total |
|--------|----|-----------|------------|----|-----------|-------------|
| Theory | IA | Sub Total | Practicals | IA | Sub Total |             |
| 80     | 20 | 100       | *          |    |           | 100         |

### **REFERENCE BOOKS:**

Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism Publishers  
 Chatterjee (CC) Human Physiology Latest Ed. Vol. 1, Medical Allied Agency  
 Choudhari (Sujith K) Concise Medical Physiology Latest Ed. New Central Book  
 Ganong (William F) Review of Medical Physiology. Latest Ed. Appleton

# BIOCHEMISTRY

No. Theory classes: 70 hours

No. Practical classes: 20 hours

## 1. Carbohydrate Chemistry [3 hours]

- Classification (Definition/ examples for each class)
- Monosaccharides (classification depending upon number of carbon atoms and functional group with examples)
- Disaccharides (Sucrose/ lactose/ maltose and their composition)
- Polysaccharides :
  - a) Homopolysaccharides (Structure of starch and glycogen)
  - b) Heteropolysaccharides (Functions )

## 2. Lipid Chemistry [3 hours]

- Definition of lipids
- Functions of lipids in the body
- Classification of lipids (subclasses with examples)
- Definition and Classification of fatty acids
- Essential fatty acids
- Phospholipids and their importance

## 3. Amino-acid and Protein Chemistry [3 hours]

- General structure of D and L amino acids
- Amino acids; Definition and Classification of amino acids with examples.
- Peptides; definition & Biologically important peptides
- Classification of Proteins based on composition, functions and shape (with examples)
- Functions of amino acids and Proteins

## 4. Nucleotide and Nucleic acid Chemistry [ 3 hours]

- Nucleosides & Nucleotides
- Nucleic acid Definition & types
- Composition & functions of DNA & RNA
- Structure of DNA (Watson and Crick model)
- Structure of tRNA, & functions of tRNA, rRNA, mRNA

- Difference between DNA and RNA

## **5. Enzymes [5 hours]**

- Definition & Classification of Enzymes with example
- Definitions of Active site, Cofactor (Coenzyme, Activator),
- Proenzyme; Definition and examples (Pepsin & trypsin)

## **6. Digestion and Absorption [ 3 Hours]**

- General characteristics of digestion and absorption,
- Digestion and absorption of carbohydrates, proteins and lipids.

## **7. Carbohydrate Metabolism [ 5 Hours]**

- Glycolysis ; Aerobic, Anaerobic, Definition , Site and subcellular site , Steps with all the enzymes and coenzymes at each step , mention the regulatory enzymes , Energetics,
- Citric acid cycle; Pyruvate dehydrogenase complex (reaction and coenzymes) , Site and subcellular site , Reactions with all the enzymes and coenzymes ,Regulatory enzymes , Energetics
- Significance of HMP Shunt pathway.
- Hyperglycemic and hypoglycemic hormones
- Blood Glucose Regulation.
- Diabetes mellitus (definition, classification, signs and symptoms)
- **Glycogen metabolism and gluconeogenesis**

## **8. Lipid Metabolism [ 4 Hours]**

- Introduction to lipid metabolism, Lipolysis
- Beta oxidation of fatty acids ; Definition ,Site and subcellular site , Activation of palmitic acid , Transport of activated palmitic acid into mitochondria , Reactions , Energetics.
- Name the different ketone bodies . Note on ketosis

## **9. Amino acid and Protein Metabolism [ 3 Hours]**

- Introduction, transamination, deamination, Fate of ammonia, transport of ammonia,
- Urea cycle.

## **10. Vitamins [5 Hours]**

- Definition and classification.
- RDA, sources, coenzyme forms, biochemical functions and disorders for the following water soluble vitamins: Thiamine, Niacin, Pyridoxine, Cobalamin, Folic acid, Ascorbic acid
- RDA, sources, coenzyme forms, biochemical functions and deficiency disorders for the following fat soluble vitamins; A and vitamin D

## **11. Mineral Metabolism [3 Hours]**

- Name the macro/ microminerals
- Iron: Sources, RDA, Functions and Disorders of deficiency and excess
- Calcium and phosphorus: Sources, RDA, functions, normal serum levels and hormones regulating their levels

## **12. Nutrition [6 hours]**

- Balanced diet (Definition)
- Caloric value ; Definition , Caloric values of carbohydrates, proteins and fats
- Total daily caloric requirements of an adult male and female,
- RDA (Definition, standard values for nutrients)
- Basal metabolic rate(BMR) ; Definition , Magnitude of BMR in men and women, Factors affecting BMR
- Thermic effect/ SDA of food (Definition, values for major macronutrients)
- Carbohydrates ;. Daily dietary requirement. 2. Dietary fibers (Definition, functions, importance and their daily requirements)
- Proteins ;. Daily requirement, Biological value. a. Definition b. Protein used as a standard for this, Protein sources with high and low biological value , Mutual supplementation of proteins (Definition, examples).
- Fats ; Daily requirement , Essential fatty acids (Definition, functions, daily requirement and deficiency manifestations) , Saturated and unsaturated fatty acids (Definition, sources, examples).
- Malnutrition

### **13. Renal Function Tests [ 2 hours]**

- Name the different tests to assess the kidney functions
- Explain Creatinine clearance & Inulin clearance
- Urinary acidification test

### **14. Radioactive Isotopes [1 hour]**

- Definition, clinical applications
- Biological effects of radiations

### **15. Clinical Biochemistry [ 5 hours ]**

A. Definitions of acid, base, pH and pKa [1 hour]

B. Buffers • Definition [2 hours]

- Henderson Hasselbalch equation,
- Principal buffer systems in the ECF ICF and urine
- Bicarbonate and phosphate buffer systems (pKa value, normal ratio of base/acid in the plasma)
- Acidosis & Alkalosis (Definition, classification, causes and biochemical findings)

C. Normal serum levels and condition where they are altered [2 hour]

- Glucose, Protein, urea, uric acid, and creatinine
- Bilirubin, cholesterol
- Serum Electrolytes

### **16. Fundamental Chemistry (1 hour)**

- Valency, Molecular weight & Equivalent weight of elements and compounds. Normality, Molarity, Molality.

### **17. Solutions: Definition, use, classification where appropriate, preparation and storage (5 hours)**

- Stock and working solutions.
- Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H<sub>2</sub>SO<sub>4</sub>, H<sub>3</sub>PO<sub>4</sub>, CH<sub>3</sub>COOH etc.,)
- Preparation of percent solutions – w/w, v/v w/v (solids, liquids and acids), Conversion of a percent solution into a molar solution
- Saturated and supersaturated solutions

- Standard solutions. Technique for preparation of standard solutions and Storage. E.g: glucose, albumin etc.
- Dilutions- Diluting Normal , Molar and percent solutions. Preparing working standard from stock standard.
- Part dilutions: Specimen dilutions. Serial dilutions. Reagent dilution. Dilution factors

### **ASSIGNMENT TOPICS**

1. **Units of measurement**
2. Hazards - Physical, Chemical, Biological
3. Arterial blood gas analysis
4. Responsibilities of Health care personnel
5. Biomedical waste management

### **PRACTICAL DEMONSTRATION**

- Color Reactions of Carbohydrates & amino acids.
- Precipitation Reactions of proteins
- Colorimetry
- Estimation of Blood glucose Folin Wu and enzymatic method
- Estimation of Urea by DAM method

### **INTERNAL ASSESSMENT**

|                                     |    |
|-------------------------------------|----|
| Theory-average of 2 exams conducted | 20 |
| Practicals: record and lab work*    | 10 |

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

### Distribution of Marks for University Theory and Practical Exam

| Theory |    |           | Practicals |    |           | Grand total |
|--------|----|-----------|------------|----|-----------|-------------|
| Theory | IA | Sub Total | Practicals | IA | Sub Total |             |
| 80     | 20 | 100       | *          |    |           | 100         |

### Text Book References

- Biochemistry – 3<sup>rd</sup> revised edition by U Sathyanarayana & U Chakrapani
- Textbook of Medical Biochemistry-6<sup>th</sup> Edition by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology 2<sup>nd</sup> edition by Godkar and Godkar.
- Biochemistry-3<sup>rd</sup> edition by Pankaja Naik
- Medical Laboratory technology 6<sup>th</sup> edition by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students- 3<sup>rd</sup> edition by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> editions

## PATHOLOGY

### Clinical Pathology, Hematology and Blood Banking

Theory-70 hours

Practicals-20 hours

#### I. Clinical Pathology- Theory

- Introduction to clinical pathology
- Collection , transport, preservation and processing of various clinical specimens
- Urine examination- collection and preservation, Physical, chemical and microscopic examination for abnormal constituents
- Examination of Body fluids
- Examination of Cerebrospinal fluid (CSF)
- Sputum examination
- Examination of feces



## **II. Hematology – Theory**

- Introduction to hematology
- Normal constituents of Blood, their structure and functions
- Collection of Blood samples
- Various anticoagulants used in Hematology
- Hemoglobin estimation, different methods and normal values
- Packed cell volume
- Erythrocyte sedimentation rate
- Normal Haemostasis
- Bleeding time. Clotting time, prothrombin time, Activated partial Thromboplastin time

## **III. Blood Bank- Theory**

- Introduction blood banking
- Blood group system
- Collection and processing of blood for transfusion
- Compatibility testing
- Blood transfusion reactions
- **General Pathology:**
- **Cell injury:**
  - a. Definition, causes.
  - b. Cellular adaptations – Hypertrophy, hyperplasia, atrophy and metaplasia.
  - c. Types of cell injury – Reversible and irreversible; morphology of reversible injury.
  - d. Necrosis – Definition and patterns of tissue necrosis.
  - e. Intracellular accumulations – Lipids, cholesterol, proteins, glycogen and pigments; examples.
  - f. Pathologic calcification – Types and examples.
- **3) Inflammation:**
  - a. Definition and signs of inflammation.

- b. Types – Acute and chronic inflammation.
- c. Acute inflammation – Causes, morphological patterns and outcome.
- d. Chronic inflammation – Causes, morphology and examples.
- e. Regeneration and repair – Mechanism of cutaneous wound healing.
- f. Factors affecting wound healing.
- **4) Hemodynamic disorders:**
  - a. Edema – Definition, pathogenesis and types: Renal, cardiac, pulmonary and cerebral.
  - b. Difference between transudate and exudate.
  - c. Shock – Definition, types of shock with examples: Hypovolemic, cardiogenic and septic shock, stages of shock: Nonprogressive, progressive and irreversible.
  - d. Thrombosis – Definition, mechanism of thrombus formation (Virchow's triad) and fate of thrombus.
  - e. Embolism – Definition and types: Thromboembolism, fat, air and amniotic fluid embolism.
  - f. Infarction – Definition and examples.
- **5) Immune system:**
  - a. Autoimmune diseases – General features, enumerate systemic and organ specific autoimmune diseases.
  - b. Systemic lupus erythematosus – Manifestations and diagnosis.
- **6) Neoplasia:**
  - a. Definition and nomenclature of tumors.
  - b. Differences between benign and malignant neoplasms.

- c. Enumerate modes of carcinogenesis: Genes, physical, chemical and microbial agents of carcinogenesis.
- d. Modes of spread of tumors.
- e. Clinical aspects of neoplasia.
- f. Grading and staging of cancers.
- g. Laboratory diagnosis of cancer.

### **Practicals**

- 1. Urine analysis- Physical, Chemical, Microscopic
- 2. Blood grouping and Rh typing
- 3. Hb estimation , packed cell volume (PCV), Erythrocyte Sedimentation rate (ESR)
- 4. Bleeding time and Clotting time

### **INTERNAL ASSESSMENT**

|                                     |    |
|-------------------------------------|----|
| Theory-average of 2 exams conducted | 20 |
| Practicals: record and lab work*    | 10 |

\*There shall be no university practical examination and internal assessment marks secured in  
Practicals need not be sent to the university.

### Distribution of Marks for University Theory and Practical Exam

| Theory |    |           | Practicals |    |           | Grand total |
|--------|----|-----------|------------|----|-----------|-------------|
| Theory | IA | Sub Total | Practicals | IA | Sub Total |             |
| 80     | 20 | 100       | *          |    |           | 100         |

### REFERENCE BOOKS:

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss- Cytology
4. Winifred Diagnostic cytopathology
5. Orell Cytopathology
6. Todd and Sanford- clinical diagnosis by Laboratory Medicine
7. Dacie and Lewis- Practical Hematology
8. Ramnik SOOD. Lab technology, Methods and interpretation, 4 th edition JP Bros New Delhi, 1996
9. Sathish Guptha , Short text book of Medical laboratory techniques for technicians
10. Sachdev K N. Clinical Pathology and Bacteriology, 8th edi JP Bros, New Delhi, 1996

## Microbiology I

Theory: 70 Hours

Practicals: 20 Hours

### 1. Introduction (6 hrs)

History of Microbiology - Louis Pasteur, Antony Van Leeuwenhoek, Robert Koch, Edward Jenner, Alexander Fleming.

Use of microscope in the study of bacteria - Types of microscopes - compound

microscope, phase contrast microscope, electron microscope, fluorescent microscope, dark ground microscope.

Morphology of bacterial cell

## **2. Growth and Nutrition (6 hrs.)**

Nutrition, growth and multiplication of bacteria, bacterial growth curve, culture media, culture methods, anaerobic culture methods.

## **3. Sterilization and disinfection (8 hrs.)**

Principles and use of equipments of sterilization, chemicals used in disinfection, testing of disinfectants.

## **4. Biomedical waste management principle and practice**

## **5. Immunology ( 5hrs.)**

Immunity - mechanism of immunity, classification, types

Vaccines

Immunization schedule

Definition of antigen, antibody, list of antigen antibody reaction (no need of detailed account of antigen antibody reactions)

Definition of hypersensitivity and classification (no need of detailed account of types of hypersensitivity)

## **6. Infection (5 hrs.)**

Definition, types and mode of transmission

Hospital acquired infection - causative agents, mode of transmission and prophylaxis.

Antimicrobial sensitivity testing

## **7. Systematic bacteriology (15 hrs.)**

Disease caused and laboratory diagnosis of medically important bacteria (Staphylococcus, coagulase negative Staphylococcus, MRSA, Streptococcus pyogenes, Pneumococcus, gonococcus, E.coli, diarrhoeagenic E.coli, Salmonella, Vibrio cholerae, ElTor vibrios, Halophilic vibrios, Shigella, Mycobacterium tuberculosis, Mycobacterium leprae, Atypical Mycobacteria, Treponema pallidum, leptospira)

(no need of classification, antigenic structure, virulence mechanism)

## **8. Parasitology (10 hrs.)**

Introduction to Parasitology

List of medically important parasites and diseases (E.histolytica, Plasmodium, W.bancrofti, Ascaris, Ancylostoma, B.coli, G.lamblia, T.solium, T.saginata)

Laboratory diagnosis of parasitic infection

(No need of including life cycles)

## **9. Virology (10 hrs.)**

Introduction to virology

List of medically important viruses and diseases (AIDS, Hepatitis, Rabies, Polio, Arbo viruses)

Cultivation of viruses and laboratory diagnosis of viral infections

## **10. Mycology (5 hrs.)**

Introduction to Mycology

Classification of medically important fungi - (based on morphology, spore production, disease production, taxonomy)

List of medically important fungi and diseases (Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis, Mucor Mycosis)

Laboratory diagnosis of fungal infections.

## **Practicals (20 hrs.)**

Compound microscope (Demonstration)

Demonstration of sterilization equipments

Demonstration of culture media and culture methods

Demonstration of antibiotic sensitivity testing

Demonstration of serological tests - Widal, VDRL, ASO, CRP, RA

Demonstration of gram stain and ZN staining

Demonstration of Helminthic ova

Grams stain, Acid fast staining

Stool exam for Helminthic ova

## INTERNAL ASSESSMENT

Theory-average of 2 exams conducted    20  
Practicals: record and lab work\*        10

\*There shall be no university practical examination and internal assessment marks secured in Practical need not be sent to the university.

### Distribution of Marks for University Theory and Practical Exam

| Theory |    |           | Practicals |    |           | Grand total |
|--------|----|-----------|------------|----|-----------|-------------|
| Theory | IA | Sub Total | Practicals | IA | Sub Total |             |
| 80     | 20 | 100       | *          |    |           | 100         |

### Reference Books-

1. Ananthanarayana & Panikar Medical Microbiology- University Press
2. Robert Cruickshank- Medical Microbiology- The Practice of Medical Microbiology
3. Chatterjee- Parasitology- Interpretation to Clinical Medicine
4. Rippon- Medical Mycology
5. Emmons- Medical Mycology
6. Basic Laboratory methods in Parasitology, J P Bros, New Delhi
7. Basic Laboratory procedures in clinical bacteriology, J P Bros, New Delhi
8. Medical Parasitology- Ajit Damle
9. Introduction to medical microbiology- Ananthanarayana- Orient Longman Pvt. Ltd

## SUBSIDIARY SUBJECTS

### ENGLISH

#### COURSE OUTLINE

**COURSE DESCRIPTION:** This course is designed to help the student acquire a good command and comprehension of the English language through individual papers and conferences.

#### BEHAVIOURAL OBJECTIVES:

The student at the end of training is able to

1. Read and comprehend English language
2. Speak and write grammatically correct English
3. Appreciates the value of English literature in personal and professional life.

#### UNIT - I: INTRODUCTION:

Study Techniques

Organisation of effective note taking and logical processes of analysis and synthesis

Use of the dictionary

Enlargement of vocabulary

Effective diction

#### UNIT - II: APPLIED GRAMMAR:

Correct usage

The structure of sentences

The structure of paragraphs

Enlargements of Vocabulary

#### UNIT - III: WRITTEN COMPOSITION:

Precise writing and summarizing

Writing of bibliography

Enlargement of Vocabulary

#### UNIT - IV: READING AND COMPREHENSION:

Review of selected materials and express oneself in one's words.

Enlargement of Vocabulary.

#### UNIT - V: THE STUDY OF THE VARIOUS FORMS OF COMPOSITION:

Paragraph, Essay, Letter, Summary, Practice in writing

#### UNIT - VI: VERBAL COMMUNICATION:

Discussions and summarization, Debates, Oral reports, use in teaching Scheme of Examination

Written (Theory): Maximum Marks: –80 marks.

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>First year</b> ) |                  |                          |
|------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                          | NO. of questions | Marks for Each Questions |
| Essay Type                                                 | 3 (2 x 10)       | 10                       |
| Short Essay Type                                           | 8 (6 x 5)        | 05                       |
| Short Answer Type                                          | 12 (10 x 3)      | 03                       |

No Practical or Viva voce examination

This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%

#### REFERENCE

1. English Grammar Collins, Birmingham University, International Language Data Base, Rupa & Co. 1993
2. Wren and Martin - Grammar and Composition, 1989, Chanda & Co, Delhi
3. Letters for all Occasions. A S Myers. Pub - Harper Perennial
4. Spoken English V. Shasikumar and P V Dhanija. Pub. By: Tata Mcgraw Hill, New Delhi
5. Journalism Made Simple D Wainwright
6. Writers Basic Bookself Series, Writers Digest series



7. Interviewing by Joan Clayton Platkon
8. Penguin Book of Interviews.

## **HEALTH CARE**

### **Teaching Hours : 40 Introduction to Health**

Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept.

National Health Policy

National Health Programmes ( Briefly Objectives and scope) Population of India and Family welfare programme in India

### **Introduction to Nursing**

What is Nursing ? Nursing principles. Inter-Personnel relationships. Bandaging : Basic turns; Bandaging extremities; Triangular Bandages and their application.

Nursing Position, Bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's positions, comfort measures, Aids and rest and sleep.

Lifting And Transporting Patients: Lifting patients up in the bed. Transferring from bed to wheel chair. Transferring from bed to stretcher.

Bed Side Management: Giving and taking Bed pan, Urinal : Observation of stools, urine. Observation of sputum, Understand use and care of catheters, enema giving.

Methods of Giving Nourishment: Feeding, Tube feeding, drips, transfusion Care of Rubber Goods

Recording of body temperature, respiration and pulse, Simple aseptic technique, sterilization and disinfection. Surgical Dressing: Observation of dressing procedures

### **First Aid :**

Syllabus as for Certificate Course of Red Cross Society of St. John's Ambulance Brigade.

### **Reference Books:**

1. Preventive and Social Medicine by J.Park
2. Text Book of P & SM by Park and Park
3. Counseling & Communicate skills for medical and health, Bayne- Orient Longman Pvt. Ltd.

## **SECOND YEAR B.Sc.NEUROSCIENCE TECHNOLOGY**

Applied Anatomy & Physiology Related to Neuroscience

### **Course Objective**

This course will provide an outline of anatomy and physiology to improve the students understanding of the technical and diagnostic procedures used with special emphasis on applied aspects.

### **Unit I**

Neuro Anatomy Cranial vault

Base of skull and relations The meanings

Cerebral hemispheres – Frontal, parietal, temporal and occipital lobes Basal ganglia & diencephalons

Midbrain Brain Stem Pons

Medulla oblongata Cerebellum

The ventricular system & cisterns Arterial supply (major vessels) Veins and venous sinuses

The cranial nerves 1 to 12 Surface anatomy of cranial nerves The spinal cord

The bony canal and ligaments and meanings and their extent; organization of structures in the cord at various levels

Arterial supply and Venous drainage

Spinal segments and spinal Nerve

### **Unit- II**

Neurophysiology

Physiology of vision – optic pathway Physiology of hearing – auditory

pathway Motor control – pyramidal system Extra pyramidal system

Cerebellum

Physiology of the ANS – divisions, chemical Transmission functions &

higher centers for regulation The autonomic nervous system

Sympathetic nervous system Parasympathetic nervous system Formation

Neuro transmitters

The skeletal muscles Myotomes & their innervations Dermatomes & their innervation Membrane potentials

Action potential

Synaptic transmission – excitation, inhibition

The physiology of Neuro-muscular transmission – the n-m junction Types of somatic sensations & sensory pathways

Physiology of muscle – mechanisms of contraction & relaxation The motor unit – its composition & function

Practicals: Includes the abovementioned theory units Recommended Books

Clinical Neuroanatomy – Richard.S.Snell

### **Reference Books**

1. Manual of Practical Anatomy - Cunningham's (G.J. Romones)
2. Textbook of Anatomy with colour atlas - Inderbir Singh
3. Textbook of Medical Physiology – Guyton & Hall

### **NO PRACTICALS**

## Basic Electroencephalography

Theory 70 hours

Practical 30hours

### Course Objective

This course will cover basic instrumentation parameters, fundamentals of EEG, appropriate electrode placement using the International 10-20 System of head measurement, machine operation and instrumentation, EEG pattern recognition, Interpret record, morphology and various abnormal EEG.

### Unit – I

**Basics of Instrumentation** Electrical concepts Conduction, insulation

Voltage current, resistance, power Capacitance, inductance

DC/AC

Impedance Transistors

Differential power amplifier

### Unit – II

**The Electroencephalography & Instrumentation**

Filter-High frequency

Low frequency

Time constant Biological filters

50Hz filters

Sensitivity

Calibration

Paper speed

Pen

mechanism

Digital Signal process

Gain

Sweep

Stimulator

Jackbox

Common mode rejection

Block Diagram of EEG

Activational Procedures

-Photic Stimulation

-Hyper ventilation

Signal to noise ratio

Sampling rate

### **Unit – III**

#### **Electroencephalography recording technique**

Electrodes-Types, Materials, Maintenance of electrode

Modes of application

The 10-20 system

The 10-10 system

Special electrodes in EEG

Reporting

Montages-Bipolar/Referential/Monopolar/laplacian

Video of EEG

Ambulatory EEG

### **Unit – IV**

#### **Normal rhythms & Abnormal**

(A) Seizure , Epilepsy and the classification of epilepsy

(B) Normal rhythms: alpha, beta, gamma, delta, theta, Mu, Lambda, Conewaves

(C) Abnormal waveforms: Spike, Sharp, Polyspike, spike and slow waves, PLEDS, Slow waves, FIRDA, Phantom Spike and wave, Photoparoxysmal response, triphasic sharp waves

## **Epilepsy**

- Abnormal epileptic patterns
  - (a) Benign rolandic epileptic forms
  - (b) 3/sec cycle
  - (c) CJD
  - (d) PLED's
  - (e) Subacute sclerotic lateralized epileptic discharges
  - (f) Hypsarrhythmia/ west syndrome

## **Unit – V**

### **Artifacts**

#### **Non- Physiological Artifact**

#### **Physiological Artifact**

## **Unit – VI**

### **Patients grounding & safety**

- Analog and digital EEG
- Factors affecting EEG
- Drugs affecting EEG
- EEG changes in sleep
- EEG in comatose patient
- Electrical silence

## **Unit – VII**

### **Disease Condition Related**

- Mechanism
- Clinical features
- Diagnosis
- Treatment
- Alzheimer
- Dementia
- Parkinson's disease
- Parkinson's Plus
- Parkinsonism
- Stroke – Thrombotic, Embolic, Aneurysm, TIA
- Epilepsy
- Management of Seizure
- Glasgow coma scale
- Hydrocephalus
- EEG findings in brain death

## **Unit – VIII**

- Neuro transmitters in CNS
- Intraoperative EEG monitoring during epilepsy surgery

**Practicals:** Includes the above mentioned theory units

### **Recommended Books**

1. EEG in Clinical in Practice – John R. Hughes
2. Electroencephalography – Ernst Niedermeyer, Fernando Lopes da Silva

### **Reference Books**

1. Primer of EEG: With A Mini-Atlas, 1e - A. James Rowan MD and Eugene Tolunsky MD

### **PRACTICALS:**

Practical exam: 80 marks

One common practical for all the papers with equal weightage of marks i.e.40 practical marks for each paper.

## Basic Nerve Conduction Studies (NCS)

Theory 70 hours

Practical 30hours

### Course Objective

This course will cover basic instrumentation parameters, fundamentals of NCS, appropriate electrode stimulation and recording parameters, machine operation and instrumentation, waveform pattern recognition, basic troubleshooting skills, relate skills for performing basic and uncommon NCS procedures and identify potential disease or injury processes correlates with NCS results.

### Unit – I

#### Basics of Nerve conduction studies

Nerve conduction velocity Action potential

CMAP & SNAP

Depolarization,Repolarization,Hyperpolarization Ions exchange

Stimulation parameters Recording Techniques Resting membrane potential End plate potential Miniature end plate potential Threshold

### Unit – II

#### Motor & Sensory Nerve conduction

- **Median Nerve:**
  - Anatomy
  - Techniques
  - Values
  - Clinical conditions (CTS, median nerve neuropathy, median nerve palsy)
  - Test (physical examination, tinel's test, Phalen's, Maneuver test)
- **UlnarNerve:**
  - Clinical conditions (cubital tunnel syndrome, ulnar nerve palsy, ulnar neuropathy, claw hand)
  - Test (physical examination, Watson test, Shear test, Piano key sign, Lichtman test)
- **RadialNerve:**
  - Clinical conditions (Radial tunnel syndrome, Saturday night palsy, radial neuropathy)
  - Test (physical examination, NCS)



- **PeronealNerve:**
  - Clinical conditions (fool drop, peroneal nerve palsy, common peroneal nerve dysfunction peroneal neuropathy)
  - Test (physical examination, NCS, common peroneal nerve stress)
- **TibailNerve:**
  - Clinical conditions (tarsal tunnel syndrome, tibial neuropathy)
  - Test (tarsal tunnel syndrome test, NCS)
- **Superficial Peroneal Nerve:**
  - Clinical conditions (Superficial Peroneal Nerve entrapment)
  - Test (NCS, physical examination)
- **SuralNerve:**
  - Clinical conditions (mononeuropathy)
  - Test (NCS, physical examination)
- **Facial Nerve:**
  - Clinical conditions (Bell's palsy, facial palsy, Bell's Phenomenon, ptosis)
  - Test (FNC, blink reflex)
- **Trigeminal Nerve:**
  - Clinical conditions (Trigeminal Neuralgia)
  - Test (pm or cotton swap test)
- **Brachial Plexus**
  - Introduction
  - Schematic Diagram
  - Median
  - Ulnar
  - Radial
  - Axillary
  - Musculocutaneous
  - Clinical conditions (Brachial plexus injuries – stingers, by birth, inflammation or tumor and accidents)
  - Test (EMG, NCS, MRI, CT)

### **Unit – III**

#### **Late Responses**

F-waves      H-

reflex Axonal

### **Unit – IV**

## **Nerve conduction study changes in damaged Nerve conditions**

Traumatic Demyelinating

Axonal Motor neuron disease Neuropraxia

Wallerian degeneration Axonal demyelination Neurotmesis

Computer application in Nerve conduction studies

**Practicals:** Includes the above mentioned theory units

- Electrodes Identification
  - Electrode Application
  - Care of Electrodes
  - Calculation of Nerve Conduction Parameters
- Interpretation of basic Nerve Conduction studies

### **Recommended Books**

1. Laboratory Reference for Clinical Neurophysiology – Jay.A.Liveson  
Dong.M.Ma
2. Electrodiagnostic Medicine – Daniel Dumitru

### **Reference Books**

1. Electrodiagnosis in Diseases of Nerve and Muscle: Principles and Practice by Jun Kimura
2. Aminoff's Electrodiagnosis in Clinical Neurology – Micheal J. Aminoff

### **PRACTICAL:**

Practical exam: 80 marks

One common practical for all the papers with equal weightage of marks i.e. 40 practical marks for each paper.

## PHARMACOLOGY

Theory 50 hours

### **COURSE OBJECTIVE:**

To introduce the student a significance of medicine related to general pharmacology.

### **COURSE CONTENT:**

2. Introduction to Pharmacology
3. Pharmacokinetics
4. Pharmacodynamics
5. Adverse effects of drugs
6. Classification of drugs
7. 6.1. Autonomic nervous system
  - ✓ Introduction. Neurotransmitters, their mechanism of action
  - ✓ Drugs affecting-
    - Pupillary size and light reflex
    - Intraocular tension
    - Accommodation
  - ✓ Skeletal muscle relaxants
7. .1. Cardiovascular system
  - ✓ Antihypertensives and drugs useful in angina
- 8.1. Diuretics
  - ✓ IN ocular disorders
- 9.1. Central nervous system
  - ✓ Alcohol, sedative hypnotics, general & local anesthetics, opioids & non-opioids
- 10.1. Chemotherapy
  - ✓ Introduction, general chemotherapy
  - ✓ Specific chemotherapy – antifungal, Antiviral, Antitubercular, Antileprotic
- 10.1.Hormones
  - ✓ Corticosteroids
  - ✓ Anitidiabetics
- 11.1.Blood
12. Coagulants
13. Antibiotics
14. Anti inflammatory
15. Analgesic and antipyretic
16. Muscle relaxant etc.
17. Classification, effects, mechanism of action, indication and contra indication.

## PHARMACOLOGY RELATED TO NEUROSCIENCE TECHNOLOGY

### Course Objective

This course will cover general pharmacology with special emphasis on common drugs, routes of administration, types of formulations, dose and frequency of administration, side effects and toxicity, management to toxic effects, drugs interactions, knowledge of chemical and trade names, importance of manufacturing and expiry dates and instructions about handling drugs.

### Unit – I

#### Epilepsy

Neurotransmitters, Therapeutics, Antiepileptic drugs, dosage & side effects (toxicity), Phenytoin (eptoine, dilantin 100) also parenteral, Phenobarbitone (Gardenal 30, 60 also parenteral.), Carbamazepine (tegretol, zeptol, mazetol, Zen 100, 200, 400), Carbamazepine – controlled release (or), Valproate sodium (valparin, epile x 200, syrup), Ethosuximide (zarontin), Primidone, Clonazepam (rivotril, lanazep 0.5,2)

New drugs

Gabapentin (neuortin 300, 400, 600), Vigabatrin, Lamotrigine, Drugs used in emergency: - diazepam (IV), IM, Lorazepam (IV, IM), Phenytoin (IV), Phenobarbitone (IV), Lignocaine (IV), Valproate (IV), Pentothal Sodium (IV), Pharmacology of neuromuscular transmission

### Unit – II

#### Neurotransmitters

Receptors, Types, Mechanisms

Drugs used - Neostigmine, Pyridostigmine, Edrophonium, guanidine

### Unit – III

#### Cerebral Vascular Accident

Drugs used, Antiplatelet agents, Aspirin, ticlopidine, anti Coagulants, Heparin, Warfarin, anti hypertensives, Oral hypoglycemics (anti diabetic), Anti edema agents (Diuretics) Mannito, Steroids, Furosemide (lasix), Thiazides.

## **Unit – IV**

### **Extrapyramidal disease**

Drugs used - Levodopa, Pimozide, Haloperidol,

## **Unit – V**

Infections – Antibiotics, Anti parasitic, Anti viral, Anti fungal agents, Anti mycobacterial,

Miscellaneous – Steroids, Anti inflammatory agents, Pain Mechanism, Analgesics. Other psychotropic, Drugs

### **Recommended Books**

1. Essentials of Medical Pharmacology - Triparthi
2. Medical Pharmacology for Allied Health Sciences – Padmaja Udayakumar

NO PRACTICAL EXAMINATION

## **SUBSIDIARY SUBJECTS**

### ***CLINICAL PSYCHOLOGY***

THEORY HOURS: 20

1. Introduction to psychology
2. Intelligence, Learning, Memory, Personality, Motivation
3. Body integrity- one's body image
4. Patient in his Milan
5. Selfconcept of the therapist, Therapistpatient relationship-some guidelines
6. Illness and its impact on the patients
7. Maladies of the age and their impact on the patient's own and others concept of his body image
8. Adapting changes in vision
9. Why Medical Psychology needs / demands commitment?

## **THIRD YEAR B.Sc NEUROSCIENCE TECHNOLOGY**

### **Advanced Neuroscience technique 1**

Theory 70 hours

Practical 30hours

#### **Course Objective**

This course will cover basic instrumentation parameters, fundamentals of EP's, appropriate electrode placement stimulation and recording parameters, machine operation and instrumentation, waveform pattern recognition, basic troubleshooting skills, relate skills for performing basic and uncommon EP's procedures and identify potential disease or injury processes correlates with Ep's results.

#### **Unit – I**

##### **Evoked Potentials - Basics of Instrumentation**

Evoked potentials-definition

Principles of averaging/recording techniques

Evoked potential Instrumentation

- General
- Analogue
- Digital

Signal to noise ratio

Frequency response

Internal noise

#### **Unit – II**

B.A.E.R

Introduction Auditory pathway Patient preparation

Materials required Procedure

Factors affecting

Normal values and waveforms Limitations

Clinical conditions – MS, CP angle, tumor BAER in Pediatrics

### **Unit – III**

V.E.P

Introduction Visual pathway Types of VEP Patient preparation Materials required

Procedures Factors affecting Limitations Normal values Clinical conditions Pediatric VEP

Responses and values

### **Unit – IV**

**SSEP**

Introduction Patient preparation Technique

Types

Upper limbs - Median SSEP

Lower limbs – Tibial Motor SSEP

Special techniques – MEPs

SSEP in brainstem/spinal cord/ Anatomical and physiological basis of SEP Reproducibility of SEP

Patient related factors of SEP Clinical applications of SEP Multiple Sclerosis

Metabolic disorders Plenopathy

Spinal cord trauma

Cervical Spondylosis and myelopathy Surgical monitoring of SSEP

### **Unit – V**

**MEP**

Measurements of CMCT and PMCT in MEP(Peripheral and central motor conduction time)

Tract – CT

Abnormalities in CMCT

Clinical conditions in MEP

MS Motor neuron disease

Movement disorders

Peripheral nerve disorders

Lumbar spinal stenosis and radiculopathies Miscellaneous disorders

Psychogenic weakness

Myelopathy Cerebral infarction Patient preparation Procedure Limitations

## **Unit – VI**

BLINK REFLEX

## **Unit – VII**

Neuropathies

AIDP

GBS

CIDP

Peripheral Neuropathy Diabetic neuropathy Subacute idiopathic

Demyelinating polyradiculoneuropathy Multifocal motor neuropathy

Focal Neuropathy

Neuropathies associated with AIDS

(a) Mononeuropathy

(b) Progressive Polyradiculoneuropathy

(c) Autonomic neuropathy.

## **Unit – VIII**

Radiculopathy

L<sub>5</sub> – S<sub>1</sub> radiculopathy

Cervical

Cervical spondylosis

S<sub>1</sub> – S<sub>2</sub>

Conduction block

Temporal dispersion

## **Unit – IX**

Special technique Median

ulnar radial

parasympathetic response



## **Unit – X**

Lumbar plexus

Lumbosacral plexopathy

Femoral

Saphenous

Obturator

L.F.C.N

Meralgia parasthesia

Sacral Plexus

Sciatic

Common Peroneal

Deep Peroneal

Superficial Peroneal

Sural NCS

Tibial

Tarsal tunnel syndrome

Posteriorcutaneous nerve of thigh

## **Unit – XI**

Spinal cord compression

Lumbar disc prolapsed

Spinal cord injury

## **Unit – XII**

Non limb nerves

Computer application in evoked potentials

**Practicals:** Includes the abovementioned theory units

## **Recommended Books**

1. Laboratory Reference for Clinical Neurophysiology – Jay.A.Liveson

- Dong.M.Ma  
2. Electrodiagnostic Medicine – Daniel Dumitru

### **Reference Books**

1. Electrodiagnosis in Diseases of Nerve and Muscle: Principles and Practice by Jun Kimura
2. Aminoff's Electrodiagnosis in Clinical Neurology – Micheal J. Aminoff

**PRACTICAL EXAMINATION:** One common practical for all the papers with equal weightage of marks i.e. 40 practical marks for each paper.

## **ADVANCED TECHNIQUE - II**

### **Course Objective**

This course will cover basic instrumentation parameters, fundamentals of EMG & Autonomic Function Studies, recording parameters, machine operation and instrumentation, Correctly identify and grade needle EMG findings, waveform pattern recognition, basic troubleshooting skills, safety considerations related to EMG testing.

### **Electromyography & Special studies**

#### **Unit – I**

#### **Disease Related**

Autosomal dominant disease

Disorders of body schema

Antons syndrome

Spacial disorder

Various disorders of speech and language

Verbal fluency aphasia

Ataxia

Apraxia

Nominal aphasia

Broca aphasia

Dysarthria

## **Unit – II**

PSG

Introduction

Normal adult PSG

Stages of sleep

Waveform

- K complex
- POST
- Sleep sprindles
- VST
- BETS

Clinical condition

- Apnea
  - (a) Central
  - (b) OSA
  - (c) Mixed
- Hypopnea
- Parasomnias

- Narcolepsy
- REM sleep disorder
- Arousal seizures
- RLS
- PLM's
- RERA
- AHI
- CPAP
- BiPAP

### **Unit – III**

Paediatric PSG

Introduction

Disease

- Apnea
- Obstructive hypoventilation
- Gastroesophageal reflux
- Nocturnal Seizures
- PLMD (Pediatric Limb Movement Disorder)
- SIDS

Sleep center environment

Recording parameter

Capinography

- End tidal
- Transcutaneous

Audio and video recording

Paediatric montages

Biocalibrations

## **Unit – IV**

### **EMG**

Basics

Recording techniques

Muscles and localization

Insertional activity

Spontaneous activity

Motor units

Polyphasic

SFEMG

Jitter and blocking

SEMG

QEMG

Fasciculations

Fibrillations

Macro EMG

Types of needles

## **Unit – V**

### **Normal and abnormal patterns**

Endplate potential

MUP

Localization technique

Neurogenic patterns

Myopathic patterns

**Clinical conditions**

ALS

Myopathy

Myotonia

Dystonia

Muscular dystrophies

DMD

Polymyocitis

Anterior poliomyelitis

Willson disease

Deep tendon reflex

**Unit – VI**

Patient safety in EMG

Computer application in EMG

Therapeutic AIDS for few  
neurological disorder

VNS

TMS

ECT

FES

## **Unit – VII**

### **Autonomic Function Studies**

Sympathetic skin response

R-R interval

**Practicals:** Includes the abovementioned theory units

### **Recommended Books**

1. Electrodiagnosis An Anatomical & Clinical Approach – Chu-Andrews, Robert J, Johnson
2. Laboratory Reference for Clinical Neurophysiology – Jay.A.Liveson  
Dong.M.Ma

### **Reference Books**

1. Electrodiagnosis in Diseases of Nerve and Muscle: Principles and Practice by Jun Kimura
2. Clinical Electromyography – Shin J. OH

### **PRACTICAL EXAMINATION:**

One common practical for all the papers with equal weightage of marks i.e. 40 practical marks for each paper.

## SYSTEMIC DISEASES

### CONCEPTS OF DISEASE AND OUTLINES OF CLINICAL EVALUATION RELATED TO NEUROSCIENCE TECHNOLOGY

Theory 50 hours

#### Course Objective

This course will cover common diseases and their causes, pertinent microbiology and pathology of the system involved, outline of major signs and symptoms and management of the disease including medical and surgical intervention.

The basic neurological examination with emphasis on

#### Unit – I

- ❖ CVA Cause, Types, syndromes, treatment
  - Ischaemic diseases
  - Thrombotic
  - Embolic
- ❖ Trauma Head injury
  - Spinal
  - Peripheral
  - Vascular diseases
- ❖ Hemorrhagic
- ❖ Intra cerebral hemorrhage
- ❖ Sub arachnoid hemorrhage
- ❖ Haematoma
- ❖ Hemiplegia
- ❖ Hemiparesis
- ❖ Quadriplegia
- ❖ Paraplegia
- ❖ Extradural haematoma
- ❖ Damage of Lobes
- ❖ Effects of cerebella lesion
- ❖ Bed sores

#### Unit – II

- ❖ Infectious diseases
  - Bacterial



Mycobacterial

Viral

Fungal

Spirochetal

Rickettsial

Viral encephalitis

Tuberculosis meningitis

Japanese encephalitis

❖ Demyelinating disease

CIDP

Central Multiple sclerosis

Peripheral other Demyelinating neuropathies

**Unit – III**

❖ Somatic disorders

Pain

Headache

Backache

Craniofacial pains

Cervical spondylosis

Thoracic out let syndrome

**Unit – IV**

❖ Disorders of speech & Language

Aphasia & its types

Articulation & phonation

Disease of cranial nerves

V & VII nerve

**Unit – V**

❖ Inherited metabolic disease

Autosomal disease

Mitochondrial disease

- ❖ Disturbances of cerebrospinal fluid - Hydrocephalus

## **Unit – VI**

- ❖ Sleep & its abnormalities  
Physiology  
Sleep disorders
- ❖ Developmental disease of nervous system  
Microcephaly, Macrocephaly

## **Unit – VII**

### **Epilepsies**

Classification & clinical approach

Epileptic syndrome

Treatment

## **Unit – VIII**

### **Disorders of PNS & Neuromuscular transmission**

Neuropathies/entrapment and infective neuropathies-Leprosy, Rabies

Myasthenia gravis

Myasthenic syndrome

Botulism

## **Unit – IX**

### **Disorder of muscle**

Twitches & pain & cramps

Inflammatory myopathies

Muscular dystrophies – Classification

Metabolic & toxic myopathies

Congenital muscular disorders

Myotonia

## **Unit – X**

### **Degenerative disorders & Classification**

Alzheimers

Dementia

Chorea

### **Extrapyramidal disorders**

Parkinsonism

### **Unit – XI**

#### **Disorders of Autonomic Nervous system**

Physiology

Regulation of BP

### **Unit – XII**

#### **Disorders of equilibrium**

Vertigo

Toxic and metabolic disorders

Deficiency disorders

Migraine

Giddiness

Syncope

Loss of Consciousness

**Practicals:** Includes the abovementioned theory units

#### **Recommended Books**

1. Principles of Neurology – Victor Adams
2. Neurology and Neurosurgery Illustrated - Kenneth W. Lindsay

#### **Reference Books**

Neurology in Clinical Practice Principles of Management and Diagnosis – Bradley Daroff  
Fenichel Jankovic

**NO PRACTICAL EXAMINATION**

**SUBSIDIARY SUBJECTS**

## RESEARCH METHODOLOGY & STATISTICS

THEORY HOURS: 60

### 1. Introduction I: Biostatistics

Definition

Role of statistics in health science and health care delivery system

### 2. Introduction II: Research Methodology

Research process

Steps involved in research process

Research methods and methodology

### 3. Variables and scales of measurements

Definitions and examples of qualitative, quantitative, continuous discrete, dependent and independent variables.

Definitions, properties and examples of nominal, ordinal, interval and ratio scales of measurements

### 4. Sampling

- ✓ Population, sample, sampling, reasons for sampling, probability and non-probability sampling.
- ✓ Methods of probability sampling – simple random, stratified, systematic- procedure
- ✓ Merits and demerits.
- ✓ Use of random number table.

### 5. Organization of data

Frequency table, histogram, frequency polygon, frequency curve, bar diagram, pie chart

### 6. Measures of location

- ✓ Arithmetic mean, median, mode, quartiles and percentiles – definition

Computation (for raw data), merits, demerits and applications

### 7. Measures of variation

- ✓ Range, inter-quartile range, variance, standard deviation, coefficient of variation- definition

Computation (for raw data), merits, demerits and applications

### 8. Normal distribution

- ✓ Concept, graphical form, properties, examples

Concept of Skewness and Kurtosis

### **9. Correlation**

- ✓ Scatter diagram

concept and properties of correlation coefficient, examples [No computation]

### **10. Health Information System**

- ✓ Definition, requirement, component and uses of health information system.

Sources of health information system- Census, Registration of vital events, Sample registration system (SRS), Notification of diseases, Hospital records, Disease registries, Record linkage, Epidemiological surveillance, Population survey

### **11. Vital statistics and hospital statistics**

Rate, ratio, proportion, Incidence, Prevalence. Common morbidity, mortality and Fertility statistics – Definition and computation.

### **12. Hypothesis**

- ✓ What is hypothesis
- ✓ Formulation of hypothesis

Characteristics of good hypothesis.

### **13. Epidemiology**

- ✓ Concept of health and disease
- ✓ Definition and aims of Epidemiology,

Descriptive Epidemiology- methods and uses.

### **14. Concept of reliability & validity**

### **RECOMMENDED BOOKS**

1. Methods in Biostatistics for medical students & Research workers Mahajan B.K.- 6<sup>th</sup> edition
2. Research methodology – Methods & techniques Kothari.C.R
3. Introduction to Biostatistics: A manual for students in health sciences Sundar Rao PSS, Richard.J
4. Text book of Preventive and social medicine Park.E.Park

**REGULATIONS & CURRICULUM OF  
GRADUATE PARAMEDICAL COURSE  
  
BACHELOR OF SCIENCE IN  
  
RENAL DIALYSIS TECHNOLOGY  
  
2020**



**Sri Siddhartha  
Academy of Higher Education  
Deemed-to-be-University**

**Established under Section 3 of the UGC Act, 1956  
MHRD, GOI No. F.9-31/2006-U.3 (A) Dtd. 30th May 2008**

**Agalakote, B.H. Road, Tumkur – 572107, Karnataka, India**

# SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

(DEEMED TO BE UNIVERSITY)

Declared under Section 3 of the UGC Act, 1956, MHRD GOI No. F.9-31/2006-U.3 (A) Dated: 30/05/2008

Accredited 'A' Grade by NAAC

Agalakote, B.H.Road, Tumkur – 572 107.KARNATAKA, INDIA.

Ph. 0816- 2275516, Fax : 0816-2275510 website: sahetumkur.ac.in email: info@sahe.in



No. SSAHE/ACA-S&C(AHSP)/16/2022

Date: 01/09/2022

## NOTIFICATION

Sub: Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Renal Dialysis Technology.

- Ref: 1). Proceedings of BOS Allied Health Sciences Programmes held on 06/04/2021  
2). Proceedings of the Academic Council meeting held on 19/08/2021  
3). Proceedings of the Board of Management held on 29/08/2022

In exercise of the powers vested under section 6 of 6.4 of MoA / Rules of SSAHE, the Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Renal Dialysis Technology is notified herewith as per Annexure.

The above Regulations shall be applicable to the students admitted to the said course from the academic year 2020-21 onwards.

By Order,

REGISTRAR

REGISTRAR

Sri Siddhartha Academy of Higher Education  
TUMKUR - 572 107, Karnataka.

To,  
Dean / Principal, Sri Siddhartha Medical College & Hospital,

Copy to

- 1) Office of the Chancellor, SSAHE, for kind information,
- 2) PA to Vice-Chancellor / PA to Registrar / Controller of Examinations / Finance Officer, SSAHE
- 3) The Director (AHSP), SSAHE
- 4) All Officers of the Academy Examination Branch / Academic Section
- 5) Guard File / Office copy.

**REVISED ORDINANCE GOVERNING REGULATIONS & CURRICULUM OF B. Sc RENAL DIALYSIS TECHNOLOGY-**

**2020**

**1. Eligibility for admission:**

A candidate seeking admission to the B.Sc. Renal Dialysis Technology shall have studied English as one of the principal subject during the tenure of the course and shall have passed:

1. Two year Pre-University examination or equivalent as recognised by Sri Siddhartha Academy of Higher Education with, Physics, Chemistry and Biology as subjects of study.

OR

2. Pre-Degree course from a recognised University considered as equivalent by SSAHE, (Two years after ten years of schooling) with Physics, Chemistry and Biology as subjects of study.

OR

3. Any equivalent examination recognised by the Sri Siddhartha Academy of Higher Education, Tumkur for the above purpose with Physics, Chemistry and Biology as subjects of study.

OR

4. The vocational higher secondary education course conducted by Vocational Higher Secondary Education, Government of Kerala with five subjects including Physics, Chemistry, Biology and English in addition to vocational subjects conducted is considered equivalent to plus TWO examinations of Government of Karnataka Pre University Course.

OR

5. Candidates with two years diploma from a recognised Government Board in Renal Technology shall have passed class 12 [10+2] with Physics, Chemistry and Biology, as subjects or candidates with 3 years diploma from a recognised Government Board in Renal Dialysis Technology should have studied Physics, Biology and Chemistry as subjects during the tenure of the course.

6. Lateral entry to the second Year of B.Sc. Renal Dialysis Technology for candidates who have passed diploma program from the Government Boards and recognised by SSAHE, fulfilling the conditions specified above under Sl. No. 5 and these students are eligible to take admission on lateral entry system only in the same subject studied at diploma level for the academic year.



**Note:**

- a. The candidate shall have passed individually in each of the subjects.
- b. Candidates who have completed diploma or vocational course through Correspondence shall not be eligible for any of the courses mentioned above.

**2. Duration of the course:**

Duration shall be for a period of four years including one Year of Internship.

**3. Medium of instruction:**

The medium of instruction and examination shall be in English.

**4. Scheme of examination:**

There shall be three examinations, one each at the end of 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> Year and Practical examination 4<sup>th</sup> Year.

**5. Attendance**

Every candidate should have attended at least 80% of the total number of classes conducted in an academic year from the date of commencement of the term to the last working day as notified by University in each of the subjects prescribed for that Year separately in Theory and practical. Only such candidates are eligible to appear for the university examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A candidate lacking in prescribed percentage of attendance in any subjects either in Theory or practical in the first appearance will not be eligible to appear for the University Examination in that subject

- The marks of the internal assessment must be displayed on the notice board of the respective colleges with in a fortnight from the date test is held.
- If a candidate is absent for anyone of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

**6. Internal Assessment (IA):**1st Year B.Sc. Renal Dialysis

Theory - 20 marks

Practicals - 10 marks\*. [Lab work- 06 marks and Record-04 marks]

2nd & 3rd year B.Sc. Renal Dialysis

Theory – 20 Marks

Practicals – 20 Marks

There shall be a minimum of two periodical tests, preferably one in each term in Theory and Practical of each subject in an academic year. The average marks of the two tests will be calculated and reduced to 20. The marks of IA shall be communicated to the University at least 15 days before the commencement of the University examination. The University shall have access to the records of such periodical tests. The marks of the internal assessment must be displayed on the notice board of the respective colleges within a fortnight from the date test is held. If a candidate is absent for anyone of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

\* There shall be no University Practical Examination in First Year.

## 7. Subject and hours of teaching for Theory and Practicals

The number of hours of teaching theory and practical, subject wise in first Year, second Year and third Year are shown in Table-I, Table-II and Table-III

Main and Subsidiary subjects are common in First Year for all the courses in Allied Health Science.

**Table - I : Distribution of Teaching Hours in First Year Subjects**

### Main subjects

| Paper | Subjects                                                      | Theory No. of Hours | Practical No. of Hours | Total No. of Hours |
|-------|---------------------------------------------------------------|---------------------|------------------------|--------------------|
| 1     | Basic Anatomy (Including Histology)                           | 70                  | 20                     | 90                 |
| 2     | Physiology                                                    | 70                  | 20                     | 90                 |
| 3     | Biochemistry                                                  | 70                  | 20                     | 90                 |
| 4     | Pathology I (Clinical Pathology, Haematology & Blood Banking) | 70                  | 20                     | 90                 |
| 5     | Microbiology                                                  | 70                  | 20                     | 90                 |
|       | <b>Total</b>                                                  | <b>350</b>          | <b>100</b>             | <b>450</b>         |

The classes in main and subsidiary subjects are to be held from Monday to Thursday. On Fridays and Saturdays, students shall work in hospitals in the respective speciality or department chosen by them

### Subsidiary Subjects

English            25 Hours  
Kannada          25 Hours  
Health Care      40 Hours

Clinical/Lab posting –470 hours. (Friday 9 am – 1 pm and 2 pm - 4-30 pm Saturday 9 am - 1 pm).

**Table - II Distribution of Teaching Hours in Second Year Subjects**

**Main Subjects**

| Paper | Subjects                                                             | Theory -No. of Hours | Practical- No. Of Hours | Clinical Postings | Total No. of Hours |
|-------|----------------------------------------------------------------------|----------------------|-------------------------|-------------------|--------------------|
| 1     | Applied anatomy & physiology related to dialysis technology          | 80<br>(40+40)        | 30<br>(15+15)           |                   | 110                |
| 2     | Pharmacology related to Haemodialysis and Peritoneal Dialysis        | 70                   | 10                      |                   | 80                 |
| 3     | Concepts of renal disease: Clinical manifestation and its management | 70                   | 10                      |                   | 80                 |
| 4     | Applied aspects of pathology & microbiology                          | 80                   | 30<br>(15+15)           |                   | 110                |
| 5     | Basics of Renal Dialysis Technology                                  | 80                   | 30                      | 750               | 860                |
|       | <b>Total</b>                                                         | <b>380</b>           | <b>110</b>              | <b>750</b>        | <b>1240</b>        |

**Subsidiary Subject:**

**Nutrition – 20 Hours**

**Table - III Distribution of Teaching Hours in Third Year Subjects**

**Main Subjects**

| Paper        | Subjects                             | Theory Number of hours | Practical Number of hours | Clinical posting | Total No    |
|--------------|--------------------------------------|------------------------|---------------------------|------------------|-------------|
| 1            | Applied Dialysis Technology Paper I  | 70                     | 100                       | 520              | 670         |
| 2            | Applied Dialysis Technology Paper-II | 70                     | 100                       | 520              | 670         |
| <b>Total</b> |                                      | <b>140</b>             | <b>200</b>                | <b>1040</b>      | <b>1380</b> |

**Subsidiary Subjects:**

1. Medico-legal aspects of health care 20 Hours
2. Basic principles of blood transfusion & fluid therapy 10 hours
3. Health care management 20 hours

## 8. Schedule of Examination:

The University shall conduct two examinations annually at an interval of not less than 4 to 6 months as notified by the University from time to time. A candidate who satisfies the requirement of attendance, progress and conduct as stipulated by the University shall be eligible to appear for the university examination. Certificate to that effect shall be produced from the Head of the institution along with the application for examination and the prescribed fee.

## 9. Scheme of Examination

There shall be three theory examinations, one each at the end of I, II and III year. The examination for both main and subsidiary subjects for all courses in Allied Health Sciences shall be common in the First Year. Distribution of Subjects and marks are shown in Table – IV, V, VI & VII.

### First year examination:

The University examination for 1st Year shall consist of only theory examination, and there shall be no University Practical Examination.

Written Examinations consists of

- 05 papers in the First Year.

### Second & Third-year examination:

The University examination for second and 3rd Year shall consist of Written Examination & Practical.

Written Examinations consists of

- 05 papers in the 2nd Year
- 02 papers in the 3rd Year.

Practical examination:

- Two practical examinations, at the end 2nd Year
- Two practical examinations at the end of the 3rd Year, Common practical Exam for two papers with an equal weightage of marks

### Fourth Year Practical Examination:

End of the fourth Year, Practical Exam will be conducted based on the clinical practice during internship

**TABLE-IV**

**Distribution of Subjects and marks for First-Year University theory Examination**

| Paper | Subject                             | Written Exam |       | IA Theory | Total |
|-------|-------------------------------------|--------------|-------|-----------|-------|
|       |                                     | Duration     | Marks | Marks     | Marks |
| 1     | Basic Anatomy (Including Histology) | 3 Hours      | 80    | 20        | 100   |
| 2     | Physiology                          | 3 Hours      | 80    | 20        | 100   |
| 3     | Biochemistry                        | 3 Hours      | 80    | 20        | 100   |
| 4     | Pathology                           | 3 Hours      | 80    | 20        | 100   |
| 5     | Microbiology                        | 3 Hours      | 80    | 20        | 100   |
|       | Subsidiary Subject**                |              |       |           |       |
| 1     | English                             | 3 Hours      | 80    | 20        | 100   |
| 2     | Kannada                             | 3 Hours      | 80    | 20        | 100   |
| 3     | 3 Health Care                       | 3 Hours      | 80    | 20        | 100   |

Note: I A = Internal Assessment

\*Main Subjects shall have University Examination.

There shall be no University Practical Examination

\*\*Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

**TABLE – V**

**Distribution of Subjects and marks for Second Year Examination of B.Sc. Renal Dialysis**

| Paper | Subjects                                                             | Theory     |    |           | Practical      |    |           | Total |
|-------|----------------------------------------------------------------------|------------|----|-----------|----------------|----|-----------|-------|
|       |                                                                      | Univ. Exam | IA | Sub Total | Practical Exam | IA | Sub Total |       |
| 1     | Applied anatomy and physiology related to dialysis technology        | 80         | 20 | 100       | No Practical   | -  | -         | 100   |
| 2     | Pharmacology related to Haemodialysis and Peritoneal Dialysis        | 80         | 20 | 100       | No Practic     | -  | -         | 100   |
| 3     | Concepts of renal disease: Clinical manifestation and its management | 80         | 20 | 100       | No Practical   | -  | -         | 100   |
| 4     | Applied aspects of Pathology and Microbiology                        | 80         | 20 | 100       | 80             | 20 | 100       | 200   |
| 5     | Basics of Renal Dialysis Technology                                  | 80         | 20 | 100       | 80             | 20 | 100       | 200   |

**Distribution of Subsidiary Subjects and marks for Second Year Examination of B.Sc. Renal Dialysis**

| Sl No | Subjects  | Duration | Marks | IA Marks | Total |
|-------|-----------|----------|-------|----------|-------|
| 1     | Nutrition | 3 Hours  | 80    | 20       | 100   |

Note: I A = Internal Assessment

\*\*Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

**TABLE – VI****Distribution of Subjects and marks for Third Year Examination of B.Sc Renal Dialysis**

| Paper | Subject                              | Theory     |    |           | Practical        |               |           | Grand Total |
|-------|--------------------------------------|------------|----|-----------|------------------|---------------|-----------|-------------|
|       |                                      | Univ. exam | IA | Sub Total | Univ. Practical* | IA            | Sub Total |             |
| I.    | Applied dialysis Technology paper-I  | 80         | 20 | 100       | 160<br>(80 + 80) | 40<br>(20+20) | 200       | 400         |
| II    | Applied Dialysis Technology Paper-II | 80         | 20 | 100       |                  |               |           |             |

\*Common practical Exam for two papers with an equal weightage of marks.

**Distribution of Subsidiary Subjects and marks for Third Year Examination of B.Sc. Renal Dialysis**

| Paper    | Subjects                                              | Duration | Marks | I A Marks | Total Marks |
|----------|-------------------------------------------------------|----------|-------|-----------|-------------|
| <b>1</b> | Medico-legal aspects of health care                   | 3 Hours  | 80    | 20        | 100         |
| <b>2</b> | Basic principles of blood transfusion & fluid therapy | 3 Hours  | 80    | 20        | 100         |
| <b>3</b> | Health care management                                | 3 Hours  | 80    | 20        | 100         |

\*\* Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges

**TABLE – VII****Distribution of Subjects and marks for 4<sup>th</sup> Year Practical Examination of B.Sc. Renal Dialysis**

| Paper | Subject   | Theory    |    |           | Practical      |    |           |       |
|-------|-----------|-----------|----|-----------|----------------|----|-----------|-------|
|       |           | Univ Exam | IA | Sub Total | Practical Exam | IA | Sub Total | Total |
| 1.    | Practical | -         | -  | -         | 170            | 30 | 200       | 200   |

## **10. Pass criteria**

### **10.1. First-year examination**

- a. Main Subjects: A candidate is declared to have passed in a subject, if he/she secures, 50% of marks in University Theory exam and internal assessment added together.
- b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

### **10.2. Second and Third year Examination**

- a. Main Subjects: A candidate is declared to have passed the examination in a subject if he/she secures 50% of the marks in Theory and 50% in practical separately. For a pass in Theory, a candidate has to secure a minimum of 40% marks in the University conducted written examination, and 50% in aggregate in the University conducted written examination and internal assessment added together and for pass in Practical, a candidate has to secure a minimum of 40% marks in the University conducted Practical/Clinical examination and 50% in aggregate i.e. University conducted Practical/Clinical and Internal Assessment.
- b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

## **11. Carryover benefit**

### **11.1 First year examination:**

A candidate who fails in any two of the five main subjects of first Year shall be permitted to carry over those subjects to second Year. However, he/ she must pass the carry over subjects before appearing for second year examination.

### **11.2. Second year examination:**

A candidate is permitted to carry over any one main subject to the third year but shall pass this subject before appearing for the third year examination.

## **12. Declaration of Class**

- a. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with Distinction.
- b. A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 60% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in First Class.
- c. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than 60% of grand total marks prescribed will be declared to have passed the examination in Second Class.
- d. A candidate passing the university examination in more than one attempt shall be placed in Pass class irrespective of the percentage of marks secured by him/her in the examination.
- e. The marks obtained by a candidate in the subsidiary subjects shall not be considered for award of Class or Rank.

[Please note, fraction of marks should not be rounded off clauses (a), (b) and (c)]

### 13. Eligibility for the award of Degree:

A candidate shall have passed in all the subjects of first, second and third year to be eligible for a compulsory 12 months of rotational internship. On completion of 12 months of the internship with pass criteria in outgoing clinical assessment exams the candidate is then eligible for the award of degree

### 14. Distribution of Type of Questions and Marks

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>First year</b> ) |                  |                          |
|------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                          | No. of Questions | Marks for Each Questions |
| Long Essay                                                 | 1                | 10                       |
| Short Essay                                                | 5                | 5                        |
| Short Notes Type                                           | 5                | 3                        |
| Short Answer Type                                          | 10               | 2                        |
| MCQ's                                                      | 10               | 1                        |

- |                                                     |                  |
|-----------------------------------------------------|------------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks   |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks   |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks   |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks   |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks   |
|                                                     | <b>Total= 80</b> |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Second and Third Year</b> ) |                  |                          |
|-----------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                     | No. of Questions | Marks for Each Questions |
| Long Essay                                                            | 1                | 10                       |
| Short Essay                                                           | 5                | 5                        |
| Short Notes Type                                                      | 5                | 3                        |
| Short Answer Type                                                     | 10               | 2                        |
| MCQ's                                                                 | 10               | 1                        |

- |                                                     |                  |
|-----------------------------------------------------|------------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks   |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks   |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks   |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks   |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks   |
|                                                     | <b>Total= 80</b> |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Subsidiary subjects</b> ) |                  |                          |
|---------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                   | No. of Questions | Marks for Each Questions |
| Essay Type                                                          | 3 (2 x 10)       | 10                       |
| Short Essay Type                                                    | 8 (6 x 5)        | 05                       |
| Short Answer Type                                                   | 12 (10 x 3)      | 03                       |



## **15. Internship**

Twelve-month compulsory rotational postings during the internship which students have to work under the supervision of experienced staff in the following areas:

- ICU Dialysis
- Paediatric Dialysis
- Peritoneal Dialysis
- CRRT
- Plasmapheresis
- Haemodialysis
- Nephrology Procedure room
- Two Weeks Posting with Kidney transplant coordinator
- Two Week Posting in Emergency Department

## **FIRST YEAR B.SC RENAL DIALYSIS TECHNOLOGY**

### **Paper 1: BASIC ANATOMY ( INCLUDING HISTOLOGY)**

No. of theory classes: 70 hours

No. of practical classes: 20 hours

#### **1. Introduction:**

##### **Theory:**

- Definition of anatomy and its divisions
- Terms of location, positions and planes
- Epithelium-definition, Classification, describe with examples, function
- Glands- classification, describe serous, mucous & mixed glands with examples
- Basic tissues – Classification with examples

##### **Practical:**

- Histology of types of epithelium
- Histology of serous, mucous & mixed salivary gland

#### **2. Connective tissue:**

##### **Theory:**

- Cartilage – types with example & histology Theory
- Bone – Classification, names of bone cells, parts of long bone, microscopy of compact bone, names of all bones, vertebral column, intervertebral disc, fontanelles of fetal skull
- Joints – Classification of joints with examples, synovial joint (in detail for radiology)
- Muscular system: Classification of muscular tissue & histology
- Names of muscles of the body

##### **Practical:**

- Histology of the 3 types of cartilage
- Histology of compact bone (TS & LS)
- Histology of skeletal (TS & LS) & cardiac muscle
- Demo of all bones showing parts, radiographs of normal bones & joints
- Demonstration of important muscles of the body

#### **3. Cardiovascular system:**

##### **Theory:**

- Heart-size, location, chambers, exterior & interior, pericardium
- Blood supply of heart
- Systemic & pulmonary circulation
- Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery
- Inferior vena cava, portal vein, portosystemic anastomosis ,Great saphenous vein, Dural venous sinuses
- Lymphatic system- cisterna chyli & thoracic duct ,Histology of lymphatic tissues, Names of regional lymphatics, axillary and inguinal lymph nodes in brief

##### **Practical:**

- Demonstration of heart and vessels in the body
  - Histology of large artery & vein, medium sized artery & vein
  - Histology of lymph node, spleen, tonsil & thymus
  - Radiology: Normal chest radiograph showing heart shadows

#### **4. Gastro-intestinal system**

##### **Theory:**

- Parts of GIT: Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring), Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas, spleen, peritoneum & reflections

##### **Practical:**

- Demonstration of parts of GIT
- Radiographs of abdomen

#### **5. Respiratory system**

- Parts of RS: nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments, diaphragm
- Histology of trachea, lung and pleura
- Names of paranasal air sinuses

##### **Practical:**

- Demonstration of parts of respiratory system.
- Normal radiographs of chest, X-ray paranasal sinuses
- Histology of lung and trachea

#### **6. Urinary system**

##### **Theory:**

- Kidney, ureter, urinary bladder, male and female urethra
- Histology of kidney, ureter and urinary bladder

##### **Practical:**

- Demonstration of parts of urinary system
- Histology of kidney, ureter, urinary bladder
- Radiographs of abdomen-IVP, retrograde cystogram

#### **7. Reproductive system**

##### **Theory:**

- Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology)
- Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology)
- Mammary gland – gross

##### **Practical:**

- Demonstration of section of male and female pelvis with organs in situ
- Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes, ovary
- Radiographs of pelvis – hysterosalpingogram

#### **8. Endocrine glands**

##### **Theory:**

- Names of all endocrine glands in detail on pituitary gland, thyroid gland & suprarenal gland – (gross & histology)

##### **Practical:**

- Demonstration of the glands

- Histology of pituitary, thyroid, parathyroid, suprarenal glands

## **9. Nervous system**

### **Theory:**

- Neuron & Classification of NS
- Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (gross & histology) Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei
- Blood supply of brain
- Cranial nerves
- Sympathetic trunk & names of parasympathetic ganglia

### **Practical:**

- Histology of peripheral nerve & optic nerve
- Demonstration of all plexuses and nerves in the body
- Demonstration of all part of brain
- Histology of cerebrum, cerebellum, spinal cord

## **10. Sensory organs**

### **Theory:**

- Skin: Skin-histology & Appendages of skin
- Eye: Parts of eye & lacrimal apparatus, Extra-ocular muscles & nerve supply
- Ear: parts of ear- external, middle and inner ear and contents

### **Practical:**

- Histology of thin and thick skin
- Demonstration and histology of eyeball
- Histology of cornea & retina

## **11. Embryology:**

### **Theory:**

- Spermatogenesis & oogenesis
- Ovulation, fertilisation
- Fetal circulation
- Placenta

## **INTERNAL ASSESSMENT**

|                                     |          |
|-------------------------------------|----------|
| Theory-average of 2 exams conducted | 20 Marks |
| Practicals: record and lab work *   | 10 Marks |

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the University.

### Distribution of Marks for University Theory and Practical Exam

| Theory |    |           | Practicals |    |           | Total |
|--------|----|-----------|------------|----|-----------|-------|
| Theory | IA | Sub Total | Practicals | IA | Sub Total |       |
| 80     | 20 | 100       | -          | -  | -         | 100   |

#### REFERENCE BOOKS:

1. William Davis (P) understanding Human Anatomy and Physiology – McGraw Hill
2. Chaurasia- A Text Book of Anatomy
3. T. S. Ranganathan- A Text Book of Human Anatomy
4. Fattana, Human Anatomy (Description and applied)- Saunder's & C P Prism Publishers, Bangalore
5. ESTER. M. Grishcimer- Physiology & Anatomy with Practical Considerations, J. P. Lippin Cott. Philadelphia
6. Bhatnagar- Essentials of Human Embryology- Revised Edition. Orient Blackswan Pvt. Ltd

### Paper 2: PHYSIOLOGY

No. of theory classes: 70 hours

No. of practical classes: 20 hours

#### 1. General Physiology

- Introduction to cell physiology, transport across the cell membrane
- Homeostasis, Body Fluid compartment & measurement

#### 2. Blood

- Introduction - composition and function of blood
- Plasma. proteins, types and functions
- Red blood cells - erythropoiesis, stages of differentiation, factors affecting it, function, normal count, physiological variation.
- Haemoglobin- function, concentration, types & methods of Hb estimation, fate of haemoglobin
- Jaundice-types Anaemia,-types
- ESR, PCV, osmotic fragility & blood indices
- WBC- morphology, production, functions, normal count, differential count, variation, variation Immunity (in brief)
- Platelets- origin, morphology, normal count, function-Platelet plug, bleeding disorder
- Haemostasis - definition, normal haemostasis, clotting factors, mechanism of clotting, anticoagulants disorders of clotting factors.

- Blood group-ABO & Rh system, Rh incompatibility blood typing ,cross matching, hazards of mismatched blood transfusion.
- RES, spleen and lymph

### **3. Nerve-Muscle**

- Neuron structure, types, neuroglia-types, nerve fibre classification, properties of nerve fibres, RMP, action potential, Wallerian degeneration
- NMJ, blockers, Myasthenia gravis
- Classification of muscle, the structure of skeletal muscle, sarcomere, contractile proteins
- Excitation contraction coupling, mechanism of muscle contraction, types of contraction
- Motor unit, fatigue, rigour mortis Smooth muscle

### **4. Respiratory system**

- Physiological anatomy of the respiratory system, muscles of respiration, respiratory & non-respiratory functions of lungs, dead space
- Mechanics of breathing, intrapulmonary & pleural pressures
- Compliance, Surfactant, Hyaline membrane disease
- Lung volumes and capacities
- Respiratory membrane , transport of O<sub>2</sub> & CO<sub>2</sub>
- Chemical regulation of respiration
- Neural regulation of respiration
- Hypoxia, Acclimatization,
- Dysbarism. Artificial respiration
- Definition-Periodic breathing ,dyspnoea, apnoea, asphyxia,, cyanosis

### **5. Cardiovascular system**

Introduction to CVS & general principles of circulation

- Properties of Cardiac muscle
- Cardiac cycle, heart sounds, Pulse
- Cardiac output, factors and measurement
- Heart rate
- BP-factors, measurement, Short term regulation
- Intermediate and long term regulation of BP
- ECG uses and significance, .normal waveform, heart block
- Coronary circulation, Cutaneous circulation-Triple response
- Shock
- Effects of exercise on CVS and Respiratory system

### **6. Renal system, Skin and body temperature**

- Kidneys- functions, structure of nephron, type, juxtaglomerular apparatus-structure and function, non-excretory functions of kidney
- Glomerular filtration rate (GFR)- Definition ,normal value, factors affecting GFR
- Tubular reabsorption - sites, substance reabsorbed, mechanisms of reabsorption
- Tubular secretion- sites, substance secreted, mechanisms of reabsorption
- Counter current mechanism of concentration of urine
- Obligatory and Facultative reabsorption of water
- Micturition reflex, Diuretics
- Artificial kidney, renal function tests-clearance tests
- Skin -structure and function, body temperature measurement, physiological variation,
- Regulation of body Temperature by physical chemical and nervous mechanisms-Role of Hypothalamus
- Hypothermia and fever

## **7. Digestive system**

- Physiological anatomy, Enteric nervous system & functions of GIT
- Saliva- composition, regulation, disorder.
- Deglutition- stages & disorders
- Stomach- functions, composition and regulation of gastric juice
- Gastric motility, MMC, vomiting reflex.
- Pancreas- function, composition and regulation of pancreatic juice
- Liver & gall bladder- functions, bile- composition, secretion and regulation
- Small intestine- Succus entericus- composition, functions & movements
- Large intestine- functions, movements and defecation reflex
- Digestion & absorption of Carbohydrates, fats and proteins

## **8. Endocrine system**

- Classification of Endocrine glands & their hormones & properties- chemistry and receptor, feedback mechanisms of hormone regulation.
- Anterior pituitary hormones- secretion, functions, disorders
- Posterior pituitary hormones- secretion, functions, disorders
- Thyroid hormones- secretion, functions, disorders
- Parathyroid hormones- secretion, functions, disorders
- Calcium homeostasis & disorders
- Pancreatic hormones, -Insulin and Glucagon- . secretion, functions, disorders
- Adrenal cortex- Glucocorticoids & Mineralocorticoids, Androgen - secretion, functions, disorders
- Adrenal medulla- secretion, functions, disorders Thymus & Pineal gland

## **9. Reproductive system**

- Introduction to reproductive system, sex differentiation & Puberty
- Male reproductive system, functions of testosterone & Spermatogenesis
- Female reproductive system, functions of Estrogen, Progesterone, Oogenesis
- Ovulation & Menstrual cycle
- Physiological changes during pregnancy, pregnancy tests, parturition & lactation
- Male & Female contraceptive methods

## **10. Central nervous system**

- Introduction to CNS, Sensory receptors classification, properties
- Synapse- classification, properties
- Sensory pathways: Anterior spino thalamic tract and Posterior column pathway
- Lateral spino thalamic tract, Types of pain, Referred pain, Thalamus; nuclei and function
- Classification of reflexes, Monosynaptic reflex- Stretch reflex, muscle spindle, inverse stretch reflex. Polysynaptic reflex- Withdrawal reflex
- Motor pathways: Pyramidal pathway and functions, UMNL, LMNL
- Cerebral cortex (Sensory and motor)- functions, Medulla and Pons- functions
- Cerebellum - functions, disorders
- Basal ganglia- functions, disorders
- Hypothalamus and Limbic system- functions
- CSF, lumbar puncture
- Sleep, EEG,
- Autonomic Nervous System - Sympathetic and parasympathetic distribution and functions

## **11. Special senses**

- Vision - Functional anatomy of eye, visual pathway, lesion
- Refractive errors, color vision

- Audition – Physiological anatomy of Ear, Mechanism of hearing, auditory pathway, deafness
- Olfaction –modalities, receptor, function, abnormalities
- Gustation-modalities, receptor, function, taste pathway, abnormalities

### Practicals

Blood pressure Recording  
Auscultation for Heart Sounds  
Artificial Respiration  
Determination of vital capacity

### INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20 Marks  
Practicals: record and lab work\* 10 Marks

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the University.

### Distribution of Marks for University Theory and Practical Exam

| Theory |    |           | Practicals |    |           | Total |
|--------|----|-----------|------------|----|-----------|-------|
| Theory | IA | Sub Total | Practicals | IA | Sub Total |       |
| 80     | 20 | 100       | -          | -  | -         | 100   |

Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism Publishers

### Reference Books:

Chatterjee (CC) Human Physiology Latest Ed. Vol. 1, Medical Allied Agency

Choudhari (Sujith K) Concise Medical Physiology Latest Ed. New Central

Book Ganong (William F) Review of Medical Physiology. Latest Ed.



### **Paper 3: BIOCHEMISTRY**

No. Theory classes: 70 hours

No. of practical classes: 20 hours

#### **1. Carbohydrate Chemistry [3 hours]**

- Classification (Definition/ examples for each class)
- Monosaccharides (classification depending upon number of carbon atoms and functional group with examples)
- Disaccharides (Sucrose/ lactose/ maltose and their composition)
- Polysaccharides :
  - a) Homopolysaccharides (Structure of starch and glycogen)
  - b) Heteropolysaccharides (Functions )

**2.**

#### **Lipid Chemistry [3 hours]**

- Definition of lipids
- Functions of lipids in the body
- Classification of lipids (subclasses with examples)
- Definition and Classification of fatty acids
- Essential fatty acids
- Phospholipids and their importance

#### **3. Amino-acid and Protein Chemistry [3 hours]**

- General structure of D and L amino acids
- Amino acids; Definition and Classification of amino acids with examples.
- Peptides; definition & Biologically important peptides
- Classification of Proteins based on composition, functions and shape (with examples)
- Functions of amino acids and Proteins

#### **4. Nucleotide and Nucleic acid Chemistry [ 3 hours]**

- Nucleosides & Nucleotides
- Nucleic acid Definition & types
- Composition & functions of DNA & RNA
- Structure of DNA (Watson and Crick model)
- Structure of tRNA, & functions of tRNA, rRNA, mRNA
- Difference between DNA and RNA

#### **5. Enzymes [5 hours]**

- Definition & Classification of Enzymes with example
- Definitions of Active site, Cofactor (Coenzyme, Activator),
- Proenzyme; Definition and examples (Pepsin & trypsin)

#### **6. Digestion and Absorption [ 3 Hours]**

- General characteristics of digestion and absorption,
- Digestion and absorption of carbohydrates, proteins and lipids.

#### **7. Carbohydrate Metabolism [ 5 Hours]**

- Glycolysis ; Aerobic, Anaerobic, Definition , Site and subcellular site , Steps with all the enzymes and coenzymes at each step , mention the regulatory enzymes , Energetics,
- Citric acid cycle; Pyruvate dehydrogenase complex (reaction and coenzymes) , Site and

subcellular site , Reactions with all the enzymes and coenzymes ,Regulatory enzymes , Energetics

- Significance of HMP Shunt pathway.
- Hyperglycemic and hypoglycemic hormones
- Blood Glucose Regulation.
- Diabetes mellitus (definition, Classification, signs and symptoms)
- **Glycogen metabolism and gluconeogenesis**

#### **8. Lipid Metabolism [ 4 Hours]**

- Introduction to lipid metabolism, Lipolysis
- Beta oxidation of fatty acids ; Definition,Site and subcellular site, Activation of palmitic acid , Transport of activated palmitic acid into mitochondria , Reactions , Energetics
- Name the different ketone bodies. Note on ketosis

#### **9. Amino acid and Protein Metabolism [ 3 Hours]**

- Introduction, transamination, deamination, Fate of ammonia, transport of ammonia,
- Urea cycle.

#### **10. Vitamins [5 Hours]**

- Definition and Classification.
- RDA, sources, coenzyme forms, biochemical functions and disorders for the following water soluble vitamins: Thiamine, Niacin, Pyridoxine, Cobalamine, Folic acid, Ascorbic acid
- RDA, sources, coenzyme forms, biochemical functions and deficiency disorders for the following fat soluble vitamins; A and vitamin D

#### **11. Mineral Metabolism [3 Hours]**

- Name the macro/ microminerals
- Iron: Sources ,RDA, Functions and Disorders of deficiency and excess
- Calcium and phosphorus: Sources ,RDA, functions, normal serum levels and hormones regulating their levels

#### **12. Nutrition [6 hours]**

- Balanced diet (Definition)
- Caloric value ; Definition , Caloric values of carbohydrates, proteins and fats
- Total daily caloric requirements of an adult male and female,
- RDA (Definition, standard values for nutrients)
- Basal metabolic rate(BMR) ; Definition , Magnitude of BMR in men and women, Factors affecting BMR
- Thermic effect/ SDA of food (Definition, values for major macronutrients)
- **Carbohydrates** ;. Daily dietary requirement. 2. Dietary fibers (Definition, functions, importance and their daily requirements)
- **Proteins** ;. Daily requirement, Biological value. a. Definition b. Protein used as a standard for this, Protein sources with high and low biological value , Mutual supplementation of proteins (Definition, examples)
- **Fats** ; Daily requirement , Essential fatty acids (Definition, functions, daily requirement and deficiency manifestations) , Saturated and unsaturated fatty acids (Definition,

sources, examples)

- **Malnutrition**

**13. Renal Function Tests [ 2 hours]**

- Name the different tests to assess the kidney functions
- Explain Creatinine clearance & Inulin clearance
- Urinary acidification test

**14. Radioactive Isotopes [1 hour]**

- Definition, clinical applications
- Biological effects of radiations

**15. Clinical Biochemistry [ 5 hours ]**

A. Definitions of acid, base, pH and pKa [1 hour]

B. Buffers • Definition [2 hours]

- Henderson Hasselbalch equation,
- Principal buffer systems in the ECF ICF and urine
- Bicarbonate and phosphate buffer systems (pKa value, normal ratio of base/acid in the plasma)
- Acidosis & Alkalosis (Definition, Classification, causes and biochemical findings)

C. Normal serum levels and condition where they are altered [2 hour]

- Glucose, Protein, urea, uric acid, and creatinine
- Bilirubin, cholesterol
- Serum Electrolytes

**16. Fundamental Chemistry (1 hour)**

- Valency, Molecular weight & Equivalent weight of elements and compounds. Normality, Molarity, Molality.

**17. Solutions: Definition, use, Classification where appropriate, preparation and storage (5 hours)**

- Stock and working solutions.
- Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H<sub>2</sub>SO<sub>4</sub>, H<sub>3</sub>PO<sub>4</sub>, CH<sub>3</sub>COOH etc.,)
- Preparation of percent solutions – w/w, v/v w/v (solids, liquids and acids), Conversion of a percent solution into a molar solution
- Saturated and supersaturated solutions
- Standard solutions. Technique for preparation of standard solutions and storage. E.g: glucose, albumin etc.
- Dilutions- Diluting Normal , Molar and per cent solutions. Preparing working standard from stock standard.
- Part dilutions: Specimen dilutions. Serial dilutions. Reagent dilution. Dilution factors

### ASSIGNMENT TOPICS

1. Units of measurement
2. Hazards - Physical, Chemical, Biological
3. Arterial blood gas analysis
4. Responsibilities of Health care personnel
5. Biomedical waste management

### PRACTICAL DEMONSTRATION [20 hours]

- Colour Reactions of Carbohydrates & amino acids.
- Precipitation Reactions of proteins
- Colourimetry
- Estimation of Blood glucose Folin Wu and enzymatic method
- Estimation of Urea by DAM method

### INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20 marks

Practicals: record and lab work\* 10 marks

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the University.

### Distribution of Marks for University Theory and Practical Exam

| Theory |    |              | Practicals |    |              | Total |
|--------|----|--------------|------------|----|--------------|-------|
| Theory | IA | Sub<br>Total | Practicals | IA | Sub<br>Total |       |
| 80     | 20 | 100          | -          | -  | -            | 100   |

### Text Book References

- Biochemistry – 3<sup>rd</sup> revised Edition by U Sathyanarayana & U Chakrapani
- Textbook of Medical Biochemistry-6<sup>th</sup> Edition by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology 2<sup>nd</sup> edition by Godkar and Godkar.
- Biochemistry-3<sup>rd</sup> edition by Pankaja Naik
- Medical Laboratory technology 6<sup>th</sup> edition by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students-3<sup>rd</sup> edition by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> editions

## **Paper 4: PATHOLOGY: Clinical Pathology, Hematology and Blood Banking**

**Theory-70 hours**

**Practicals-20 hours**

### **I. Clinical Pathology- Theory**

- Introduction to clinical pathology
- Collection, transport, preservation and processing of various clinical specimens
- Urine examination- collection and preservation, Physical, chemical and microscopic examination for abnormal constituents
- Examination of Body fluids
- Examination of Cerebrospinal fluid (CSF)
- Sputum examination
- Examination of faeces

### **II. Hematology – Theory**

- Introduction to hematology
- Normal constituents of Blood, their structure and functions
- Collection of Blood samples
- Various anticoagulants used in Hematology
- Hemoglobin estimation, different methods and normal values
- Packed cell volume
- Erythrocyte sedimentation rate
- Normal Haemostasis
- Bleeding time. Clotting time, prothrombin time, Activated partial Thromboplastin time

### **III. Blood Bank- Theory**

- Introduction blood banking
- Blood group system
- Collection and processing of blood for transfusion
- Compatibility testing
- Blood transfusion reactions

### **VI. General Pathology:**

#### **1. Cell injury:**

- a. Definition, causes.
- b. Cellular adaptations – Hypertrophy, hyperplasia, atrophy and metaplasia.
- c. Types of cell injury – Reversible and irreversible; morphology of reversible injury.
- d. Necrosis – Definition and patterns of tissue necrosis.
- e. Intracellular accumulations – Lipids, cholesterol, proteins, glycogen and pigments; examples.
- f. Pathologic calcification – Types and examples.

#### **2. Inflammation:**

- g. Definition and signs of inflammation.
- h. Types – Acute and chronic inflammation.

- i. Acute inflammation – Causes, morphological patterns and outcome.
- j. Chronic inflammation – Causes, morphology and examples.
- k. Regeneration and repair – Mechanism of cutaneous wound healing.
- l. Factors affecting wound healing.

### **3. Hemodynamic disorders:**

- m. Edema – Definition, pathogenesis and types: Renal, cardiac, pulmonary and cerebral.
- n. Difference between transudate and exudate.
- o. Shock – Definition, types of shock with examples: Hypovolemic, cardiogenic and septic shock, stages of shock: Nonprogressive, progressive and irreversible.
- p. Thrombosis – Definition, mechanism of thrombus formation (Virchow's triad) and fate of thrombus.
- q. Embolism – Definition and types: Thromboembolism, fat, air and amniotic fluid embolism.
- r. Infarction – Definition and examples.

### **4. Immune system:**

- s. Autoimmune diseases – General features, enumerate systemic and organ specific autoimmune diseases.
- t. Systemic lupus erythematosus – Manifestations and diagnosis.

### **5. Neoplasia:**

- u. Definition and nomenclature of tumors.
- v. Differences between benign and malignant neoplasms.
- w. Enumerate modes of carcinogenesis: Genes, physical, chemical and microbial agents of carcinogenesis.
- x. Modes of spread of tumors.
- y. Clinical aspects of neoplasia.
- z. Grading and staging of cancers.
- aa. Laboratory diagnosis of cancer.

### **Practicals**

1. Urine analysis- Physical, Chemical, Microscopic
2. Blood grouping and Rh typing
3. Hb estimation , packed cell volume (PCV), Erythrocyte Sedimentation rate (ESR)
4. Bleeding time and Clotting time

### **INTERNAL ASSESSMENT**

|                                     |          |
|-------------------------------------|----------|
| Theory-average of 2 exams conducted | 20 Marks |
| Practicals: record and lab work*    | 10 Marks |

### Distribution of Marks for University Theory and Practical Exam

| Theory |    |           | Practicals |    |           | Total |
|--------|----|-----------|------------|----|-----------|-------|
| Theory | IA | Sub Total | Practicals | IA | Sub Total |       |
| 80     | 20 | 100       | -          | -  | -         | 100   |

#### REFERENCE BOOKS:

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss- Cytology 4. Winifred Diagnostic cytopathology
5. Orell Cytopathology
6. Todd and Sanford- clinical diagnosis by Laboratory Medicine
7. Dacie and Lewis- Practical Hematology
8. Ramnik SOOD. Lab technology, Methods and interpretation, 4 th edition JP Bros New Delhi, 1996
9. Sathish Guptha , Short text book of Medical laboratory techniques for technicians
10. Sachdev K N. Clinical Pathology and Bacteriology, 8 th edi JP Bros, New Delhi, 1996

#### Microbiology I

Theory: 70 Hours  
Practicals: 20 Hours

##### 1. Introduction (6 hrs)

History of Microbiology - Louis Pasteur, Antony Van Leeuwenhoek, Robert Koch, Edward Jenner, Alexander Fleming.

Use of microscope in the study of bacteria - Types of microscopes - compound microscope, phase contrast microscope, electron microscope, fluorescent microscope, dark ground microscope.

Morphology of bacterial cell

##### 2. Growth and Nutrition (6 hrs.)

Nutrition, growth and multiplication of bacteria, bacterial growth curve, culture media, culture methods, anaerobic culture methods.

##### 3. Sterilization and disinfection (8 hrs.)

Principles and use of equipments of sterilization, chemicals used in disinfection, testing of disinfectants.

##### 4. Biomedical waste management principle and practice

### **5. Immunology ( 5hrs.)**

Immunity - mechanism of immunity, classification, types

Vaccines

Immunization schedule

Definition of antigen, antibody, list of antigen antibody reaction (no need of detailed account of antigen antibody reactions)

Definition of hypersensitivity and classification (no need of detailed account of types of hypersensitivity)

### **6. Infection (5 hrs.)**

Definition, types and mode of transmission

Hospital acquired infection - causative agents, mode of transmission and prophylaxis.

Antimicrobial sensitivity testing

### **7. Systematic bacteriology (15 hrs.)**

Disease caused and laboratory diagnosis of medically important bacteria (Staphylococcus, coagulase negative Staphylococcus, MRSA, Streptococcus pyogenes, Pneumococcus, gonococcus, E.coli, diarrhoeagenic E.coli, Salmonella, Vibrio cholerae, ElTor vibrios, Halophilic vibrios, Shigella, Mycobacterium tuberculosis, Mycobacterium leprae, Atypical Mycobacteria, Treponema pallidum, leptospira)

(no need of classification, antigenic structure, virulence mechanism)

### **8. Parasitology (10 hrs.)**

Introduction to Parasitology

List of medically important parasites and diseases (E.histolytica, Plasmodium, W.bancrofti, Ascaris, Ancylostoma, B.coli, G.lamblia, T.solium, T.saginata)

Laboratory diagnosis of parasitic infection (No need of including life cycles)

### **9. Virology (10 hrs.)**

Introduction to virology

List of medically important viruses and diseases (AIDS, Hepatitis, Rabies, Polio, Arbo viruses)

Cultivation of viruses and laboratory diagnosis of viral infections

### **10. Mycology (5 hrs.)**

Introduction to Mycology

Classification of medically important fungi - (based on morphology, spore production, disease production, taxonomy)

List of medically important fungi and diseases (Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis, Mucor Mycosis)

Laboratory diagnosis of fungal infections.

### **Practicals (20 hrs.)**

Compound microscope (Demonstration)

Demonstration of sterilization equipments

Demonstration of culture media and culture methods

Demonstration of antibiotic sensitivity testing

Demonstration of serological tests - Widal, VDRL, ASO, CRP, RA

Demonstration of gram stain and ZN staining

Demonstration of Helminthic ova

Grams stain, Acid fast staining

Stool exam for Helminthic ova

There shall be no university practical examination and Internal Assessment marks secured in practicals need not be sent to the university.



### INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20 marks

Practicals: record and lab work\* 10 marks

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the University.

### Distribution of Marks for University Theory and Practical Exam

| Theory |    |              | Practicals |    |              | Total |
|--------|----|--------------|------------|----|--------------|-------|
| Theory | IA | Sub<br>Total | Practicals | IA | Sub<br>Total |       |
| 80     | 20 | 100          | -          | -  | -            | 100   |

### Reference Books-

1. Ananthanarayana & Panikar Medical Microbiology- University Press
2. Robert Cruickshank- Medical Microbiology- The Practice of Medical Microbiology
3. Chatterjee- Parasitology- Interpretation to Clinical Medicine
4. Rippon- Medical Mycology
5. Emmons- Medical Mycology
6. Basic Laboratory methods in Parasitology, J P Bros, New Delhi
7. Basic Laboratory procedures in clinical bacteriology, J P Bros, New Delhi
8. Medical Parasitology- Ajit Damle
9. Introduction to medical microbiology- Ananthanarayana- Orient Longman Pvt. Ltd

## **SUBSIDIARY SUBJECTS**

### **ENGLISH**

#### **COURSE OUTLINE**

**COURSE DESCRIPTION:** This course is designed to help the student acquire a good command and comprehension of the English language through individual papers and conferences.

#### **BEHAVIOURAL OBJECTIVES:**

The student at the end of training is able to

1. Read and comprehend English language
2. Speak and write grammatically correct English
3. Appreciates the value of English literature in personal and professional life.

#### **UNIT - I: INTRODUCTION:**

Study Techniques

Organisation of effective note taking and logical processes of analysis and synthesis

Use of the dictionary

Enlargement of vocabulary

Effective diction

#### **UNIT - II: APPLIED GRAMMAR:**

Correct usage

The structure of sentences

The structure of paragraphs

Enlargements of Vocabulary

#### **UNIT - III: WRITTEN COMPOSITION:**

Precise writing and summarising

Writing of bibliography

Enlargement of Vocabulary

#### **UNIT - IV: READING AND COMPREHENSION:**

Review of selected materials and express oneself in one's words.

Enlargement of Vocabulary.

#### **UNIT - V: THE STUDY OF THE VARIOUS FORMS OF COMPOSITION:**

Paragraph, Essay, Letter, Summary, Practice in writing

**UNIT - VI: VERBAL COMMUNICATION:**

Discussions and summarisation, Debates, Oral reports, use in teaching

**Scheme of Examination**

Written (Theory): Maximum Marks: –80 marks.

No Practical or Viva voce examination

**REFERENCE**

1. English Grammar Collins, Birmingham University, International Language Data Base, Rupa & Co. 1993
2. Wren and Martin - Grammar and Composition, 1989, Chanda & Co, Delhi
3. Letters for all Occasions. A S Myers. Pub - Harper Perennial
4. Spoken English V. Shasikumar and P V Dhanija. Pub. By: Tata Mcgraw Hill, New Delhi
5. Journalism Made Simple D Wainwright
6. Writers Basic Bookself Series, Writers Digest series
7. Interviewing by Joan Clayton Platkon
8. Penguin Book of Interviews.

No Practical or Viva voce examination

This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%.

## HEALTH CARE

**Teaching Hours : 40**

### **Introduction to Health**

Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept.  
National Health Policy

National Health Programmes ( Briefly Objectives and scope) Population of India and Family welfare programme in India Introduction to Nursing

What is Nursing? Nursing principles. Inter-Personnel relationships. Bandaging: Basic turns; Bandaging extremities; Triangular Bandages and their application. Nursing Position, Bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's positions, comfort measures, Aids and rest and sleep.

Lifting And Transporting Patients: Lifting patients in the bed. Transferring from bed to wheelchair. Transferring from bed to stretcher.

Bed Side Management: Giving and taking Bedpan, Urinal: Observation of stools, urine.

Observation of sputum, Understand the use and care of catheters, enema giving. Methods of Giving Nourishment: Feeding, Tube feeding, drips, transfusion Care of Rubber Goods

Recording of body temperature, respiration and pulse, Simple aseptic technique, sterilisation and disinfection.

Surgical Dressing: Observation of dressing procedures

### **First Aid :**

Syllabus as for Certificate Course of Red Cross Society of St. John's Ambulance Brigade.

### **Reference Books:**

**Preventive and Social Medicine** by J.Park

Text Book of P & SM by Park and Park

Counseling & Communicate skills for medical and health, Bayne- Orient Longman Pvt. Ltd.

No Practical or Viva voce examination

This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for pass is 35%. SECOND YEAR B.SC RENAL DIALYSIS TECHNOLOGY

### **Paper 1: APPLIED ANATOMY AND PHYSIOLOGY RELATED TO DIALYSIS TECHNOLOGY**

#### **APPLIED ANATOMY**

1. Basic Anatomy of Urinary System-Structural Anatomy Of Kidney, Bladder, Ureter, Urethra, Prostate
2. Histology of Kidney
3. Blood Supply of Kidney
4. Development of Kidney in Brief
5. Anatomy of Peritoneum
6. Concept of Abdominal Hernias
7. Anatomy of Vascular System
8. Upper Limb Vessels- Course, Distribution, Branches, Origin& Abnormalities
9. Neck Vessels- Course, Distribution, Branches, Origin& Abnormalities
10. Femoral Vessels- Course, Distribution, Branches, Origin& Abnormalities

#### **PHYSIOLOGY**

1. Mechanism Of Urine Formation
2. Glomerular Filtration Rate (GFR)
3. Clearance Studies
4. **Physiological Values** - Urea, Creatinine, Electrolytes, Calcium, Phosphorous, Uric Acid, Magnesium, **Glucose 24 Hours Urinary Indices** - Urea, Creatinine, Electrolytes, Calcium, Magnesium
5. Physiology Of Renal Circulation
6. Factors Contributing to & Modifying Renal Circulation
7. Auto-regulation
8. Hormones Produced By Kidney & Physiologic Alterations In Pregnancy
9. **Haemostasis** - Coagulation Cascade, Coagulation Factors, Auto Regulation, Bleeding time(BT), Clotting time(CT), PT, PTT, Thrombin Time
10. **Acid-Base Balance** - Basic Principles & Common Abnormalities Like Hypokalemia, Hyponatremia, Hyperkalemia, Hypermnatremia, Hypocalcemia, Hypercalcemia, pH, Etc.

### Distribution of Marks for University Theory and Practical Exam

| Theory |    |       | Practical  |    |       | Total |
|--------|----|-------|------------|----|-------|-------|
| Theory | IA | Total | Practicals | IA | Total |       |
| 80     | 20 | 100   | -          | -  | -     | 100   |

### Reference Books:

1. William Davis (P) understanding Human Anatomy and Physiology – McGraw Hill
2. Chaurasia- A Text Book of Anatomy
3. T. S. Ranganathan- A Text Book of Human Anatomy
4. Fattana, Human Anatomy (Description and applied)- Saunder's & C P Prism Publishers, Bangalore
5. ESTER. M. Grishcimer- Physiology & Anatomy with Practical Considerations, J. P. Lippin Cott. Philadelphia
6. Bhatnagar- Essentials of Human Embryology- Revised Edition. Orient Blackswan Pvt. Ltd

### Paper 2: PHARMACOLOGY RELATED TO HAEMODIALYSIS AND PERITONEAL DIALYSIS

1. **Diuretics**-classification, action, dosage, side effects and contraindications
2. **Antihypertensive drugs**: Classification, action, dosage, side effects and contraindications
3. **Vasopressors and inotropes** - Classification, action, dosage, side effects and contraindications
4. **Colloids and crystalloids**: - Classification, action, dosage, side effects and contraindications
5. **Erythropoietin** - classification, action, dosage, side effects and contraindications
6. Phosphate binders, calcium supplements, folic acid & other vitamin supplements used for patients on Dialysis.
7. **Iron supplementation** injections and tablets - Classification, action, dosage, side effects and contraindications
8. **Anticoagulant** - Classification, action, dosage, side effects and contraindications

9. **Protamine sulphate:** dose indication and side effects
10. **Antibiotics** used in dialysis patients to treat catheter infections and peritonitis
11. **Vaccines** used in dialysis patients; dose and frequency
12. **Peritoneal dialysis solutions**-composition and different types of fluids
13. **Immunosuppressive drugs**
14. **Haemodialysis solutions** – composition and dilution ratios
15. Continuous Renal Replacement Therapy (CRRT) solutions and citrate coagulation

**Distribution of Marks for University Theory and Practical Exam**

| Theory |    |       | Practical  |    |       | Total |
|--------|----|-------|------------|----|-------|-------|
| Theory | IA | Total | Practicals | IA | Total |       |
| 80     | 20 | 100   | -          | -  | -     | 100   |

**Reference books:**

Essentials of Medical Pharmacology - Tripathi  
 Basics and Clinical Pharmacology - Katzung

**PAPER 3: CONCEPTS OF RENAL DISEASES: CLINICAL MANIFESTATIONS EVALUATION & MANAGEMENT**

1. Acute renal failure
2. Nephrotic syndrome - primary & secondary
3. Nephritic syndrome
4. UTI- urinary tract infections
5. Asymptomatic urinary abnormalities
6. Chronic renal failure causes, stages, diagnosis and management

7. Renal stone diseases
8. Obstructive uropathies
9. Congenital & inherited renal diseases
10. Tumours of kidney
11. Pregnancy-associated renal diseases
12. Renal vascular disorders & hypertension associated renal diseases
13. Renal replacements therapies
14. Renal nutrition –Pre Dialysis stage (Stage 1-4), Haemodialysis, Peritoneal Dialysis and post transplant

#### **Distribution of Marks for University Theory and Practical Exam**

| Theory |    |       | Practical  |    |       | Total |
|--------|----|-------|------------|----|-------|-------|
| Theory | IA | Total | Practicals | IA | Total |       |
| 80     | 20 | 100   | -          | -  | -     | 100   |

#### **Reference books:**

1. Brenner & Rector's the Kidney: Karl Skorecki, Glenn M. Chertow, Philip A. Marsden
2. Diagnostic Pathology: Kidney Diseases E-Book: By Matthew R Lindberg, Anthony Chang

#### **PAPER 4: APPLIED ASPECTS OF PATHOLOGY & MICROBIOLOGY**

##### **Pathology**

1. Congenital abnormalities of the urinary system
2. Classification of renal diseases
3. Glomerular diseases- causes, types & pathology
4. Tubule interstitial diseases



5. Renal vascular disorders
6. End-stage renal diseases- causes & pathology
7. Pathology of kidney in hypertension, diabetes mellitus, pregnancy
8. Pathology of peritoneum- peritonitis- bacterial, tubular& sclerosing peritonitis  
Dialysis induced changes
9. Pathology of urinary tract infections
10. Pyelonephritis & tuberculous pyelonephritis

### **Microbiology**

1. Hepatotrophic viruses in the detail- mode of transfusion, universal precautions, vaccinations
2. Human immune deficiency virus (HIV), mode of transfusion, universal precautions
3. Opportunistic infections
4. Microbiology of urinary tract infections
5. Microbiology of vascular access infection (femoral, jugular and subclavian )
6. Sampling methods for culture & sensitivity

### **Practicals**

1. Staining technique (performance)
  - Gram stain
  - ZN stain
2. Demonstration of culture media and culture methods
3. Demonstration of antibiotic sensitivity testing
4. Demonstration of sterilisation equipment

## SCHEME OF EXAMINATION – PRACTICALS

The scheme of examination for **APPLIED ASPECTS OF PATHOLOGY & MICROBIOLOGY** Practical shall be as follows:

### Distribution of marks

| Type of question                              | Marks allotted |
|-----------------------------------------------|----------------|
| Spotters                                      | 20             |
| Practical Based on Pathology and Microbiology | 20             |
| Viva                                          | 20             |
| Record                                        | 20             |
| <b>Total</b>                                  | <b>80</b>      |

### Distribution of Marks for University Theory and Practical Exam

| Theory |    |       | Practical  |    |       | Total |
|--------|----|-------|------------|----|-------|-------|
| Theory | IA | Total | Practicals | IA | Total |       |
| 80     | 20 | 100   | 80         | 20 | 100   | 200   |

### Reference Books-

1. Ananthanarayana & Panikar Medical Microbiology- University Press
2. Robert Cruickshank- Medical Microbiology- The Practice of Medical Microbiology
3. Chatterjee- Parasitology- Interpretation to Clinical Medicine
4. Rippon- Medical Mycology
5. Emmons- Medical Mycology
6. Basic Laboratory methods in Parasitology, J P Bros, New Delhi
7. Basic Laboratory procedures in clinical bacteriology, J P Bros, New Delhi
8. Medical Parasitology- Ajit Damle
9. Introduction to medical microbiology- Ananthanarayana- Orient Longman Pvt. Ltd
10. Basic Pathology: An introduction to the mechanisms of disease :Sunil R Lakhani, Susan A

## Paper 5: BASICS OF RENAL DIALYSIS TECHNOLOGY

1. Checking vitals- Blood pressure, Heart rate, Respiratory rate and temperature
2. Basic science related to Dialysis
3. Indications for Dialysis
4. Types of Dialysis
5. Vascular access
6. Dialyser-types, membrane, surface area, clearance and Kuf
7. Dialysis solutions compositions
8. Pre haemodialysis assessments
9. Monitoring during Dialysis
10. Post dialysis assessments
11. Complications during Dialysis

12. Haemodialysis machines preparation and settings
13. Haemodialysis machine alarms during Dialysis and troubleshooting
14. Anticoagulation
15. Dialyser reuse
16. Water treatment system – basics
17. Peritoneal Dialysis- Physiology of Peritoneal Dialysis and apparatus for peritoneal Dialysis
18. BCLS and Crash-cart management
19. Equipment used in Dialysis and its monitoring and safety check: Hemodialysis machine, Dialyser Reprocessor, CRRT machines, Cardiac monitors, Defibrillator, ECG machines, BP apparatus, USG machines, Acid Bicarbonate mixing system, Water treatment system.
20. Infection control practices and universal precautions
  - Hand wash
  - Waste management
  - Needlestick management and prevention
  - Personal protective equipment and appropriate usage
  - Cleaning and disinfection of dialysis machines
  - Managing patients with HIV HBsAg and HCV
  - Vascular access- infection prevention
  - Blood spill management.
  - Hazardous material storage and spill management

Practicals :

- Pre –Dialysis and post Dialysis assessments
- Dialysis machine connection and disconnection
- Monitoring during Dialysis
- Checking blood pressure, temperature and heart rate
- Priming blood system
- Reuse of dialysers
- Assisting haemodialysis
- water treatment system monitoring
- Preparation of dialysis solution.
- Demonstrate Hand wash techniques
- Peritoneal dialysis apparatus

### Distribution of Marks for University Theory and Practical Exam

| Theory |    |       | Practical  |    |       | Total |
|--------|----|-------|------------|----|-------|-------|
| Theory | IA | Total | Practicals | IA | Total |       |
| 80     | 20 | 100   | 80         | 20 | 100   | 200   |

### SCHEME OF EXAMINATION – PRACTICALS

The scheme of examination for the “**BASICS OF DIALYSIS TECHNOLOGY**” Practical shall be as follows

#### Distribution of marks:

| Type of question                                 | Marks allotted |
|--------------------------------------------------|----------------|
| Spotters                                         | 20             |
| Practical Based on Basics of dialysis technology | 30             |
| Viva                                             | 20             |
| Record                                           | 10             |
| Total                                            | 80             |

#### Reference Books:

1. Handbook of Dialysis – 5<sup>th</sup> Edition – John T Daugirdass
2. Handbook of dialysis therapy – Allen R Nissenson
3. Core curriculum for dialysis technician 6<sup>th</sup> edition
4. KDOQI guidelines.
5. Dialysis Water and Dialysate Recommendations: AAMI

## Subsidiary subjects

### 1. Nutrition

- Introduction to the science of nutrition
  - Definition
  - Food pattern and its relation to health
  - Factors influencing food habits, selection and foodstuffs
  - Superstitions, culture, religion, income, the composition of family, age, occupation,
- special group
  - Food selection, storage & preservation
  - Prevention of blood adulteration
- Classification of nutrients
  - Macronutrients and micronutrients
  - Proteins- types, sources, requirements and deficiencies of proteins
  - Carbohydrates sources, requirements & deficiency
  - Fats- types, sources, requirements and deficiency of fats
  - Water- sources of drinking water, requirements, preservation of water
  - Minerals - types, sources, requirements deficiencies of minerals
  - Vitamins - types, sources, requirements deficiencies of vitamins
  - Planning diets
- Need for planning diets
  - Concept of a balanced diet
  - Food group & a balanced diet
  - Influence of age, sex, occupation & physiological state
  - Recommended dietary intake in planning diet
  - Steps in planning a balanced diet
  - Planning renal diet
  - Purpose and methods of cooking
  - Effects of heat on the cooking of foods
  - Preparation of basic recipes - clear fluids
  - Full fluids, vegetable preparation, egg recipes, fish and meat recipes, light puddings

## Scheme of Examination

Written (Theory): Maximum Marks: –80 marks.

No Practical or Viva-voce examination

This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35 marks.

# THIRD YEAR B.Sc RENAL DIALYSIS TECHNOLOGY

## PAPER 1: APPLIED DIALYSIS TECHNOLOGY PAPER I

1. Chronic Renal Failure and Acute Renal Failure causes, stages and management. Indications for Dialysis
  2. Choice of renal replacement therapy (RRT) modality
  3. History & types of Dialysis
  4. Theory of haemodialysis - diffusion, osmosis, ultrafiltration & solvent drag
  5. Vascular access for haemodialysis
    - A. Arteriovenous fistula
      - Types of vascular access
        - Vessel preservation
        - Preoperative evaluation
        - Physical examination
          - Imaging studies
          - Allen Test
          - Venography
      - Possible locations for upper extremity AV fistulas
      - Perioperative care and fistula maturation
        - Rule of sixes
        - Details of fistula maturation
      - Initial trial cannulation of a new AV fistula
      - Initial cannulation procedure
    - B. Arteriovenous grafts
      - Potential AV graft locations
        - Common locations
        - Uncommon locations
      - Postoperative care
      - Maturation
      - Physical examination of AV fistulas and grafts
- Inspection
  - Palpation and auscultation
    - Pulse
    - Thrill
    - Auscultation
    - Pulse augmentation and arm elevation tests
  - General issues relating to cannulation of either AV fistulas or grafts
    - Skin preparation
    - Anaesthesia
    - Use of tourniquets for AV fistulas.
    - Needle size
    - Needle position, spacing, and orientation

- Risk of inflow/outflow needle reversal
- Buttonhole cannulation and rope ladder
- Preventing and dealing with infiltration
- Hemostasis post-dialysis

#### AV access monitoring and complications

- Stenosis
- Thrombosis
- Ischemia in a limb bearing AV access
- Pseudo-aneurysm
- Congestive heart failure

#### C. Venovenous access

- Catheter types and design
- Insertion location
- Selected Factors favouring different temporary (Nontunneled) Hemodialysis Catheter Insertion Sites
- Cuffed catheter advantages and types
- Insertion-related complications
- Care and use of venous catheters
- Risk of air embolism on the removal of dialysis catheters from the neck.
- Catheter locks
- Prophylactic antibiotics
- Nasal decolonisation

#### D. Venous catheter infections and other Complications

- Infections
- Poor catheter flow ( catheter dysfunction)
- Thrombosis
- Central venous stenosis
- Catheter adhesion

### 6. Haemodialysis apparatus

- Blood circuit
  - Inflow bloodline: Pre-pump segment
  - Roller pump segment and calibration
  - Inflow (arterial) bloodline: Post-pump segment
  - Outflow (venous) bloodline: Air trap and pressure monitor
- Dialysis fluid circuit
  - Proportioning system.
  - Heating and degassing
  - Monitors and alarms
- Conductivity
- Temperature
- Bypass valve
- Blood leak detector
- Dialysate outflow pressure monitor
- Ultrafiltration control
- Advanced control options
  - Adjustable bicarbonate

- Variable sodium.
  - Programmable ultrafiltration
  - Monitoring UV absorbance of spent dialysate (online  $Kt/V$ )
  - Online sodium clearance monitors.
  - Blood temperature control module.
  - Modules to measure access recirculation or access blood flow
  - Blood volume monitors.
  - Single blood pathway (“single-needle”) devices
  - Dialysers and Membranes
  - Dialysis solutions
    - Fluid quality standards
    - Ultrapure dialysis solutions
    - Different types of mixing ratios
  - Content of dialysis solution
  - Bicarbonate concentrates mixing and distribution systems.
  - Dialysis solution preparation
    - Dual-concentrate system for bicarbonate-based solutions.
    - Dry concentrates
    - Bicarbonate.
    - Acid (citric acid or sodium diacetate)
  - Final dialysis solution composition
  - Disinfection of dialysis machines
7. Acute haemodialysis prescriptions & Chronic haemodialysis prescriptions
- Dialysis solution bicarbonate level
  - Dialysis solution Sodium level
  - Dialysis solution Calcium level
  - Dialysis solution Magnesium level
  - Dialysis solution Potassium level
  - Dialysis solution Phosphorus level. Adding phosphorus in the dialysis solution
  - Ultrafiltration guidelines
  - Dialysis solution flow rate ( $Q_d$ )
  - Dialysis solution temperature
  - Blood flow rate ( $Q_b$ )
  - Clearance and adequacy
8. Complications during haemodialysis
9. Biochemical investigations for dialysis patients and its significance
10. Urea Kinetic modelling
- Mechanisms of solute transport
  - Solute removal from the perspective of the dialyser
  - Concept of clearance
  - URR,  $spKt/V$ ,  $eKt/V$
  - Solute removal from the patient perspective
  - Access recirculation
  - Cardiopulmonary recirculation
  - Urea nitrogen generation rate (g) and the nPNA



- Residual renal function
- 11. Anticoagulation
- 12. Dialyser reuse
- 13. Withdrawal of dialysis criteria
  - Acute dialysis
  - Chronic dialysis
- 14. Physiology of peritoneal dialysis
  - Anatomy of the peritoneal cavity
  - Peritoneal membrane histology
  - Models of peritoneal transport
  - Physiology of peritoneal transport
    - Diffusion
    - Ultrafiltration
    - Fluid absorption
  - Clinical assessment of and implications of peritoneal transport
  - Peritoneal equilibration test (PET) and Classification
  - Peritoneal clearance
  - Urea versus creatinine
  - Sodium removal
  - Protein losses
  - Residual renal function
- 15. Apparatus for peritoneal dialysis
  - Dialysis solution
  - Non-glucose solutions
  - Transfer set and exchange procedure
  - Various connectors for PD
  - Automated peritoneal dialysis
  - Tidal peritoneal dialysis (TPD)
  - APD with day time exchanges
- 16. Peritoneal dialysis catheter, placement and care
  - Acute and chronic catheters
  - Catheter selection
  - Catheter placement procedures
  - Special access procedures
    - Extended catheters
    - Catheter embedding procedure
  - Catheter break-in procedures
  - Acute complications of catheters
  - Complications of chronic peritoneal catheters
  - Catheter infection and management
  - Care of the chronic peritoneal catheters
  - Catheter removal and secondary embedding
- 17. Peritoneal dialysis for the treatment of acute kidney injury
  - Indications
  - Technical aspects

- Advantages and Disadvantages of Peritoneal Dialysis in Acute Kidney Injury
  - Complications
18. Adequacy of peritoneal dialysis and chronic PD prescription
- Modalities of peritoneal dialysis therapy and prescription
  - Measurement of clearance
  - Determinants of clearance
  - Prescription strategies to achieve clearance targets in chronic peritoneal dialysis
  - The nutritional issue in peritoneal dialysis.
  - Treatment of malnutrition
19. Volume status and fluid overload in Peritoneal dialysis
- Assessment of fluid status
  - Mechanism of fluid overload
  - Diagnosis of peritoneal membrane dysfunction and ultrafiltration failure
    - High transporter with UFF (type I)
    - Low transporter with UFF (type II)
    - UFF with transport in the normal range (usually high-average and low-average transporters)
    - Prevention and management of fluid overload
    - Glucose sparing strategies.
    - Hypertension and Hypotension in PD.
20. Peritonitis & exit site infection
- A. Peritonitis
- Pathogenesis
  - Diagnosis
  - Treatment
  - Prescriptions for Initial Treatment of Peritonitis with Unknown Organism type
  - Refractory peritonitis and indications for catheter removal
  - Relapsing, recurrent, and repeat peritonitis.
  - Peritonitis with catheter obstruction
- B. Exit -site and tunnel infection
21. Hernia, leaks and encapsulating peritoneal sclerosis in Peritoneal dialysis (mechanical complications)
- Hernia
  - Abdominal wall and peri-catheter leaks
  - Respiratory complications
  - Genital Edema.
  - Back pain
  - Overfill
  - Encapsulating peritoneal sclerosis
22. Metabolic, Acid-base and electrolyte aspects of peritoneal dialysis ( Metabolic complications)
- Hyperglycaemia
  - Weight gain
  - Peritoneal protein loss
  - Lipid abnormalities
  - Hypokalemia/ hyperkalemia

- Metabolic acidosis
- Hypo/Hypernatremia

#### **PRACTICALS–PAPER I**

- Dialysis machine preparation for dialysis
- Dialyser and bloodlines priming
- A V fistula / AV graft cannulation
- Initiation of dialysis through central venous temporary and tunnelled catheters -internal jugular and femoral
- Catheter dressing
- Closing/termination of dialysis
- Single needle dialysis settings
- Post dialysis sample collections
- Preparation of acid and bicarbonate concentrates
- Reuse of dialysers - manual and reuse machines
- Machine disinfection
- Isolated ultrafiltration settings
- Dialysis machines minor troubleshooting- Treatment-related and machine-related
- Performance of peritoneal dialysis exchange

#### **SCHEME OF EXAMINATION – PRACTICALS**

The scheme of examination for **APPLIED DIALYSIS TECHNOLOGY PAPER I** Practical shall be as follows:

### Distribution of marks

| Type of question                                        | Marks allotted |
|---------------------------------------------------------|----------------|
| Spotters                                                | 20             |
| Practical Based on APPLIED DIALYSIS TECHNOLOGY- paper 1 | 20             |
| Viva                                                    | 30             |
| Record                                                  | 10             |
| Total                                                   | 80             |

### Distribution of Marks for University Theory and Practical Exam

| Theory |    |       | Practical  |    |       | Total |
|--------|----|-------|------------|----|-------|-------|
| Theory | IA | Total | Practicals | IA | Total |       |
| 80     | 20 | 100   | 80         | 20 | 100   | 200   |

#### Reference Books:

1. Handbook of dialysis – 5<sup>th</sup> Edition – John T Daugirdass
2. Handbook of dialysis therapy – Allen R Nissenson
3. Oxford handbook of dialysis- 4<sup>th</sup> Edition
4. Core curriculum for dialysis technician 6<sup>th</sup> edition
5. KDOQI guidelines.
6. Dialysis Water and Dialysate Recommendations: AAMI

## PAPER-2: APPLIED DIALYSIS TECHNOLOGY PAPER II

### 1. Dialysis in infants & children

- Vascular access in children
- Choice of acute dialysis modality
- Choice of chronic dialysis modality
- Dialysers and bloodlines for dialysis and CRRT
- Complications during dialysis
- Care of paediatric end-stage kidney disease patients

### 2. Extracorporeal treatment for poison and drug overdose

- Criteria for Consideration of Dialysis or Hemoperfusion in Poisoning
- Choice of therapy
  - Peritoneal dialysis
  - Haemodialysis
  - Haemoperfusion
  - Continuous Haemodiafiltration or haemoperfusion
- Technical requirements

- Complications
- Examples of a few drugs that can be removed by dialysis and haemoperfusion

### **3. Online Haemodiafiltration (HDF)**

- Diffusion versus convection based clearance
- Basics of hemodiafiltration.
- Substitution: Post-dilution, pre-dilution, and mixed dilution
- Advantages and Shortcomings of Each of HDF Modalities
- Technical issues
- Prescription of HDF
- Clinical benefits of convective therapies
- Clinical comparisons of HDF versus haemodialysis
- Morbidity and mortality benefits
- Issues to be considered when applying convective modalities

### **4. Continuous renal replacement therapy (CRRT)**

- Continuous Haemodialysis (C-HD)
- Continuous Haemofiltration (C-HF)
- Continuous Haemodiafiltration (C-HDF)
- Slow continuous ultrafiltration (SCUF)
- Sustained Low-Efficiency Dialysis And Haemodiafiltration (SLED and SLED-F)
- Clinical indications for CRRT versus intermittent renal replacement therapy
- Differences among C-HD, C-HF, and C-HDF in the clearance of small- and large molecular-weight solutes
- Filtration fraction
- CRRT filters
- Dialysates and replacement solutions
- Methods of preparing bicarbonate-based CRRT solutions when pre-packaged solutions are not available
- Prescribing and delivering CRRT
- Regional citrate anticoagulation for continuous RRT
- Isolated ultrafiltration and slow continuous ultrafiltration (SCUF)

### **5. Molecular Adsorbent Recirculating System (MARS)**

- Pathophysiology of acute liver failure
- Indications
- MARS techniques
- Mechanism of action
- Prescription
- Advantage and disadvantage

## 6. Home haemodialysis and intensive (frequent)

- Modality selection
- In-center HD.
- Technical consideration for home HD
- Patient safety and precautions.
- Infrastructure requirement for home HD
  - Prescription of intensive HD
    - Physiological rationale
    - Dialysis solution composition
    - Anticoagulation
    - Ultrafiltration, adjustment of target weight, and antihypertensive medications
  - Follow-up
    - Clinic visits
    - Blood tests
  - Comparative effectiveness and safety of home and intensive HD versus other modalities
  - Frequent HD
    - Short and standard frequent HD
    - Long, frequent HD
    - Long-session dialysis given three times per week or every other day

## 7. Sorbet dialysis technology

- Principles of sorbent dialysis
- The sorbent cartridge
- Removal of contaminants
- Changes to the electrolyte composition of the prime solution during pre-dialysis recirculation
- Adjusting dialysis solution sodium
- Adjusting dialysis solution bicarbonate
- Sorbent based dialysis machines

## 8. Plasmapheresis

- Indications
- Pharmacokinetics of immunoglobulin (IG)
- The macromolecule reduction ratio
- Membrane plasma separation and centrifugal aphaeresis
- Comparison of Membrane Plasma Separation and Centrifugal Aphaeresis
- Plasma volume calculation
- Complications
- Replacement solutions
- The selective aphaeresis procedure
- LDL aphaeresis.
- Immunoabsorption columns.
- Double filtration plasmapheresis (DFPP)
- Cryofiltration.

Other apheresis procedures

- Extracorporeal photopheresis (ECP)

## **9. Dialysis in special situations**

- Patients with congestive cardiac failure
- Advanced liver disease
- Patients positive for, HBsAg & HCV
- Failed transplant
- Pregnancy

## **10. Telemedicine in dialysis practice**

## **11. Water treatment system**

- AAMI and EPA Maximum Allowable Levels of Contaminants in Water
- Signs and Symptoms and Possible Water Contaminant-Related Causes

### **Feed Water Components**

- Back-flow preventer.
- Temperature blending valve
- Booster pump

### **Pre-treatment Components**

- Chemical injection systems
- Sediment filters.
- Water softener
- Carbon adsorption
- Reverse Osmosis Systems
- Cartridge prefilter

### **RO System**

- RO pump and motor assembly
- RO membranes
- Post-treatment Components
- Deionisation.
- Ultraviolet irradiator (UV).
- Submicron and ultrafiltration (UF)

### **Distribution System**

- Water storage.
- Water distribution piping systems.
- Alternative Disinfection of Water Systems
- Ozone disinfection.
- Hot water disinfection systems

### **Bacteria and Endotoxin Bacteria testing of product water**

- Bacteria assaying technique.
- Endotoxin testing of product water
- Bacteriology of Dialysate
- Conventional dialysate
- Ultrapure dialysate.
- Dialysate for infusion (*Water for online HDF*)

## **12. Diet in a patient with renal insufficiency and dialysis**

### 13. Basic Cardiac Life Support

- Identify cardiac arrest
- Emergency codes
- Compression ventilation ratios
- One rescuer and two-rescuer compression and ventilation
- Pediatric and neonatal resuscitation
- Common drugs used during cardiac arrest
- Look like sound-alike drugs used in Crash cart
- Defibrillator and AED

### 14. Special problems in dialysis patients

#### A. Psychology & rehabilitation

- Depression
- Dementia/ Delirium
- Anxiety and behaviour disorders.

Other psychosocial issues in the CKD population

- Marital issues.
- Sexual dysfunction
- Socioeconomic issues
- Rehabilitation.
- Quality of life (QOL)

#### B. Diabetes

- Dialysis modalities for diabetes
- Hyperkalemia
- Cardiovascular disease and hypertension
- Cerebrovascular disease
- Eye problems in people with diabetes on dialysis
- Impotence

#### C. Hypertension

Definition and Measurement

- Pathophysiology
- Treatment
  - a. Prevention
  - b. Correction of salt and fluid overload
  - c. Clinical assessment of dry weight.
- Common clinical problems
- Antihypertensive drug use.
- Hypertensive urgencies and emergencies

#### D. Infections

- Derangement of immune functions in uremia
- Derangement of temperature control in uremia
- Bacterial infections in dialysis patients
- Viral infections
- Vaccinations



E. Bone diseases

- Pathophysiology
- Bone disease in CKD
- Control of hyperphosphatemia
- Optimising serum calcium
- Parathyroid hormone levels
- Aluminium toxicity

F. Hematologic abnormalities

- Anaemia
- Haemolysis
- Disorder of Hemostasis

G. Nervous system and sleep disorder

- Intracranial bleeding and ischemic stroke
- Subclinical brain structural abnormalities
- Diagnosis and management of epileptic seizures
- Partial Differential Diagnoses of Chronic Dementia in Dialysis Patients
- Seizures in Dialysis Patients
- Sleep-related disorders
- Peripheral neuropathy.

**15. Medication administration and IV therapy**

**16. Quality in dialysis**

- Guidelines for dialysis care
- ESRD quality initiative
- Continuous quality improvement in dialysis
- Preparation and monitoring dialysis unit for NABH and JCI accreditations
- International patient safety guidelines

**17. Preparing dialysis patients for transplantation**

**18. Renal transplantation** - principles, immunology, patients selection, surgical procedure and complications

**PRACTICALS –PAPER II**

- CRRT -Priming and starting treatment
- Plasmapheresis- Priming and starting the treatment
- BCLS/ACLS demonstration.
- RO water sample collection for water culture, endotoxin and chemical analysis
- RO plant monitoring and disinfection.
- Pediatric dialysis settings -Pediatric Hemodialysis, Peritoneal dialysis, CRRT and plasmapheresis
- Online HDF preparation and demonstration
- Hemoperfusion- Priming and starting treatment
- APD Machine settings

## SCHEME OF EXAMINATION – PRACTICALS

The scheme of examination for **APPLIED DIALYSIS TECHNOLOGY II-PAPER II** Practical shall be as follows:  
Common practical Exam for two papers with an equal weightage of marks

### Distribution of marks

| Type of question            | Marks allotted |
|-----------------------------|----------------|
| Spotters                    | 20             |
| Practical Based on paper II | 20             |
| Viva                        | 30             |
| Record                      | 10             |
| <b>Total</b>                | <b>80</b>      |

### Distribution of Marks for University Theory and Practical Exam

| Theory |    |       | Practical |    |       | Total |
|--------|----|-------|-----------|----|-------|-------|
| Theory | IA | Total | Practical | IA | Total |       |
| 80     | 20 | 100   | 80        | 20 | 100   | 200   |

### Reference Books:

1. Handbook of dialysis – 5<sup>th</sup> Edition – John T Daugirdass
2. Handbook of dialysis therapy – Allen R Nissenson
3. Oxford handbook of dialysis- 4<sup>th</sup> Edition
4. Core curriculum for dialysis technician 6<sup>th</sup> Edition

5. KDOQI guidelines.
6. www.uptodate.com
7. Dialysis Water and Dialysate Recommendations: AAMI

#### Subsidiary subjects\*\*

| Paper | Subjects                                              | Duration | Marks | I A Marks | Total Marks |
|-------|-------------------------------------------------------|----------|-------|-----------|-------------|
| 1     | Medico-legal aspects of health care                   | 10 Hours | 80    | 20        | 100         |
| 2     | Basic principles of blood transfusion & fluid therapy | 10 Hours | 80    | 20        | 100         |
| 3     | Health care management                                | 10 Hours | 80    | 20        | 100         |

#### 1. Medico-legal aspects of health care

- Code of ethics
- introduction
- professional ethics
- personal qualities of the medical professional

#### Laws Related To Medical Practice

- Medical council act
- clinical trials
- disability act
- legal aspects of medical records
- transplantation of human organ act
- prevention of food and adulteration act
- medical termination of pregnancy act, 1971
- birth and death registration act
- sex determination act
- Indian mental health act, 1987

#### Laws Related To Hospital Administration

- Companies act
- law of contracts
- consumer protection act

#### Scheme of Examination

Written (Theory): Maximum Marks: –80 marks.

No Practical or Viva-voce examination

\*\*This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35 marks

## **2. Basic principles of blood transfusion & fluid therapy**

- Key Concepts
- Fluid Management & Blood Component Therapy: Introduction
- Evaluation of Intravascular Volume
- Intravenous Fluids
- Fluid Therapy
- Transfusion
- Complications of Blood Transfusion
- Alternative Strategies for Management of Blood Loss.

### **Scheme of Examination**

Written (Theory): Maximum Marks: –80 marks.

No Practical or Viva-voce examination

**\*\*This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35**

## **3. Health care management**

- Departments in Hospital
- Clinical services management
- Organising of support services
- Management of utility services
- Evaluation of Hospital services
- Issues related to Healthcare technology
- Present trend in healthcare technology
- Problems & constraints
- Planning & adopting appropriate technology in healthcare
- Evaluation method of health technology

### **Scheme of Examination**

Written (Theory): Maximum Marks: –80 marks.

No Practical or Viva-voce examination

**\*\*This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35**

## FOURTH YEAR B.Sc RENAL DIALYSIS TECHNOLOGY

### BSc RDT IV YEAR - INTERNSHIP :

1. Project Submission: Project work is a compulsory requirement for the B Sc RDT –course. Each student can choose a topic for the project in any one of the subjects -Haemodialysis/Peritoneal dialysis/Dialysis unit Management, which would be approved by his/her supervising Teacher. Supervising Teacher should have a minimum of 3 years of teaching experience in the concerned subject.

The student should be under the guidance of the supervising staff, carry out the work on the topic selected and prepare a project report including results and references—the project report duly certified by the supervising staff and Head of the department of RDT.

One month before the “Fourth Year university practical examination” the project should be submitted to the HOD.

The project report evaluation will be conducted by the concerned subjects, internal and external examiners together during the Fourth Year B Sc RDT University practical examination.

2. Twelve-month compulsory rotational postings during the internship, which students have to work under the supervision of experienced staff in the following areas:

- ICU Dialysis
- Paediatric dialysis
- Peritoneal dialysis
- CRRT
- Plasmapheresis
- Haemodialysis
- Nephrology Procedure room
- Two Weeks Posting with Kidney transplant coordinator
- Two Week Posting in Emergency Department

3. **Log Book:** Maintain a daily Logbook checked and signed by In charge of the unit. Submit the monthly summary of procedures along with the logbook, checked and signed by the coordinator or in charge. Logbook assessed by Internal and External examiners during the fourth year BSc RDT University practical examination.

### 4. Practical and Viva.

#### PRACTICALS

- A V fistula / AV graft cannulation
- Initiation of dialysis through central venous temporary and tunnelled catheters
- Catheter-related complications management
- Closing/termination of new AV access dialysis
- Adequacy of dialysis
- Single needle dialysis settings
- Post dialysis sample collections.
- Acid and bicarbonate concentrate selection.
- Reuse of dialysers- quality assessment.

- Machine troubleshooting
- Isolated ultrafiltration settings
- Dialysis machines minor troubleshooting- Treatment-related and machine-related
- Performance of peritoneal dialysis exchange
- PET test
- Automated Peritoneal dialysis machine management: TIPD, CCPD
- Peritoneal dialysis- Transfer set/ Extension change
- Peritoneal dialysis – Titanium adaptor change
- Peritoneal dialysis - sample collection of PD fluid
- CRRT -Priming and starting treatment
- Plasmapheresis- Priming and starting the treatment
- BCLS/ACLS demonstration.
- DFPP settings
- RO water sample collection for water culture, endotoxin and chemical analysis
- RO plant monitoring and disinfection.
- Pediatric dialysis settings -pediatric Hemodialysis, Peritoneal dialysis, CRRT and plasmapheresis
- Online HDF machine preparation and demonstration
- Hemoperfusion- Priming and starting treatment

#### SCHEME OF EXAMINATION – PRACTICALS

The scheme of examination for 4<sup>th</sup> Year Practical shall be as follows, Exam based on the clinical training during the internship

##### Distribution of marks.

| Type of question | Marks allotted |
|------------------|----------------|
| Spotters         | 40             |
| Practical        | 40             |
| Viva             | 30             |
| Project          | 40             |
| Log Book         | 20             |
| <b>Total</b>     | <b>170</b>     |

##### Distribution of Marks for University Theory and Practical Exam

| Theory |    |       | Practical  |           |            | Total      |
|--------|----|-------|------------|-----------|------------|------------|
| Theory | IA | Total | Practicals | IA        | Total      |            |
| -      | -  | -     | <b>170</b> | <b>30</b> | <b>200</b> | <b>200</b> |

##### Reference books:

1. Handbook of dialysis – 5<sup>th</sup> Edition – John T Daugirdass
2. Handbook of dialysis therapy – Allen R Nissenson

3. Core curriculum for dialysis technician 6<sup>th</sup> edition
4. Oxford handbook of dialysis- 4<sup>th</sup> Edition
5. KDOQI guidelines.
6. Dialysis Water and Dialysate Recommendations: AAMI

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**REGULATIONS & CURRICULUM OF  
GRADUATE PARAMEDICAL COURSE  
  
BACHELOR OF SCIENCE IN  
  
RESPIRATORY CARE TECHNOLOGY  
  
2020**



**Sri Siddhartha  
Academy of Higher Education  
Deemed-to-be-University**

**Established under Section 3 of the UGC Act, 1956  
MHRD, GOI No. F.9-31/2006-U.3 (A) Dtd. 30th May 2008**

**Agalakote, B.H. Road, Tumkur – 572107, Karnataka, India**



# SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

(DEEMED TO BE UNIVERSITY)

Declared under Section 3 of the UGC Act, 1956, MHRD GOI No. F.9-31/2006-U.3 (A) Dated: 30/05/2008

Accredited 'A' Grade by NAAC

Agalakote, B.H.Road, Tumkur – 572 107. KARNATAKA, INDIA.

Ph. 0816- 2275516, Fax : 0816-2275510 website: sahetumkur.ac.in email: info@sahe.in



No. SSAHE/ACA-S&C(AHSP)/17/2022

Date: 01/09/2022

## NOTIFICATION

Sub: Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Respiratory Care Technology.

- Ref: 1). Proceedings of BOS Allied Health Sciences Programmes held on 06/04/2021  
2). Proceedings of the Academic Council meeting held on 19/08/2021  
3). Proceedings of the Board of Management held on 29/08/2022

In exercise of the powers vested under section 6 of 6.4 of MoA / Rules of SSAHE, the Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Respiratory Care Technology is notified herewith as per Annexure.

The above Regulations shall be applicable to the students admitted to the said course from the academic year 2020-21 onwards.

By Order,

REGISTRAR  
REGISTRAR

Sri Siddhartha Academy of Higher Education  
TUMKUR - 572 107, Karnataka.

To,  
Dean / Principal, Sri Siddhartha Medical College & Hospital,

Copy to

- 1) Office of the Chancellor, SSAHE, for kind information,
- 2) PA to Vice-Chancellor / PA to Registrar / Controller of Examinations / Finance Officer, SSAHE
- 3) The Director (AHSP), SSAHE
- 4) All Officers of the Academy Examination Branch / Academic Section
- 5) Guard File / Office copy.

## **REVISED ORDINANCE GOVERNING REGULATIONS & CURRICULUM OF BACHELOR OF MEDICAL LABORATORY TECHNOLOGY - 2020**

### **1. Eligibility for admission:**

A candidate seeking admission to the BSc. MLT shall have studied English as one of the principal subject during the tenure of the course and shall have passed:

Two year Pre-University examination or equivalent as recognized by Sri Siddhartha Academy of Higher Education with, Physics, Chemistry and Biology as subjects of study.

OR

Pre-Degree course from a recognized University considered as equivalent by SSAHE, (Two years after ten years of schooling) with Physics, Chemistry and Biology as subjects of study.

OR

Any equivalent examination recognized by the Sri Siddhartha Academy of Higher Education, Tumkur for the above purpose with Physics, Chemistry and Biology as subjects of study.

OR

The vocational higher secondary education course conducted by Vocational Higher Secondary Education, Government of Kerala with five subjects including Physics, Chemistry, Biology and English in addition to vocational subjects conducted is considered equivalent to plus TWO examinations of Government of Karnataka Pre University Course.

OR

Candidates with two years diploma from a recognized Government Board in MLT shall have passed class 12 [10+2] with Physics, Chemistry and Biology, as subjects or candidates with 3 years diploma from a recognized Government Board in MLT

should have studied Physics, Biology and Chemistry as subjects during the tenure of the course.

Lateral entry to second year of B.Sc.MLT for candidates who have passed diploma program from the Government Boards and recognized by SSAHE, fulfilling the conditions specified above under Sl. No. 5 and these students are eligible to take admission on lateral entry system only in the same subject studied at diploma level for the academic year .

**Note:**

The candidate shall have passed individually in each of the subjects.

Candidates who have completed diploma or vocational course through Correspondence shall not be eligible for any of the courses mentioned above.

**Duration of the course:**

Duration shall be for a period of four years including one year of Internship.

**Medium of instruction:**

The medium of instruction and examination shall be in English.

**Scheme of examination:**

There shall be three examinations one each at the end of 1st, 2nd and 3rd year.

**Attendance:**

Every candidate should have attended at least 80% of the total number of classes conducted in an academic year from the date of commencement of the term to the last working day as notified by university in each of the subjects prescribed for that year separately in theory and practical. Only such candidates are eligible to appear for the university examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A candidate lacking in prescribed percentage of attendance in any subjects either in theory or practical in the first appearance will not be eligible to appear for the University Examination in that subject

## **Internal Assessment (IA):**

### 1st Year B.Sc. RCT

Theory - 20 marks

Practicals - 10 marks\*. [Lab work- 06 marks and Record-04 marks]

### 2nd & 3rd year B.Sc. RCT

Theory – 20 Marks

Practicals – 20 Marks

There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an academic year. The average marks of the two tests will be calculated and reduced to 20. The marks of IA shall be communicated to the University at least 15 days before the commencement of the University examination. The University shall have access to the records of such periodical tests. The marks of the internal assessment must be displayed on the notice board of the respective colleges with in a fortnight from the date test is held. If a candidate is absent for any one of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

\*There shall be no University Practical Examination in First year.

### **Subject and hours of teaching for Theory and Practicals**

The number of hours of teaching theory and practical, subject wise in first year, second year and third year are shown in Table-I, Table-II and Table-III

Main and Subsidiary subjects are common in first year for all the courses in Allied Health Science.

The number of hours for teaching theory and practical for main subjects in first, Second and Third year are shown in Table-I, II and III.

**Table - I Distribution of Teaching Hours in First Year Subjects Main subjects**

| <b>Sl. No</b> | <b>Subject</b>                                                | <b>Theory No. Of Hours</b> | <b>Practical No. Of Hours</b> | <b>Total No. Of Hours</b> |
|---------------|---------------------------------------------------------------|----------------------------|-------------------------------|---------------------------|
| 1             | Human Anatomy                                                 | 70                         | 20                            | 90                        |
| 2             | Physiology                                                    | 70                         | 20                            | 90                        |
| 3             | Biochemistry I                                                | 70                         | 20                            | 90                        |
| 4             | Pathology I (Clinical Pathology, Haematology & Blood Banking) | 70                         | 20                            | 90                        |
| 5             | Microbiology                                                  | 70                         | 20                            | 90                        |
|               | Total                                                         | 350                        | 100                           | 450                       |

The classes in main and subsidiary subjects are to be held from Monday to Thursday. On Fridays and Saturday's students shall work in hospitals in the respective speciality or department chosen by them

**Subsidiary Subjects**

English                25 Hours  
Kannada              25 Hours  
Health-Care          40 Hours

Clinical/Lab posting – 470 hours (Friday 9am – 1pm and 2pm - 4-30 pm Saturday 9am - 1pm)

**Table - II Distribution of Teaching Hours in Second Year Subjects**  
**Main Subjects**

| Sl. No. | Subject                                                       | Theory No. of Hours | Practical No. of Hours | Clinical posting | Total No. of Hours |
|---------|---------------------------------------------------------------|---------------------|------------------------|------------------|--------------------|
| 1.      | Medicine relevant to Respiratory technology                   | 50                  | --                     | --               | 50                 |
| 2.      | Section A Applied Pathology<br>Section B Applied Microbiology | 30<br>30            | 30<br>30               | --               | 120                |
| 3.      | Pharmacology                                                  | 50                  | --                     | --               | 50                 |
| 4.      | Introduction to Respiratory Technology                        | 80                  | 100                    | 650              | 830                |
|         | <b>Total</b>                                                  | <b>240</b>          | <b>160</b>             | <b>650</b>       | <b>1050</b>        |

Subsidiary Subjects:

|                                |          |
|--------------------------------|----------|
| Sociology                      | 20 Hours |
| Constitution of India          | 10 Hours |
| Environmental Science & Health | 10 Hours |

**Table -III Distribution of Teaching Hours in Third Year Subjects**  
**Main Subjects**

| Sl. No. | Subject                           | Theory No. of Hours | Practical No. of Hours | Clinical posting | Total No. of Hours |
|---------|-----------------------------------|---------------------|------------------------|------------------|--------------------|
| 1.      | Respiratory Technology - Clinical | 50                  | 50                     | 250              | 350                |
| 2.      | Respiratory Technology - Applied  | 50                  | 50                     | 250              | 350                |
| 3.      | Respiratory Technology - Advanced | 50                  | 50                     | 250              | 350                |
|         | <b>Total</b>                      | <b>150</b>          | <b>150</b>             | <b>750</b>       | <b>1050</b>        |

Subsidiary Subjects

|                             |          |
|-----------------------------|----------|
| Ethics, Database Management | 50 Hours |
| Research & Biostatistics    | 20 Hours |
| Computer application        | 10 Hours |

#### **9. Schedule of Examination:**

The university shall conduct two examinations annually at an interval of not less than 4 to 6 months as notified by the university from time to time. A candidate who satisfies the requirement of attendance, progress and conduct as stipulated by the university shall be eligible to appear for the university examination. Certificate to that effect shall be produced from the Head of the institution along with the application for examination and the prescribed fee.

#### **10. Scheme of Examination:**

There shall be three examinations, one each at the end of I, II and III year. The examination for both main and subsidiary subjects for all courses in Allied Health Sciences shall be common in the first year. Distribution of Subjects and marks for First Year, second year & Third year University theory and practical Examinations are shown in the Table – IV, V & VI.

#### **First year Examination:**

The University examination for 1st year shall consist of only theory examination and there shall be no University Practical Examination.

#### **Second & Third year examination:**

The University examination for 2nd and 3rd year shall consist of Written Examination & Practical.

#### **Written Examinations consists of**

- 05 papers in the 1<sup>st</sup> year
- 03 papers in the 2nd Year
- 03 papers in the 3rd Year.

#### **Practical examination:**

- There shall be no practical examination in the first year.

- Three practical examinations, at the end 2nd Year.
- Three practical examinations at the end of the 3rd year.

**TABLE-IV**

**Distribution of Subjects and marks for First Year University Theory Examination**

| A | Main Subjects *                     | Written Paper |       | I A Theory | Total |
|---|-------------------------------------|---------------|-------|------------|-------|
|   |                                     | Duration      | Marks | Marks      | Marks |
| 1 | Basic Anatomy (Including Histology) | 3 Hours       | 80    | 20         | 100   |
| 2 | Physiology                          | 3 Hours       | 80    | 20         | 100   |
| 3 | Biochemistry                        | 3 Hours       | 80    | 20         | 100   |
| 4 | Pathology                           | 3 Hours       | 80    | 20         | 100   |
| 5 | Microbiology                        | 3 Hours       | 80    | 20         | 100   |
|   | Subsidiary Subject **               |               |       |            |       |
| 1 | English                             | 3 Hours       | 80    | 20         | 100   |
| 2 | Kannada                             | 3 Hours       | 80    | 20         | 100   |
| 3 | Health Care                         | 3 Hours       | 80    | 20         | 100   |

Note: I A = Internal Assessment

\*Main Subjects shall have University Examination. There shall be no University Practical Examination.

\*\* Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.



TABLE - V  
Distribution of Subjects and marks for Second Year Examination

| Theory |                                                                 |          |     |           | Practical  |              |           |             |
|--------|-----------------------------------------------------------------|----------|-----|-----------|------------|--------------|-----------|-------------|
| Paper  | Subjects                                                        | Theory   | I.A | Sub Total | Practicals | I.A          | Sub total | Grand Total |
| i      | Section A – Applied Pathology<br>Section B Applied Microbiology | 40<br>40 | 20  | 100       | 40         | 10           | 50        | 150         |
| ii     | Introduction to Respiratory Technology                          | 80       | 20  | 100       | 40         | 10           | 50        | 150         |
| iii    | Pharmacology                                                    | 80       | 20  | 100       |            | No Practical |           | 100         |
| iv     | Medicine relevant to Respiratory technology                     | 80       | 20  | 100       |            | No Practical |           | 100         |

*Distribution of Subsidiary Subjects & marks for First Year University Theory Examination*

| B  | Subsidiary Subject**           | Duration | Marks | I.A Theory Marks | Total Marks |
|----|--------------------------------|----------|-------|------------------|-------------|
| 1. | Sociology                      | 3 hours  | 80    | 20               | 100         |
| 2. | Constitution of India          | 3 hours  | 80    | 20               | 100         |
| 3. | Environmental Science & Health | 3 hours  | 80    | 20               | 100         |

\*\* Subsidiary subjects: Examination for subsidiary Subjects shall be conducted by respective colleges

TABLE - VI

**Distribution of Subjects and marks for Third Year Examination.**

| SL NO | THEORY                               |        |     |          | PRACTICAL         |     |           |             |
|-------|--------------------------------------|--------|-----|----------|-------------------|-----|-----------|-------------|
| PAPER | SUBJECTS                             | THEORY | I.A | SUBTOTAL | PRACTICAL         | I.A | SUB TOTAL | GRAND TOTAL |
| 1     | Respiratory Technology<br>- Clinical | 80     | 20  | 100      | 120<br>(40+40+40) | 30  | 150       | 450         |
| 2     | Respiratory Technology<br>- Applied  | 80     | 20  | 100      |                   |     |           |             |
| 3     | Respiratory Technology<br>- Advanced | 80     | 20  | 100      |                   |     |           |             |

\*\* Practicals-One common practical for all the three papers with equal weight age of marks i.e. 40 practical mark and 10 I.A. marks for each paper.

*Distribution of Subsidiary Subjects & marks for First Year University Theory Examination*

| B  | Subsidiary Subject**        | Duration | Marks | I .A Theory Marks | Total Marks |
|----|-----------------------------|----------|-------|-------------------|-------------|
| 1. | Ethics, Database Management | 3 hours  | 80    | 20                | 100         |
| 2. | Research & Biostatistics    | 3 hours  | 80    | 20                | 100         |
| 3. | Computer application        | 3 hours  | 80    | 20                | 100         |

\*\* Subsidiary subjects : Examination for subsidiary subjects shall be conducted by respective colleges

## **11. Pass criteria**

### **11.1. First year examination**

- a. Main Subjects: A candidate is declared to have passed in a subject, if he/she secures, 50% of marks in University Theory exam and internal assessment added together.
- b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the Commencement of the University examination.

### **11.2. Second and Third year Examination**

- a. Main Subjects: A candidate is declared to have passed the examination in a subject if he/she secures 50% of the marks in Theory and 50% in practical separately. For a pass in theory, a candidate has to secure a minimum of 40% marks in the University conducted written examination, and 50% in aggregate in the University conducted written examination and internal assessment added together and for pass in Practical, a candidate has to secure a minimum of 40% marks in the university conducted Practical/Clinical examination and 50% in aggregate i.e. University conducted Practical/Clinical and Internal Assessment.
- b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

## **12. Carry over benefit**

### **12.1 First year examination:**

A candidate who fails in any two of the five main subjects of first year shall be permitted to carry over those subjects to second year. However, he/ she must pass the carry over subjects before appearing for second year examination.

### **12.2. Second year examination:**

A candidate is permitted to carry over any one main subject to the third year but shall pass this subject before appearing for the third-year examination.

### **13. Declaration of Class**

**a.** A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with Distinction.

**b.** A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 60% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in First Class.

**c.** A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than 60% of grand total marks prescribed will be declared to have passed the examination in Second Class.

**d.** A candidate passing the university examination in more than one attempt shall be placed in Pass class irrespective of the percentage of marks secured by him/her in the examination.

The marks obtained by a candidate in the subsidiary subjects shall not be considered for award of Class or Rank. [Please note, fraction of marks should not be rounded off clauses (a), (b) and (c)]

#### 14. Eligibility for the award of Degree:

A candidate shall have passed in all the subjects of first, second and third year to be eligible for a compulsory 12 months of rotational internship. On completion of 12 months of the internship with pass criteria in outgoing clinical assessment exams the candidate is then eligible for the award of degree

#### 15. Distribution of Type of Questions and Marks

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>First year</b> ) |                  |                          |
|------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                          | No. of Questions | Marks for Each Questions |
| Long Essay                                                 | 1                | 10                       |
| Short Essay                                                | 5                | 5                        |
| Short Notes Type                                           | 5                | 3                        |
| Short Answer Type                                          | 10               | 2                        |
| MCQ's                                                      | 10               | 1                        |

- |                                                     |                  |
|-----------------------------------------------------|------------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks   |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks   |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks   |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks   |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks   |
|                                                     | <b>Total= 80</b> |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Second and Third Year</b> ) |                  |                          |
|-----------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                     | No. of Questions | Marks for Each Questions |
| Long Essay                                                            | 1                | 10                       |
| Short Essay                                                           | 5                | 5                        |
| Short Notes Type                                                      | 5                | 3                        |
| Short Answer Type                                                     | 10               | 2                        |
| MCQ's                                                                 | 10               | 1                        |

- |                                                     |                  |
|-----------------------------------------------------|------------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks   |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks   |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks   |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks   |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks   |
|                                                     | <b>Total= 80</b> |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Subsidiary subjects</b> ) |                  |                          |
|---------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                   | No. of Questions | Marks for Each Questions |
| Essay Type                                                          | 3 (2 x 10)       | 10                       |
| Short Essay Type                                                    | 8 (6 x 5)        | 05                       |
| Short Answer Type                                                   | 12 (10 x 3)      | 03                       |

# **I YEAR B.Sc. RCT**

## **ANATOMY**

Theory: 70hrs

Practicals: 20hrs

### **Chapter 1: Introduction:**

#### **Theory:**

- Definition of anatomy and its divisions
- Terms of location, positions and planes
- Epithelium-definition, classification, describe with examples, function
- Glands- classification, describe serous, mucous & mixed glands with examples
- Basic tissues – classification with examples

#### ● **Practical:**

- Histology of types of epithelium
- Histology of serous, mucous & mixed salivary gland

### **Chapter 2: Connective tissue:**

#### **Theory:**

- Cartilage – types with example & histology theory
- Bone – Classification, names of bone cells, parts of long bone, microscopy of compact
- bone, names of all bones, vertebral column, intervertebral disc, fontanelles of fetal skull
- Joints – Classification of joints with examples, synovial joint (in detail for radiology)

- Muscular system: Classification of muscular tissue & histology
- Names of muscles of the body

### **Practical:**

- Histology of the 3 types of cartilage
- Histology of compact bone (TS & LS)
- Histology of skeletal (TS & LS) & cardiac muscle
- Demo of all bones showing parts, radiographs of normal bones & joints
- Demonstration of important muscles of the body

## **Chapter 3: Cardiovascular system:**

### **Theory:**

- Heart-size, location, chambers, exterior & interior, pericardium
- Blood supply of heart
- Systemic & pulmonary circulation
- Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery
- Inferior vena cava, portal vein, portosystemic anastomosis, Great saphenous vein, Dural venous sinuses
- Lymphatic system- cisterna chyli & thoracic duct, Histology of lymphatic tissues, Names of regional lymphatics, axillary and inguinal lymph nodes in brief

### **Practical:**

- Demonstration of heart and vessels in the body
- Histology of large artery & vein, medium sized artery & vein
- Histology of lymph node, spleen, tonsil & thymus
- Radiology: Normal chest radiograph showing heart shadows

## **Chapter 4: Gastro-intestinal system**

## **Theory:**

- Parts of GIT: Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring), Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas, spleen, peritoneum & reflections

## **Practical:**

- Demonstration of parts of GIT
- Radiographs of abdomen

## **Chapter 5: Respiratory system**

- Parts of RS: nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments, diaphragm
- Histology of trachea, lung and pleura
- Names of paranasal air sinuses

## **Practical:**

- Demonstration of parts of respiratory system.
- Normal radiographs of chest, X-ray paranasal sinuses
- Histology of lung and trachea

4.

## **Chapter 6: Urinary system**

## **Theory:**

- Kidney, ureter, urinary bladder, male and female urethra
- Histology of kidney, ureter and urinary bladder

## **Practical:**

- Demonstration of parts of urinary system
- Histology of kidney, ureter, urinary bladder
- Radiographs of abdomen-IVP, retrograde cystogram



## **Chapter 7: Reproductive system**

### **Theory:**

- Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology)
- Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology)
- Mammary gland – gross

### **Practical:**

- Demonstration of section of male and female pelvis with organs in situ
- Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes, ovary
- Radiographs of pelvis – hysterosalpingogram

## **Chapter 8: Endocrine glands**

### **Theory:**

- Names of all endocrine glands in detail on pituitary gland, thyroid gland & suprarenal gland – (gross & histology)

### **Practical:**

- Demonstration of the glands
- Histology of pituitary, thyroid, parathyroid, suprarenal glands

## **Chapter 9: Nervous system**

### **Theory:**

- Neuron & Classification of NS
- Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (gross & histology) Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei
- Blood supply of brain
- Cranial nerves

- Sympathetic trunk & names of parasympathetic ganglia

### **Practical:**

- Histology of peripheral nerve & optic nerve
- Demonstration of all plexuses and nerves in the body
- Demonstration of all part of brain
- Histology of cerebrum, cerebellum, spinal cord

## **Chapter 10: Sensory organs**

### **Theory:**

- Skin: Skin-histology & Appendages of skin
- Eye: Parts of eye & lacrimal apparatus, Extra-ocular muscles & nerve supply
- Ear: parts of ear- external, middle and inner ear and contents
- 
- **Practical:**
- Histology of thin and thick skin
- Demonstration and histology of eyeball
- Histology of cornea & retina

## **Chapter 11: Embryology:**

### **Theory:**

- Spermatogenesis & oogenesis
- Ovulation, fertilization
- Fetal circulation
- Placenta

### **INTERNAL ASSESSMENT**

Theory-average of 2 exams conducted

20

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

### Distribution of Marks for University Theory and Practical Exam

| Theory |           |    |           | Practicals |    |           | Grand Total |
|--------|-----------|----|-----------|------------|----|-----------|-------------|
| Theory | Viva Voce | IA | Sub Total | Practicals | IA | Sub Total |             |
| 80     | --        | 20 | 100       | *          |    |           | 100         |

### REFERENCE BOOKS:

1. William Davis (P) understanding Human Anatomy and Physiology – McGraw Hill
2. Chaurasia- A Text Book of Anatomy
3. T. S. Ranganathan- A Text Book of Human Anatomy
4. Fattana, Human Anatomy (Description and applied)- Saunder's & C P Prism Publishers, Bangalore
5. ESTER. M. Grishcimer- Physiology & Anatomy with Practical Considerations, J. P. Lippin Cott. Philadelphia
6. Bhatnagar- Essentials of Human Embryology- Revised Edition. Orient Blackswan Pvt. Ltd.

## **PHYSIOLOGY**

Theory 70 hours

Practical 20hours

### **1. General Physiology**

Introduction to cell physiology, transport across cell membrane Homeostasis, Body Fluid compartment & measurement.

### **2. Blood**

Introduction- composition and function of blood Plasma. proteins, types and functions

Red blood cells - erythropoiesis, stages of differentiation, factors affecting it, function, normal count, physiological variation.

Hemoglobin- function, concentration, types & methods of Hb estimation, fate of hemoglobin Jaundice-types Anaemia,-types

ESR, PCV, osmotic fragility & blood indices

WBC- morphology, production, functions, normal count, differential count, variation, variation Immunity (in brief)

Platelets- origin, morphology, normal count, function-Platelet plug ,bleeding disorder

Haemostasis - definition, normal haemostasis, clotting factors, mechanism of clotting, anticoagulants disorders of clotting factors.

Blood group-ABO & Rh system, Rh incompatibility blood typing ,cross matching, hazards of mismatched blood transfusion

RES, spleen and lymph.

### **3. Nerve-Muscle**

Neuron structure, types, neuroglia-types, nerve fibre classification, properties of nerve fibres, RMP, action potential, wallerian degeneration

NMJ, blockers, Myasthenia gravis

Classification of muscle, structure of skeletal muscle, sarcomere, contractile proteins Excitation contraction coupling, mechanism of muscle contraction, types of contraction Motor unit, fatigue, rigor mortis Smooth muscle.

### **4. Respiratory system**

Physiological anatomy of respiratory system, muscles of respiration, respiratory & non respiratory functions of lungs, dead space

Mechanics of breathing, intrapulmonary & pleural pressures Compliance, Surfactant, Hyaline membrane disease

Lung volumes and capacities

Respiratory membrane, transport of  $O_2$  &  $CO_2$

Chemical regulation of respiration Neural regulation of respiration Hypoxia, Acclimatization, Dysbarism. Artificial respiration

Definition-Periodic breathing, dyspnoea, apnoea, asphyxia,, cyanosis.

### **5. Cardiovascular system**

Introduction to CVS & general principles of circulation Properties of Cardiac muscle Cardiac cycle, heart sounds, Pulse Cardiac output, factors and measurement Heart rate

BP-factors, measurement, Short term regulation Intermediate and long term regulation of BP

ECG uses and significance, .normal waveform, heart block Coronary circulation, Cutaneous circulation-Triple response Shock

Effects of exercise on CVS and Respiratory system.

### **6. Renal system, Skin and body temperature**

Kidneys- functions, structure of nephron, type, juxtaglomerular apparatus-structure and function, non- excretory functions of kidney

Glomerular filtration rate (GFR)- Definition, normal value, factors affecting GFR

Tubular reabsorption - sites, substance reabsorbed, mechanisms of reabsorption

Tubular secretion- sites, substance secreted, mechanisms of reabsorption

Counter current mechanism of concentration of urine Obligatory and Facultative reabsorption of water Micturition reflex, Diuretics

Artificial kidney, renal function tests-clearance tests

Skin -structure and function, body temperature measurement, physiological variation,

Regulation of body Temperature by physical chemical and nervous mechanisms-

Role of Hypothalamus Hypothermia and fever.

## **7. Digestive system**

Physiological anatomy, Enteric nervous system & functions of GIT Saliva-composition, regulation, disorder.

Deglutition- stages & disorders

Stomach-functions, composition and regulation of gastric juice Gastric motility, MMC, vomiting reflex.

Pancreas- function, composition and regulation of pancreatic juice

Liver & gall bladder-functions, bile- composition, secretion and regulation Small

intestine- Succus entericus-composition, functions & movements Large intestine-functions, movements and defecation reflex

Digestion & absorption of Carbohydrates, fats and proteins.

## **8. Endocrine system**

Classification of Endocrine glands & their hormones & properties-chemistry and receptor, feedback mechanisms of hormone regulation.

Anterior pituitary hormones- secretion, functions , disorders Posterior pituitary hormones- secretion , functions , disorders Thyroid hormones- secretion, functions, disorders

Parathyroid hormones- secretion, functions, disorders Calcium homeostasis & disorders

Pancreatic hormones, -Insulin and Glucagon- . secretion, functions, disorders

Adrenal cortex- Glucocorticoids & Mineralocorticoids, Androgen - secretion, functions, disorders Adrenal medulla- secretion, functions, disorders Thymus & Pineal gland.

## **9. Reproductive system**

Introduction to reproductive system, sex differentiation & Puberty Male reproductive system, functions of testosterone & Spermatogenesis

Female reproductive system, functions of Estrogen, Progesterone, Oogenesis Ovulation & Menstrual cycle

Physiological changes during pregnancy, pregnancy tests, parturition & lactation

Male & Female contraceptive methods.

## 10. Central nervous system

Introduction to CNS, Sensory receptors classification, properties Synapse—classification, properties

Sensory pathways: Anterior spino thalamic tract and Posterior column pathway

Lateral spino thalamic tract, Types of pain, Referred pain, Thalamus; nuclei and function

Classification of reflexes, Monosynaptic reflex- Stretch reflex , muscle spindle ,inverse stretch reflex. Polysynaptic reflex-Withdrawal reflex

Motor pathways : Pyramidal pathway and functions, UMNL, LMNL Cerebral cortex (Sensory and motor)-functions, Medulla and Pons-functions Cerebellum –functions, disorders

Basal ganglia-functions, disorders Hypothalamus and Limbic system-functions CSF, lumbar puncture

Sleep, EEG,

Autonomic Nervous System - Sympathetic and parasympathetic distribution and functions.

## 11. Special senses

Vision –Functional anatomy of eye, visual pathway, lesion Refractive errors, color vision

Audition – Physiological anatomy of ear, Mechanism of hearing, auditory pathway, deafness Olfaction –modalities, receptor, function, abnormalities

Gustation-modalities, receptor, function, taste pathway, abnormalities.

## Practicals

Blood pressure Recording

Auscultation for Heart Sounds

Artificial Respiration

Determination of vital capacity

## INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work\* 10

\* There shall be no university practical examination and internal assessment marks

secured in Practicals need not be sent to the university.

**Distribution of Marks for University Theory and Practical Exam**

| Theory |           |    |           | Practicals |    |           | Grand Total |
|--------|-----------|----|-----------|------------|----|-----------|-------------|
| Theory | Viva Voce | IA | Sub Total | Practicals | IA | Sub Total |             |
| 80     | --        | 20 | 100       | *          |    |           | 100         |

**REFERENCE BOOKS:**

1. Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism Publishers
2. Chatterjee (CC) Human Physiology Latest Ed. Vol. 1, Medical Allied Agency
3. Choudhari (Sujith K) Concise Medical Physiology Latest Ed. New Central Book
4. Ganong (William F) Review of Medical Physiology. Latest Ed. Appleton



# BIOCHEMISTRY I

No. Theory classes: 70 hours

No. Practical classes: 20 hours

## 1. Carbohydrate Chemistry [3 hours]

- Classification (Definition/ examples for each class)
- Monosaccharides (classification depending upon number of carbon atoms and functional group with examples)
- Disaccharides (Sucrose/ lactose/ maltose and their composition)
- Polysaccharides:
  - a) Homopolysaccharides (Structure of starch and glycogen)
  - b) Heteropolysaccharides (Functions ).

## 2. Lipid Chemistry [3 hours]

- Definition of lipids
- Functions of lipids in the body
- Classification of lipids (subclasses with examples)
- Definition and Classification of fatty acids
- Essential fatty acids
- Phospholipids and their importance

## 3. Amino-acid and Protein Chemistry [3 hours]

- General structure of D and L amino acids
- Amino acids; Definition and Classification of amino acids with examples.
- Peptides; definition & Biologically important peptides
- Classification of Proteins based on composition, functions and shape (with examples)
- Functions of amino acids and Proteins.

## 4. Nucleotide and Nucleic acid Chemistry [ 3 hours]

- Nucleosides & Nucleotides
- Nucleic acid Definition & types
- Composition & functions of DNA & RNA
- Structure of DNA (Watson and Crick model)
- Structure of tRNA, & functions of tRNA, rRNA, mRNA
- Difference between DNA and RNA.

## 5. Enzymes [5 hours]

- Definition & Classification of Enzymes with example
- Definitions of Active site, Cofactor (Coenzyme, Activator),
- Proenzyme; Definition and examples (Pepsin & trypsin).

## 6. **Digestion and Absorption [ 3 Hours]**

- General characteristics of digestion and absorption,
- Digestion and absorption of carbohydrates, proteins and lipids.

## 7. **Carbohydrate Metabolism [ 5 Hours]**

- Glycolysis ; Aerobic, Anaerobic, Definition , Site and subcellular site , Steps with all the enzymes and coenzymes at each step , mention the regulatory enzymes , Energetics,
- Citric acid cycle; Pyruvate dehydrogenase complex (reaction and coenzymes) , Site and subcellular site , Reactions with all the enzymes and coenzymes ,Regulatory enzymes , Energetics
- Significance of HMP Shunt pathway.
- Hyperglycemic and hypoglycemic hormones
- Blood Glucose Regulation.
- Diabetes mellitus (definition, classification, signs and symptoms)
- Glycogen metabolism and gluconeogenesis.

## 8. **Lipid Metabolism [ 4 Hours]**

- Introduction to lipid metabolism, Lipolysis
- Beta oxidation of fatty acids ; Definition ,Site and subcellular site , Activation of palmitic acid ,Transport of activated palmitic acid into mitochondria , Reactions , Energetics.
- Name the different ketone bodies . Note on ketosis.

## 9. **Amino acid and Protein Metabolism [ 3 Hours]**

- Introduction, transamination, deamination, Fate of ammonia, transport of ammonia,
- Urea cycle.

## 10. **Vitamins [5 Hours]**

- Definition and classification .
- RDA, sources, coenzyme forms, biochemical functions and disorders for the following water soluble vitamins: Thiamine, Niacin, Pyridoxine,

Cobalamine, Folic acid, Ascorbic acid

- RDA, sources, coenzyme forms, biochemical functions and deficiency disorders for the following fat soluble vitamins; A and vitamin D.

### **11. Mineral Metabolism [3 Hours]**

- Name the macro/ microminerals
- Iron: Sources ,RDA, Functions and Disorders of deficiency and excess
- Calcium and phosphorus: Sources ,RDA, functions, normal serum levels and hormones regulating their levels.

### **12. Nutrition [6 hours]**

- Balanced diet (Definition)
- Caloric value ; Definition , Caloric values of carbohydrates, proteins and fats
- Total daily caloric requirements of an adult male and female,
- RDA (Definition, standard values for nutrients)
- Basal metabolic rate(BMR) ; Definition , Magnitude of BMR in men and women, Factors affecting BMR
- Thermic effect/ SDA of food (Definition, values for major macronutrients)
- Carbohydrates ; 1. Daily dietary requirement. 2. Dietary fibers (Definition, functions, importance and their daily requirements)
- Proteins ; 1. Daily requirement , Biological value. a. Definition b. Protein used as a standard for this, Protein sources with high and low biological value , Mutual supplementation of proteins (Definition, examples).
- Fats ; Daily requirement , Essential fatty acids (Definition, functions, daily requirement and deficiency manifestations) , Saturated and unsaturated fatty acids (Definition, sources, examples).
- Malnutrition

### **13. Renal Function Tests [ 2 hours]**

- Name the different tests to assess the kidney functions
- Explain Creatinine clearance & Inulin clearance
- Urinary acidification test

### **14. Radioactive Isotopes [1 hour]**

- Definition, clinical applications
- Biological effects of radiations

## **15. Clinical Biochemistry [ 5 hours ]**

A. Definitions of acid, base, pH and pKa [1 hour]

B. Buffers • Definition [2 hours]

- Henderson Hasselbalch equation,
- Principal buffer systems in the ECF ICF and urine
- Bicarbonate and phosphate buffer systems (pKa value, normal ratio of base/acid in the plasma)
- Acidosis & Alkalosis (Definition, classification, causes and biochemical findings)

C. Normal serum levels and condition where they are altered [2 hour]

- Glucose, Protein, urea, uric acid, and creatinine
- Bilirubin, cholesterol
- Serum Electrolytes

## **16. Fundamental Chemistry (1 hour)**

- Valency, Molecular weight & Equivalent weight of elements and compounds. Normality, Molarity, Molality.

## **17. Solutions: Definition, use, classification where appropriate, preparation and storage (5 hours)**

- Stock and working solutions.
- Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H<sub>2</sub>SO<sub>4</sub>, H<sub>3</sub>PO<sub>4</sub>, CH<sub>3</sub>COOH etc.,)
- Preparation of percent solutions – w/w, v/v w/v (solids, liquids and acids), Conversion of a percent solution into a molar solution
- Saturated and supersaturated solutions
- Standard solutions. Technique for preparation of standard solutions and Storage. E.g: glucose, albumin etc.
- Dilutions- Diluting Normal , Molar and percent solutions. Preparing working standard from stock standard.
- Part dilutions: Specimen dilutions. Serial dilutions. Reagent dilution. Dilution factors.

## **ASSIGNMENT TOPICS**

1. Units of measurement
2. Hazards - Physical, Chemical, Biological
3. Arterial blood gas analysis
4. Responsibilities of Health care personnel
5. Biomedical waste management

## **PRACTICAL DEMONSTRATION [20 hours]**

- Color Reactions of Carbohydrates & amino acids.
- Precipitation Reactions of proteins
- Colorimetry
- Estimation of Blood glucose Folin Wu and enzymatic method
- Estimation of Urea by DAM method

## **INTERNAL ASSESSMENT**

|                                     |    |
|-------------------------------------|----|
| Theory-average of 2 exams conducted | 20 |
| Practicals: record and lab work*    | 10 |

\* There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

### Distribution of Marks for University Theory and Practical Exam

| Theory |           |    |           | Practicals |    |           | Grand Total |
|--------|-----------|----|-----------|------------|----|-----------|-------------|
| Theory | Viva Voce | IA | Sub Total | Practicals | IA | Sub Total |             |
| 80     | --        | 20 | 100       | *          |    |           | 100         |

### Text Book References

- Biochemistry – 3<sup>rd</sup> revised edition by U Sathyanarayana & U Chakrapani
- Textbook of Medical Biochemistry-6<sup>th</sup> Edition by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology 2<sup>nd</sup> edition by Godkar and Godkar.
- Biochemistry-3<sup>rd</sup> edition by Pankaja Naik
- Medical Laboratory technology 6<sup>th</sup> edition by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students-3<sup>rd</sup> edition by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> editions.

## PATHOLOGY I

(Clinical Pathology, Hematology and Blood Banking)

Theory-70 hours

Practicals-20 hours

### I. Clinical Pathology- Theory

- Introduction to clinical pathology
- Collection , transport, preservation and processing of various clinical specimens
- Urine examination- collection and preservation, Physical, chemical and microscopic examination for abnormal constituents
- Examination of Body fluids
- Examination of Cerebrospinal fluid (CSF)

- Sputum examination
- Examination of feces

## II. Hematology – Theory

- Introduction to hematology
- Normal constituents of Blood, their structure and functions
- Collection of Blood samples
- Various anticoagulants used in Hematology
- Hemoglobin estimation, different methods and normal values
- Packed cell volume
- Erythrocyte sedimentation rate
- Normal Haemostasis
- Bleeding time. Clotting time, prothrombin time, Activated partial Thromboplastin time

## III. Blood Bank- Theory

- Introduction blood banking
- Blood group system
- Collection and processing of blood for transfusion
- Compatibility testing
- Blood transfusion reactions

## IV General Pathology:

### 1. Cell injury:

- a. Definition, causes.
- b. Cellular adaptations – Hypertrophy, hyperplasia, atrophy and metaplasia.
- c. Types of cell injury – Reversible and irreversible; morphology of reversible injury.
- d. Necrosis – Definition and patterns of tissue necrosis.
- e. Intracellular accumulations – Lipids, cholesterol, proteins, glycogen and pigments; examples.
- f. Pathologic calcification – Types and examples.

### 2. Inflammation:

- a. Definition and signs of inflammation.
- b. Types – Acute and chronic inflammation.
- c. Acute inflammation – Causes, morphological patterns and outcome.
- d. Chronic inflammation – Causes, morphology and examples.
- e. Regeneration and repair – Mechanism of cutaneous wound healing.

f. Factors affecting wound healing.

### **3. Hemodynamic disorders:**

- a. Edema – Definition, pathogenesis and types: Renal, cardiac, pulmonary and cerebral.
- b. Difference between transudate and exudate.
- c. Shock – Definition, types of shock with examples: Hypovolemic, cardiogenic and septic shock, stages of shock: Nonprogressive, progressive and irreversible.
- d. Thrombosis – Definition, mechanism of thrombus formation (Virchow's triad) and fate of thrombus.
- e. Embolism – Definition and types: Thromboembolism, fat, air and amniotic fluid embolism.
- f. Infarction – Definition and examples.

### **4. Immune system:**

- a. Autoimmune diseases – General features, enumerate systemic and organ specific autoimmune diseases.
- b. Systemic lupus erythematosus – Manifestations and diagnosis.

### **5. Neoplasia:**

- a. Definition and nomenclature of tumors.
- b. Differences between benign and malignant neoplasms.
- c. Enumerate modes of carcinogenesis: Genes, physical, chemical and microbial agents of carcinogenesis.
- d. Modes of spread of tumors.
- e. Clinical aspects of neoplasia.
- f. Grading and staging of cancers.
- g. Laboratory diagnosis of cancer.

### **Practicals**

- 1. Urine analysis- Physical, Chemical, Microscopic
- 2. Blood grouping and Rh typing
- 3. Hb estimation , packed cell volume (PCV), Erythrocyte Sedimentation rate (ESR)
- 4. Bleeding time and Clotting time
- 5. Histopathology - section cutting and H&E staining.

## **INTERNAL ASSESSMENT**



|                                     |    |
|-------------------------------------|----|
| Theory-average of 2 exams conducted | 20 |
| Practicals: record and lab work*    | 10 |

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

#### **Distribution of Marks for University Theory and Practical Exam**

| <b>Theory</b> |           |    |           | <b>Practicals</b> |    |           | <b>Grand Total</b> |
|---------------|-----------|----|-----------|-------------------|----|-----------|--------------------|
| Theory        | Viva Voce | IA | Sub Total | Practicals        | IA | Sub Total |                    |
| 80            | --        | 20 | 100       | *                 |    |           | 100                |

## REFERENCE BOOKS:

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss- Cytology
4. Winifred Diagnostic cytopathology
5. Orell Cytopathology
6. Todd and Sanford- clinical diagnosis by Laboratory Medicine
7. Dacie and Lewis- Practical Hematology
8. Ramnik SOOD. Lab technology, Methods and interpretation, 4 th edition JP Bros New Delhi, 1996
9. Sathish Guptha , Short text book of Medical laboratory techniques for technicians
10. Sachdev K N. Clinical Pathology and Bacteriology, 8 th edi JP Bros, New Delhi, 1996.

## Microbiology I

Theory: 70 Hours

Practicals: 20 Hours

### 1. Introduction (6 hrs)

History of Microbiology - Louis Pasteur, Antony Van Leeuwenhoek, Robert Koch, Edward Jenner, Alexander Fleming.

Use of microscope in the study of bacteria - Types of microscopes - compound microscope, phase contrast microscope, electron microscope, fluorescent microscope, dark ground microscope.

Morphology of bacterial cell

### 2. Growth and Nutrition (6 hrs.)

Nutrition, growth and multiplication of bacteria, bacterial growth curve, culture media, culture methods, anaerobic culture methods.

### 3. Sterilization and disinfection (8 hrs.)

Principles and use of equipments of sterilization, chemicals used in disinfection, testing of disinfectants.

#### **4. Biomedical waste management principle and practice**

#### **5. Immunology ( 5hrs.)**

Immunity - mechanism of immunity, classification, types

Vaccines

Immunization schedule

Definition of antigen, antibody, list of antigen antibody reaction (no need of detailed account of antigen antibody reactions)

Definition of hypersensitivity and classification (no need of detailed account of types of hypersensitivity)

#### **6. Infection (5 hrs.)**

Definition, types and mode of transmission

Hospital acquired infection - causative agents, mode of transmission and prophylaxis.

Antimicrobial sensitivity testing

#### **7. Systematic bacteriology (15 hrs.)**

Disease caused and laboratory diagnosis of medically important bacteria (Staphylococcus, coagulase negative Staphylococcus, MRSA, Streptococcus pyogenes, Pneumococcus, gonococcus, E.coli, diarrhoeagenic E.coli, Salmonella, Vibrio cholerae, ElTor vibrios, Halophilic vibrios, Shigella, Mycobacterium tuberculosis, Mycobacterium leprae, Atypical Mycobacteria, Treponema pallidum, leptospira)

(no need of classification, antigenic structure, virulence mechanism)

#### **8. Parasitology (10 hrs.)**

Introduction to Parasitology

List of medically important parasites and diseases (E.histolytica, Plasmodium, W.bancrofti, Ascaris, Ancylostoma, B.coli, G.lamblia, T.solium, T.saginata)

Laboratory diagnosis of parasitic infection (No need of including life cycles)

#### **9. Virology (10 hrs.)**

Introduction to virology

List of medically important viruses and diseases (AIDS, Hepatitis, Rabies, Polio, Arbo viruses)

Cultivation of viruses and laboratory diagnosis of viral infections

## **10. Mycology (5 hrs.)**

Introduction to Mycology

Classification of medically important fungi - (based on morphology, spore production, disease production, taxonomy)

List of medically important fungi and diseases (Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis, Mucor Mycosis)

Laboratory diagnosis of fungal infections.

## **Practicals (20 hrs.)**

Compound microscope (Demonstration)

Demonstration of sterilization equipments

Demonstration of culture media and culture methods

Demonstration of antibiotic sensitivity testing

Demonstration of serological tests - Widal, VDRL, ASO, CRP, RA

Demonstration of gram stain and ZN staining

Demonstration of Helminthic ova

Grams stain, Acid fast staining

Stool exam for Helminthic ova

There shall be no university practical examination and Internal Assessment marks secured in practicals need not be sent to the university.

## **INTERNAL ASSESSMENT**

|                                              |    |
|----------------------------------------------|----|
| Theory-average of 2 exams conducted          | 20 |
| Practicals: record and lab work <sup>*</sup> | 10 |

### **Distribution of Marks for University Theory and Practical Exam**

| <b>Theory</b> |           |    |           | <b>Practicals</b> |    |           | <b>Grand Total</b> |
|---------------|-----------|----|-----------|-------------------|----|-----------|--------------------|
| Theory        | Viva Voce | IA | Sub Total | Practicals        | IA | Sub Total |                    |
| 80            | --        | 20 | 100       | *                 |    |           | 100                |

### **Reference Books-**

1. Ananthanarayana & Panikar Medical Microbiology- University Press
2. Robert Cruickshank- Medical Microbiology- The Practice of Medical Microbiology
3. Chatterjee- Parasitology- Interpretation to Clinical Medicine
4. Rippon- Medical Mycology
5. Emmons- Medical Mycology
6. Basic Laboratory methods in Parasitology, J P Bros, New Delhi
7. Basic Laboratory procedures in clinical bacteriology, J P Bros, New Delhi
8. Medical Parasitology- Ajit Damle
9. Introduction to medical microbiology- Ananthanarayana- Orient Longman Pvt. Ltd.

## **SUBSIDIARY SUBJECTS**

### **ENGLISH**

### **COURSE OUTLINE**

**COURSE DESCRIPTION:** This course is designed to help the student acquire a good

command and comprehension of the English language through individual papers and conferences.

### **BEHAVIOURAL OBJECTIVES:**

The student at the end of training is able to

1. Read and comprehend English language
2. Speak and write grammatically correct English
3. Appreciates the value of English literature in personal and professional life.

### **UNIT - I: INTRODUCTION:**

Study Techniques

Organisation of effective note taking and logical processes of analysis and synthesis

Use of the dictionary

Enlargement of vocabulary Effective diction

### **UNIT - II: APPLIED GRAMMAR:**

Correct usage

The structure of sentences The structure of paragraphs Enlargements of Vocabulary

### **UNIT - III: WRITTEN COMPOSITION:**

Precise writing and summarizing Writing of bibliography Enlargement of Vocabulary

### **UNIT - IV: READING AND COMPREHENSION:**

Review of selected materials and express oneself in one's words. Enlargement of Vocabulary.

### **UNIT - V: THE STUDY OF THE VARIOUS FORMS OF COMPOSITION:**

Paragraph, Essay, Letter, Summary, Practice in writing

### **UNIT - VI: VERBAL COMMUNICATION:**

Discussions and summarization, Debates, Oral reports, use in teaching

## REFERENCE

1. English Grammar Collins, Birmingham University, International Language Data Base, Rupa & Co. 1993
2. Wren and Martin - Grammar and Composition, 1989, Chanda & Co, Delhi
3. Letters for all Occasions. A S Myers. Pub - Harper Perennial
4. Spoken English V. Shasikumar and P V Dhanija. Pub. By: Tata Mcgraw Hill, New Delhi
5. Journalism Made Simple D Wainwright
6. Writers Basic Bookself Series, Writers Digest series
7. Interviewing by Joan Clayton Platkon
8. Penguin Book of Interviews.

## HEALTH CARE

### Teaching Hours : 40 Introduction to Health

Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept.

National Health Policy

National Health Programmes ( Briefly Objectives and scope) Population of India and Family welfare programme in India **Introduction to Nursing**

What is Nursing ? Nursing principles. Inter-Personnel relationships. Bandaging : Basic turns; Bandaging extremities; Triangular Bandages and their application.

Nursing Position, Bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's positions, comfort measures, Aids and rest and sleep.

Lifting And Transporting Patients: Lifting patients up in the bed. Transferring from bed to wheel chair. Transferring from bed to stretcher.

Bed Side Management: Giving and taking Bed pan, Urinal : Observation of stools,

urine. Observation of sputum, Understand use and care of catheters, enema giving. Methods of Giving Nourishment: Feeding, Tube feeding, drips, transfusion Care of Rubber Goods  
Recording of body temperature, respiration and pulse, Simple aseptic technique, sterilization and disinfection. Surgical Dressing: Observation of dressing procedures

### **First Aid :**

Syllabus as for Certificate Course of Red Cross Society of St. John's Ambulance Brigade.

### **Reference Books:**

1. Preventive and Social Medicine by J.Park
2. Text Book of P & SM by Park and Park
3. Counseling & Communicate skills for medical and health, Bayne- Orient Longman Pvt. Ltd.

This is a subsidiary subject, examination to be conducted by respective colleges.

Marks required for a pass is 35%.

## **APPLIED PHARMACOLOGY**

- General concepts about pharmacodynamic and Pharmacokinetic Principles involved in drug activity.



***I. Cardiovascular drugs- Enumerate the mode of action, side effects and therapeutic uses of the following drugs.***

- a. Antihypertensives
  - Beta Adrenergic antagonists
  - Alpha Adrenergic antagonists
  - Peripheral Vasodilators
  - Calcium channel blockers
- b. Antiarrhythmic drugs
- c. Cardiac glycosides
- d. Sympathetic and nonsympathetic inotropic agents.
- e. Coronary vasodilators.
- f. Antianginal and anti failure agents
- g. Lipid lowering & anti atherosclerotic drugs.
- h. Drugs used in Haemostasis- anticoagulants, Thrombolytics and antithrombotics.
- i. Cardioplegic drugs- History, Principles and types of cardioplegia.
- j. Primary solutions- History, principles & types.
- k. Drugs used in the treatment of shock.

***II. Anaesthetic agents.***

- Definition of general and local anaesthetics.
- Classification of general anaesthetics.
- Pharmacokinetics and Pharmacodynamics of inhaled anaesthetic agents.
- Intravenous general anaesthetic agents.
- Local anaesthetics - classification, mechanism of action, duration of action and methods to prolong the duration of action. Preparation, dose and routes of administration.

***III. Analgesics***

- Definition and classification
- Routes of administration, dose, frequency of administration, Side effects and management of non opioid and opioid analgesics

***IV. Antihistamines and antiemetics-***

- Classification, Mechanism of action, adverse effects,

Preparations, dose and routes and administration.

***V. CNS stimulants and depressants***

- Alcohol
- Sedatives, hypnotics and narcotics
- CNS stimulants
- Neuromuscular blocking agents and muscle relaxants.

## ***VI. Pharmacological protection of organs during CPB***

## ***VII. Inhalational gases and emergency drugs.***

## ***VIII. Pharmacotherapy of respiratory disorders***

- Introduction - Modulators of bronchial smooth muscle tone and pulmonary vascular smooth muscle tone
- Pharmacotherapy of bronchial asthma
- Pharmacotherapy of cough
- Mucokinetic and mucolytic agents
- Use of bland aerosols in respiratory care.

## ***IX. Corticosteroids*** - Classification, mechanism of action, adverse effects and complications. Preparation, dose and routes of administration.

## ***X. Diuretics***

- Renal physiology
- Side of action of diuretics
- Adverse effects
- Preparations, dose and routes of administration.

## ***XI. Chemotherapy of infections***

- Definition
- Classification and mechanism of action of antimicrobial agents
- Combination of antimicrobial agents
- Chemoprophylaxis.
- Classification, spectrum of activity, dose, routes of administration and adverse effects of penicillin, cephalosporins, aminoglycosides, tetracyclines, chloramphenicol, antitubercular drugs.

## ***XIII. Miscellaneous.***

- IV fluids - various preparations and their usage.
  - Electrolyte supplements
  - Immunosuppressive agents
  - New drugs included in perfusion technology.
  - Drugs used in metabolic and electrolyte imbalance.
-

### *PRACTICALS:*

1. Preparation and prescription of drugs of relevance.
2. Experimental pharmacology directed to show the effects of commonly used drugs of relevance and interpretation of few charts.

### *NO PRACTICAL EXAMINATION*

#### *Recommended Books.*

1. R. S. Satoskar, S.D. Bhandarkar, S. S. Ainapure, Pharmacology and Pharmacotherapeutics, 18th Edition, single Volume, M/S Popular Prakashan, 350, Madan Mohan Marg, Tardeo, Bombay - 400 034.
2. K.D. Tripathi, Essentials of Medical Pharmacology, V. Edition, M/s. Jaypee Brothers, Post Box, 7193, G-16, EMCA House, 23/23, Bansari Road, Daryaganj, New Delhi.
3. Laurence and Bennet, Clinical Pharmacology, ELBS Edition, 9th Edition.

# APPLIED PATHOLOGY

## *I. CARDIOVASCULAR SYSTEM*

- Hypertension-Definition, types and briefly Pathogenesis and effects of Hypertension.
- Ischaemic heart diseases- Definition, Types. Briefly Pathophysiology, Pathology & Complications of various types of IHD.
- Valvular Heart diseases-causes, Pathology & complication. Complications of artificial valves.
- Cardiomyopathy- Definition, Types, causes and significance.
- Pericardial effusion-causes, effects and diagnosis.

## *II. HAEMATOLOGY*

- Anaemia - Definition, morphological types and diagnosis of anaemia. Brief concept about Haemolytic anaemia and polycythaemia.
- Leukocyte disorders- Briefly leukaemia, leukocytosis, agranulocytosis etc.,
- Bleeding disorders- Definition, classification, causes & effects of important types of bleeding disorders. Briefly various laboratory tests used to diagnose bleeding disorders.

## *III. RESPIRATORY SYSTEM*

- Chronic obstructive airway diseases - Definition and types. Briefly causes, Pathology and complications of each type of COPD.
- Briefly concept about obstructive versus restrictive pulmonary disease.
- Pneumoconiosis- Definition, types, Pathology and effects in brief.
- Pulmonary congestion and edema.
- Pleural effusion - causes, effects and diagnosis.

## *PRACTICALS*

1. Estimation Bleeding & Clotting time.

There will be a Combined Practical examination for Applied Pathology & Applied Microbiology.

| Sl. No. | Tests                                       | Marks |
|---------|---------------------------------------------|-------|
| 1.      | Interpretation of Hematology Chart          | 05    |
| 2.      | Interpretation of Urine Chart               | 05    |
| 3.      | Estimation of Hemoglobin                    | 05    |
| 4.      | Estimation of Bleeding time & Clotting time | 05    |
|         | Total                                       | 20    |

# APPLIED MICROBIOLOGY

## THEORY - 40 HOURS

1. Health care associated infections and Antimicrobial resistance: Infections that patients acquire during the course of receiving treatment for other conditions within a healthcare setting like Methicillin Resistant *Staphylococcus aureus* infections, Infections caused by *Clostridium difficile*, Vancomycin resistant enterococci etc. Catheter related blood stream infections, Ventilator associated pneumonia, Catheter Related urinary tract infections, Surveillance of emerging resistance and changing flora. The impact and cost attributed to Hospital Associated infection.  
6 Hours
2. Disease communicable to Healthcare workers in hospital set up and its preventive measure: Occupationally acquired infections in healthcare professionals by respiratory route ( tuberculosis, varicella-zoster, respiratory syncytial virus etc ), blood borne transmission ( HIV, Hepatitis B, Hepatitis C, Cytomegalovirus, Ebola virus etc), oro faecal route ( Salmonella, Hepatitis A etc), direct contact ( Herpes Simplex Virus etc). Preventive measures to combat the spread of these infections by monitoring and control.  
6 Hours
3. Microbiological surveillance and sampling: Required to determine the frequency of potential bacterial pathogens including *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis* and also to assess the antimicrobial resistance. Sampling: rinse technique, direct surface agar plating technique.  
6 Hours
4. Importance of sterilization:
  - a. Disinfection of instruments used in patient care: Classification, different methods, advantages and disadvantages of the various methods.
  - b. Disinfection of the patient care unit
  - c. Infection control measures for ICU's10 Hours
5. Sterilization:
  - a. Rooms: Gaseous sterilization, one atmosphere uniform glow discharge plasma (OAUGDP).
  - b. Equipments: classification of the instruments and appropriate methods of sterilization.
  - c. Central supply department: the four areas and the floor plan for instrument cleaning, high-level disinfecting and sterilizing areas.8 Hours
6. Preparation of materials for autoclaving: Packing of different types of materials, loading, holding time and unloading.  
4 Hours

### PRACTICALS- 30 HOURS

1. Principles of autoclaving & quality control of Sterilization.
2. Collection of specimen from outpatient units, inpatient units, minor operation theater and major operation theater for sterility testing.
3. The various methods employed for sterility testing.
4. Interpretation of results of sterility testing.
5. Disinfection of wards, OT and Laboratory.

### PRACTICAL EXAMINATION

40 Marks

There will be a Combined Practical examination for Applied Pathology & Applied Microbiology.

| Sl. No. | Tests                                                                                                                                                | Marks |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 5.      | Dry heat/Moist heat: Temperature recording charts interpretation                                                                                     | 05    |
| 6.      | Dry heat/Moist heat: Color change indicators interpretation                                                                                          | 05    |
| 7.      | Air sampling culture plates interpretation of Colony forming units based on air flow rate and sampling time                                          | 05    |
| 8.      | Interpretation of Sterility of Hemodialysis water/Distilled water/Deionised water based on growth of colonies in BHI agar to be reported as X CFU/mL | 05    |
|         |                                                                                                                                                      | 20    |

There will be a Combined Practical examination for Applied Pathology & Applied Microbiology.

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## MEDICINE RELEVANT TO RESPIRATORY CARE TECHNOLOGY

### **CardioPulmonary Diseases**

#### **Course Description**

This course is designed to teach the respiratory therapy student about the pathological changes, clinical findings and treatment of major cardiopulmonary diseases.

#### **Learning Objectives**

By the end of this course students will be able to:

1. Enumerate the pathological changes that occurs in the pulmonary system of patients suffering from cardiopulmonary diseases
2. Describe and diagnose clinical features and outline the treatment of cardiopulmonary disease
3. Appreciate the role of the respiratory therapist in the management and diagnosis of cardiopulmonary disease



## Course Outline

| Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>CARDINAL MANIFESTATIONS AND PRESENTATION OF DISEASES</p> <p>Alteration in circulatory and Respiratory Functions</p> <p>Dyspnea</p> <p>Cough</p> <p>Chest Pain and Palpitations</p> <p>Hematemesis and Hemoptysis</p> <p>Hypoxia and Cyanosis</p> <p>Fever</p> <p>Edema</p>                                                                                                                                                                                                                                                                                                                                                        |
| <p>Respiratory Insufficiency and Respiratory Failure</p> <p>Classification Background, Pathophysiology, Etiology and Management of Respiratory failure</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <p>OBSTRUCTIVE LUNG DISEASES</p> <p>Chronic Obstructive Pulmonary Disease (COPD), Chronic Bronchitis and Emphysema</p> <p>Anatomic alterations of the lungs associated with Chronic Bronchitis and Emphysema</p> <p>Etiology and Epidemiology, Risk factors, Diagnosis and assessment of Chronic Obstructive Pulmonary Disease</p> <p>Distinguishing features between Emphysema and Chronic Bronchitis</p> <p>Cardiopulmonary clinical manifestations associated with Chronic Bronchitis and Emphysema</p> <p>General management of COPD</p> <p>Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines of COPD</p> |
| <p>Asthma</p> <p>National Asthma Education and prevention program</p> <p>Global Initiative for Asthma (GINA) guidelines</p> <p>Anatomic alterations of the lung</p> <p>Etiology, Classification and Epidemiology, Diagnosis of Asthma</p> <p>Cardiopulmonary clinical manifestations associated with Asthma</p> <p>General Management of Asthma</p> <p>Respiratory care treatment protocols</p>                                                                                                                                                                                                                                      |
| <p>Respiratory Insufficiency and Respiratory Failure</p> <p>Classification Background, Pathophysiology, Etiology and Management of Respiratory failure</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <p>OBSTRUCTIVE LUNG DISEASES</p> <p>Chronic Obstructive Pulmonary Disease (COPD), Chronic Bronchitis and Emphysema</p> <p>Anatomic alterations of the lungs associated with Chronic Bronchitis and Emphysema</p>                                                                                                                                                                                                                                                                                                                                                                                                                     |

|                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Etiology and Epidemiology, Risk factors, Diagnosis and assessment of Chronic Obstructive Pulmonary Disease</p> <p>Distinguishing features between Emphysema and Chronic Bronchitis</p> <p>Cardiopulmonary clinical manifestations associated with Chronic Bronchitis and Emphysema</p> <p>General management of COPD</p> <p>Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines of COPD</p>       |
| <p>Asthma</p> <p>National Asthma Education and prevention program</p> <p>Global Initiative for Asthma (GINA) guidelines</p> <p>Anatomic alterations of the lung</p> <p>Etiology, Classification and Epidemiology, Diagnosis of Asthma</p> <p>Cardiopulmonary clinical manifestations associated with Asthma</p> <p>General Management of Asthma</p> <p>Respiratory care treatment protocols</p>                           |
| <p>Cystic Fibrosis</p> <p>Anatomic alterations of the lung</p> <p>Etiology and Epidemiology</p> <p>Cardiopulmonary clinical manifestations, Pancreatic insufficiency associated with Cystic Fibrosis</p> <p>General Management of Cystic fibrosis</p> <p>Heart or Heart-Lung transplantation</p>                                                                                                                          |
| <p>Bronchiectasis</p> <p>Anatomic alterations of the lung</p> <p>Etiology and Epidemiology</p> <p>Diagnosis, Cardiopulmonary clinical manifestations associated with Bronchiectasis</p> <p>General and Pharmacological management for Bronchiectasis</p>                                                                                                                                                                  |
| <p>LOSS OF ALVEOLAR VOLUME</p> <p>Atelectasis</p> <p>Anatomic alterations of the lung</p> <p>Etiology , Classification of Atelectasis</p> <p>Cardiopulmonary clinical manifestations associated with Postoperative Atelectasis</p>                                                                                                                                                                                        |
| <p>INFECTIOUS PULMONARY DISEASE</p> <p>Pneumonia, Lung Abscess Formation and Important Fungal Diseases</p> <p><b>Pneumonia: Anatomic alterations of the lungs</b></p> <p>Etiology and Epidemiology Community acquired Pneumonia</p> <p>Chronic Pneumonia</p> <p>Fungal diseases: Anatomic alterations of the lungs</p> <p>Primary pathogens</p> <p>Viral Pneumonia</p> <p>Pneumonia in the immunocompromised patients</p> |

|                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Necrotizing Pneumonia and Lung Abscess</b><br><b>Bronchiolitis Obliterans Organizing Pneumonia (BOOP)</b><br>Cardiopulmonary clinical manifestations associated with Pneumonia<br>General management of Pneumonia                                                                                                                                                                                                      |
| Tuberculosis (TB)<br>Anatomic alterations of the lung<br>Etiology and Epidemiology, Types of Tuberculosis<br>Tuberculosis among health care workers<br>Diagnostic tests, Cardiopulmonary clinical manifestations associated with Tuberculosis<br>General Management of Tuberculosis                                                                                                                                       |
| <b>PULMONARY VASCULAR DISEASE</b><br>Pulmonary edema<br>Anatomic alterations of the lung<br>Etiology and Epidemiology<br>Cardiogenic and Non-Cardiogenic Pulmonary Edema<br>General management of Pulmonary Edema<br>Cardiopulmonary clinical manifestations associated with Pulmonary Edema                                                                                                                              |
| Pulmonary Vascular Disease:<br>Pulmonary Embolism<br>Anatomic alterations of the lung<br>Etiology and Epidemiology<br>Diagnosis and Screening<br>General management of Pulmonary Embolism<br>Cardiopulmonary clinical manifestations associated with Pulmonary Embolism<br>Pulmonary Hypertension<br>Pulmonary Hypertension due to lung disease<br>Emerging role of Respiratory Therapist in Pulmonary Vascular Disorders |
| <b>CHEST WALL AND SPINAL DIFORMITIES</b><br>Pleural Effusion and Empyema<br>Anatomic alterations of the lung<br>Pleural anatomy and Physiology<br>Etiology and Epidemiology<br>Hydrothorax, Hemothorax, Urinothorax, Chylothorax, Pyothorax<br>Cardiopulmonary clinical manifestations associated with Pleural Effusion and Empyema<br>General management of Pleural Effusion                                             |
| Kyphoscoliosis<br>Anatomic alterations of the lung<br>Etiology and Epidemiology<br>Kyphosis and Scoliosis<br>Pectus Excavatum and Pectus Carinatum<br>Cardiopulmonary clinical manifestations associated with Kyphoscoliosis<br>General management of Scoliosis<br>Respiratory Care Treatment Protocols                                                                                                                   |

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| <p><b>LUNG CANCERS</b></p> <p>Carcinomas of Lung</p> <p>Anatomic alterations of the lungs</p> <p>Types, Etiology and Epidemiology</p> <p>Diagnosis and Screening</p> <p>Cardiopulmonary clinical manifestations associated with Cancer of the Lung</p> <p>Staging of Lung Cancer</p> <p>General management of Lung Cancer</p>                                                                                                            |
| <p><b>INTERSTITIAL AND INFLAMMATORY LUNG DISEASE</b></p> <p>Interstitial Lung Disease (ILD)</p> <p>Anatomic alterations of the lungs</p> <p>Etiology and Epidemiology</p> <p>Classification of ILD</p> <p>Cardiopulmonary clinical manifestations associated with Chronic Interstitial Lung Disease</p> <p>General management of Interstitial Lung Disease</p>                                                                           |
| <p>Inflammatory Lung Disease and its Pulmonary effects</p> <p>Rheumatoid Arthritis and Pulmonary complications</p> <p>Pulmonary involvement in Systemic Sclerosis</p>                                                                                                                                                                                                                                                                    |
| <p><b>DIFFUSE ALVEOLAR DISEASE</b></p> <p>Acute Respiratory Distress Syndrome (ARDS)</p> <p>Anatomic alterations of the lung</p> <p>Etiology and Epidemiology</p> <p>Diagnostic criteria for Acute Respiratory Distress Syndrome</p> <p>The National Institute of Health ARDS network</p> <p>Cardiopulmonary clinical manifestations associated with ARDS</p> <p>General management of ARDS</p> <p>Recent updates in ARDS management</p> |
| <p><b>NEURO-RESPIRATORY DISORDERS</b></p> <p>Gullian-Barré (GB) Syndrome</p> <p>Anatomic alterations of the lungs associated with Gillian-Barré Syndrome</p> <p>Etiology and Epidemiology</p> <p>Clinical presentation</p> <p>Cardiopulmonary clinical manifestations</p> <p>General Management</p>                                                                                                                                      |
| <p><b>Myasthenia Gravis (MG)</b></p> <p>Anatomic alterations of the lungs</p> <p>Etiology and Epidemiology</p> <p>Screening and Diagnosis</p> <p>Cardiopulmonary clinical manifestations</p> <p>General management</p>                                                                                                                                                                                                                   |
| <p>Cardiopulmonary Care and Assessment of Patients with Neuromuscular Disease</p> <p>Chronic neuromuscular disease</p> <p>Cardiopulmonary clinical manifestations associated with neuromuscular diseases</p>                                                                                                                                                                                                                             |

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| General management of neuromuscular disease<br>Ventilatory management of patients with neuromuscular disease                                                                                                                                                                                                                                                                                                                                                                     |
| CARDIOVASCULAR DISEASES<br>Congestive heart failure<br>Pathophysiology<br>Diagnosis<br>Management                                                                                                                                                                                                                                                                                                                                                                                |
| Valvular Heart Disease<br>Mitral and tricuspid Regurgitation<br>Mitral and tricuspid stenosis<br>Aortic and pulmonary valve Stenosis and Regurgitation                                                                                                                                                                                                                                                                                                                           |
| Cardiomyopathy, Myocarditis and Endocarditis<br>Pathophysiology<br>Diagnosis<br>Management                                                                                                                                                                                                                                                                                                                                                                                       |
| Cardiac tamponade and Pericarditis<br>Pathophysiology<br>Diagnosis<br>Management                                                                                                                                                                                                                                                                                                                                                                                                 |
| Cardiothoracic Surgical Conditions and Prolonged Assisted Circulation<br>Indication, Contraindications and Complications<br>Pre-operative management<br>Post-operative management <ul style="list-style-type: none"> <li>• Thoracotomies, Lung Volume Reduction Surgery (LVRS), Pneumonectomy, Lung Transplantation</li> <li>• Coronary Angioplasty, Coronary Artery Bypass Grafting (CABG), Heart Transplantation</li> <li>• Principles of Ventricular Assist Device</li> </ul> |
| Coronary and Peripheral Vascular Disease<br>Hypertension<br>Primary and Secondary hypertension<br>Grades of hypertension<br>Accelerated hypertension                                                                                                                                                                                                                                                                                                                             |
| Ischemic Heart Disease<br>Myocardial infarction<br>Stable and Unstable Angina<br>Acute Coronary Syndrome                                                                                                                                                                                                                                                                                                                                                                         |
| Shock: Definition, Classification, Pathophysiology and General management<br>Hypovolemic shock<br>Cardiogenic shock<br>Obstructive shock<br>Distributive shock                                                                                                                                                                                                                                                                                                                   |
| PULMONARY MANIFESTATIONS OF CENTRAL NERVOUS SYSTEM DISEASES<br>Acute Stroke: Ischemic stroke and Hemorrhagic stroke                                                                                                                                                                                                                                                                                                                                                              |

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| Definition<br>Classification<br>Risk factors<br>Management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Seizure and Epilepsy<br>Traumatic Brain Injury and Respiratory Manifestations<br>Hypoxemic encephalopathy and Coma                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| ENVIRONMENTAL AND OCCUPATIONAL DISORDERS<br>Occupational Disorders<br>Asbestos-related lung disease<br>Coal workers lung disease<br>Silicosis<br>Sarcoidosis<br>Acute and chronic responses to toxic inhalations                                                                                                                                                                                                                                                                                                                                             |
| Environmental Disorders<br>High-altitude physiology and clinical disorders<br>Diving injuries and air embolism<br>Thermal injuries (Burns)<br>Acute smoke inhalation injuries-CO Poisoning<br>Drowning<br>Electrical safety injuries<br>Thermal injuries<br>Envenomation<br>Tetanus                                                                                                                                                                                                                                                                          |
| TRAUMA AND MANAGEMENT- The Deadly Dozen of Chest Trauma and Management<br>Immediate Life-Threatening Injuries: Anatomic alteration, Pathophysiology and Management<br>Airway obstruction<br>Tension Pneumothorax<br>Pericardial Tamponade<br>Open Pneumothorax<br>Massive Hemothorax<br>Flail chest<br>Potential Life-threatening Injuries: Anatomic alteration, Pathophysiology and Management<br>Thoracic aortic disruption<br>Tracheobronchial injuries<br>Blunt Myocardial injury<br>Diaphragmatic Injuries<br>Oesophageal injury<br>Pulmonary Contusion |
| Cervical Spine Injury and management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Extremity trauma- Long bone fracture and Fat embolism                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AN INTRODUCTION TO SLEEP DISORDERS- CARDIOPULMONARY MANIFESTATIONS<br>Obstructive sleep Apnea                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

Central sleep Apnea  
Mixed Sleep Apnea  
Sleep-related hypoventilation and hypoxemia syndromes  
Diagnosis of obstructive sleep apnea

## **Cardiopulmonary pharmacology**

### **Administration of Aerosolized & Instilled Medications:**

Describe general advantages and disadvantages associated with the delivery of aerosolized medications.

Describe the three most common devices used to administer aerosolized Respiratory Care drugs, their advantages and disadvantages, optimal procedures for effective medication delivery, basic care of MDIs, SVN. DPIs

- a. Small Reservoir Nebulizer (SVN)
- b. Metered Dose Inhaler (MDI)
- c. Dry Powder Inhaler (DPI)

Describe the use of SVN and MDIs for aerosol drug administration during continuous mechanical ventilation.

Describe the clinical situations in which continuous and high-dose, high frequency aerosol bronchodilator therapy would be indicated.

Define drug administration by instillation including advantages and disadvantages of utilizing this method for medication delivery.

Describe how to select the most appropriate aerosol delivery device for a patient.

### **Drugs affecting Respiratory system:**

#### **Bronchodilator drugs-**

Differentiate between bronchoconstriction & bronchospasm, pathological triad of mechanisms leading to bronchoconstriction, types of bronchodilator.

Role of the sympathetic receptor site intracellular chemical (c-AMP) & role of the parasympathetic receptor site intracellular chemical (c-GMP).

Generic name, Trade name, Mode of action, Receptor site stimulation, Side effects & Usual adult dosage of following drugs:

- Sympathomimetic/adrenergic bronchodilators.
- Parasympatholytic/anti-cholinergic/anti-muscarinic bronchodilator drugs.
- Xanthine drugs.

2.1 Given various patient clinical scenarios, be able to suggest the most appropriate bronchodilator therapy, including drug of choice, route of delivery, and recommended dosage

#### **Mucus Controlling Therapy-**

3.1 Key terms associated with mucokinetic, mucolytics, mucoactive drugs

3.2 Physical characteristics of the mucociliary system of the lung, Types of secretory glands, Anatomical

structures, Normal structure and composition of mucus, Normal ciliary function, describe various factors that can adversely affect the mucociliary system.

- 3.3 Identify substances that lyse/breakdown pulmonary secretions, Compare and contrast major mucolytic drugs, Identify the dosage ranges for each mucolytic drug, describe hazards and contraindications associated with each mucolytic drug, Identify delivery methods for each drug.

## **Anti-Inflammatory and Anti- Asthma Agents:**

### **Corticosteroids-**

. Describe key terms and abbreviations, inflammatory process, contrast humoral (circulating) and cell-mediated immunity, Humoral immunity process involving mast cells and antigen/antibody reactions, early phase and late phase inflammatory response.

Describe the three major effects of corticosteroids, differentiate between anabolic and catabolic steroids, describe the hypothalamic-pituitary-adrenal (HPA) axis for control of normal body corticosteroid production, describe how "exogenous (outside the body)" steroid therapy can suppress the HPA axis and lead to "steroid dependency".

Describe potential side effects associated with prolonged/long-term systemic steroid therapy, identify common oral and aerosolized steroid drugs used in the treatment of respiratory disease, advantages and disadvantages associated with the use of aerosolized corticosteroid drugs, characteristics of oral versus aerosol delivered corticosteroids.

Identify how the procedure for administering MDI/DPI steroid preparations should be modified in contrast to other types of medications delivered in this form.

### **Non-Steroidal Anti-Asthma Agents (NSAAA)**

Mode of action, Mode of administration, Trade names, Usual adult dosages & Hazards/ Precautions of NSAAA

Role of cromolyn sodium and nedocromil sodium, leukotriene antagonists/modifiers in the prevention of bronchospasm and airway inflammation.

### **Anti-Infective Agents:**

Describe the rationale for aerosol administered anti-infective agents, describe the clinical effectiveness of administering anti-infective agents to the lungs via the inhalational route.

Identify special clinical situations that would indicate the use of this administration method for anti-infective therapy, potential side effects and hazards associated with using this route for anti-infective drug delivery.

Identify various common anti-infective agents administered by the RCP in clinical practice (Antibacterial agents, Antiviral agents, Antifungal agents)

### **Drugs affecting Cardiovascular system:**

(Mode of action, Mode of administration, Trade names, Usual adult dosages & Hazards/ Precautions of each of these following drugs:)

Anti-hypertensive drugs

Anti- Arrhythmic drugs

Drugs affecting vascular tone and volume of circulation, renin angiotensin in system & other mechanisms of affecting these systems.



pharmacology and physiology of inhaled nitric oxide

**Drugs used in Acute Care**

(Mode of action, Mode of administration, Trade names, Usual adult dosages & Hazards/ Precautions of each of these following drugs:)

Drugs used in Cardiac arrest and Pre Arrest

Drugs used in Acute Coronary Syndrome

Drugs used in Cerebrovascular Accidents

*NO PRACTICAL EXAMINATION*

# INTRODUCTION TO RESPIRATORY CARE TECHNOLOGY

## **Introduction to Respiratory Therapy**

### **Introduction to Respiratory Therapy profession**

#### **Course Description**

‘Introduction to Respiratory Therapy Profession’ provides an overview of the history and development of Respiratory Therapy profession. The course is designed to explain the role and scope of respiratory therapy profession and describes the academic and Career Perspectives in Respiratory therapy. This course emphasizes on the standards of professional and clinical practices that a Respiratory Therapist should follow in an actual hospital setting. The course provides an introduction of various clinical domains and equipment used in Respiratory Therapy.

#### **Learning Objectives**

By the end of this course students will be able to:

- Explain the history of respiratory care and its professional organizations.
- Understand the role and scope of the respiratory therapist in the health care sector
- Understand the Academic and Career Perspectives in Respiratory Therapy
- Understand and explain the standards of professional practice.
- Recognize the ethical and legal aspects implied in respiratory care profession
- Understand the importance of developing communication skills and the need for maintaining interpersonal and interprofessional relationships.
- Discuss the standards of clinical practice including health promotion and infection control practices.
- Understand the importance of various clinical domains and practice in Respiratory Therapy.

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| Respiratory Care as a profession<br>History and development of Respiratory Therapy profession<br>Professional Organizations and events<br>Respiratory Therapy education                                                                                                                                                                                                                                 |
| Role and Scope of Respiratory Therapist in the Health Care Sector                                                                                                                                                                                                                                                                                                                                       |
| Academic and Career Perspectives in Respiratory Therapy<br>Academic Perspectives- Masters, Doctorate, Post-Doctoral Fellowships in Respiratory Care and Allied Fields; Higher Certification in advanced and related areas like Emergency Medical Care and Extra corporeal Life Support Therapy<br>Clinical Professionals<br>Academic Professionals<br>Research Professionals<br>Corporate Professionals |
| Standards of Professional Practice<br>Competencies<br>Scope of Practice- Diagnostics and Therapeutics<br>Standards of practice<br>Evidence-Based Respiratory Therapy<br>Research in Respiratory Therapy<br>Elements of hospital based Respiratory Therapy<br>Critical thinking in Respiratory Therapy<br>Professional Hierarchy in Respiratory Therapy Profession                                       |
| Ethical and Legal Implications of Practice-<br>Codes of Ethics, Ethical Theories and principles & Legal issues related to Respiratory Therapy Profession                                                                                                                                                                                                                                                |
| Communication in Health care<br>Communication skills<br>Conflict and conflict resolution<br>Interpersonal and inter-professional relationship.                                                                                                                                                                                                                                                          |
| Standards of Clinical Practice<br>Clinical Assessment and Management<br>Health promotion and Education<br>Principles of Infection Prevention and Control                                                                                                                                                                                                                                                |

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| Infection prevention strategies                                                                                                                                                                                                                                                                                                                                            |
| <p>Orientation to Profession</p> <p>Orientation to the Respiratory Therapy laboratories.</p> <p>Orientation to Intensive Care Units and Emergency Departments</p> <p>Oxygen Therapy devices.</p> <p>Aerosol and humidification equipment and devices.</p> <p>Mechanical Ventilators.</p> <p>Pulmonary Function and Sleep lab</p> <p>Other Respiratory Care modalities.</p> |

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| <p><b><u>Respiratory Therapy Science</u></b></p> <p>Introduction to Infection Control in Respiratory Care</p> <p>Modes of Transmission</p> <p>Standard precautions- Aerosol, Droplet, Contact, Negative pressure, Positive pressure isolations</p> <p>Basics of sterilization and Disinfection</p> <p>Personal Protective Gears</p>                                                                                                                                                                                                                                                                                                                                                                                                     |
| <p>Basic Cardiac Life Support</p> <p>Heart attack and Cardiac arrest</p> <p>Importance and application of Chain of Survival</p> <p>Cardiopulmonary and cerebral resuscitation- Rationale, indication, technique.</p> <p>Difference between adults, children and infants CPR</p> <p>Automated External Defibrillation- Indication, technique, Special considerations</p> <p>Choking in adults, children and infants- Indicators and management</p> <p>Airway management</p> <p>Maintaining patent airway</p> <p>Basic Airway Adjuncts:</p> <ul style="list-style-type: none"> <li>• Nasopharyngeal Airway</li> <li>• Oropharyngeal Airway (Guedel, Berman airways)</li> </ul> <p>Bag valve mask ventilation- Flow and Self inflating</p> |
| <p>Introduction to Basic Respiratory Science</p> <p>Basic Physics for the Respiratory Therapist: -</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

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| <p>Behavior of gases, Gas pressure</p> <p>Gas laws:</p> <ul style="list-style-type: none"> <li>• Boyle's Law Charles' and Gay-Lussac's Laws</li> <li>• Fick's Law, Henry's Law, Graham's Law</li> <li>• Combined Gas Law</li> <li>• Dalton's Law of Partial Pressures</li> <li>• Avogadro's Law</li> </ul> <p>Laws of Diffusion</p> <ul style="list-style-type: none"> <li>• Combined gas law's</li> </ul> <p>Fluid Mechanics: Patterns of Flow, Compressible flow, Poiseuille's Law, Reynolds Number, Bernoulli Principle, Venturi Principle, Coanda Effect</p> |
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| <p>Oxygen analyzers</p> <p>Physical oxygen analyzers</p> <p>Electrical oxygen analyzers</p> <p>Electrochemical oxygen analyzers</p>                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <p>Humidity and Aerosol Therapy</p> <p>Physiology of Heat and Moisture Exchange</p> <p>Indications for Humidification and Warming of Inspired Gases</p> <p>Types of humidifiers and Equipment</p> <p>Problem Solving and Troubleshooting</p> <p>Bland Aerosol Therapy</p> <p>Equipment</p> <p>Sputum Induction</p> <p>Selecting the Appropriate Therapy</p> <p>Aerosolized Drug Therapy</p> <p>Characteristics of Therapeutic Aerosols</p> <p>Hazards of Aerosol Therapy</p> <p>Aerosol Drug Delivery Systems</p>                                                |
| <p>Hyperbaric oxygen therapy</p> <p>Physiological effects</p> <p>Methods of administration</p> <p>Indications and Contraindications</p> <p>Complications and Hazards</p> <p>Troubleshooting</p>                                                                                                                                                                                                                                                                                                                                                                  |
| <p>Oxygen analyzers</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

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| Physical oxygen analyzers<br>Electrical oxygen analyzers<br>Electrochemical oxygen analyzers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Humidity and Aerosol Therapy <ul style="list-style-type: none"> <li>Physiology of Heat and Moisture Exchange</li> <li>Indications for Humidification and Warming of Inspired Gases</li> <li>Types of humidifiers and Equipment</li> <li>Problem Solving and Troubleshooting</li> </ul> Bland Aerosol Therapy <ul style="list-style-type: none"> <li>Equipment</li> <li>Sputum Induction</li> <li>Selecting the Appropriate Therapy</li> </ul> Aerosolized Drug Therapy <ul style="list-style-type: none"> <li>Characteristics of Therapeutic Aerosols</li> <li>Hazards of Aerosol Therapy</li> <li>Aerosol Drug Delivery Systems</li> </ul>                                                                                                                                                                                                       |
| Airway Clearance Therapy <ul style="list-style-type: none"> <li>Mechanism of Coughing</li> <li>Physiology of Airway Clearance Therapies</li> <li>General Goals and Indications</li> <li>Determining the Need for Airway Clearance Therapy</li> <li>Airway Clearance Methods- Active Cycle of Breathing Techniques, Autogenic Drainage, Forced Expulsion Techniques like Coughing and Huffing</li> <li>Postural drainage</li> <li>Positive Expiratory Pressure- Acapella, Flutter</li> <li>Selecting Airway Clearance Techniques</li> <li>Endotracheal suctioning - Indications, Contraindications, Complications, Assessment of need, Assessment of outcome, Types of suction</li> <li>Clinical aspects of Suction techniques</li> <li>Suction catheters (Open and Closed)</li> <li>Suction regulators</li> <li>Portable suction Units</li> </ul> |
| Chest Physiotherapy Devices <ul style="list-style-type: none"> <li>Manual, pneumatic and electrical percussors</li> <li>High-Frequency Oscillation Devices- Vest</li> <li>Intrapulmonary Percussive Ventilation</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

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| <p>High-Frequency Chest Wall Oscillation Devices</p> <p>Mechanical Insufflation Exsufflation- Cough Assist</p>                                                                                                                                                                                                                                                                                                                                                                                                              |
| <p>Lung Expansion Therapy</p> <p>Incentive Spirometers</p> <ul style="list-style-type: none"> <li>• Volume-Displacement Devices</li> <li>• Flow-Dependent Devices</li> </ul> <p>Intermittent Positive-Pressure Breathing Devices</p> <p>Positive Airway Pressure (PAP) Devices</p> <ul style="list-style-type: none"> <li>• Continuous Positive Airway Pressure</li> <li>• Bilevel Positive Airway Pressure</li> </ul> <p>Thoracic expansion exercises, Breathing exercises and Ventilatory Muscle training- Techniques</p> |
| <p>Noninvasive monitoring of Oxygen and Carbon dioxide</p> <p>Pulse oximetry</p> <p>Co-oximetry</p> <p>Colorimetric End-tidal determination</p> <p>End-tidal Capnography</p> <ul style="list-style-type: none"> <li>• Main and Side stream</li> <li>• Waveform morphology and applications</li> </ul> <p>Transcutaneous monitoring</p> <p>Transcutaneous monitoring of carbon-di-oxide</p> <p>Transcutaneous monitoring of oxygen</p>                                                                                       |
| <p>Advanced Cardiovascular Life Support</p> <p>Review of Basic Cardiac Life Support</p> <p>Review of Cardiac electrophysiology</p> <p>Cardiac Arrest Rhythms and Management (Shockable and Non shockable)</p> <p>Pre Arrest Rhythms- Tachy and Brady arrhythmias</p> <p>Post Cardiac Arrest Management</p> <p>Acute Stroke and management</p> <p>Acute coronary Syndrome and management</p> <p>Defibrillator- Technical aspect and Clinical application</p> <p>Pacer- Technical aspect and clinical application</p>         |
| <p>Airway Management</p> <p>Review of Airway Anatomy</p> <p>Airway assessment</p> <ul style="list-style-type: none"> <li>• Congenital anomalies</li> </ul>                                                                                                                                                                                                                                                                                                                                                                  |

- Acquired anomalies
- Predictors of Difficult airway- Mallampatti, LEMON, ULBT, TMD

#### Advanced Airway Adjuncts

- Endotracheal tubes
- Double lumen tube
- Specialized endotracheal tubes

#### Supraglottic Airways

- Laryngeal Mask Airway and its variants
- Combi tube
- Laryngeal tubes- King's LT

#### Aids to Endotracheal Intubation: -

- Laryngoscopes- Macintosh and Miller
- Endotracheal Tube Guide/Intubating Stylet
- Video laryngoscopy
- Bronchoscopy guided intubation

#### Adjuncts to Endotracheal Intubation: -

- Lighted Stylets or Light-wand
- Tube exchanger
- Bougie
- Indirect Laryngoscopy

#### Retrograde Wire Intubation

#### Blind Intubation

#### Complications of Intubation

#### Confirmation of definitive airway- ETCO<sub>2</sub>, 5 Points, EDD

#### Specialized Endotracheal Tubes

#### Surgical Airway Devices (Indication & Contraindication, Procedure, Complication and Hazard): -

- Tracheostomy Tubes
- Cricothyrotomy sets
- Trans-tracheal catheters
- Positioning Adjuncts- ET tube holder, TT holder
- Cuff manometer

#### Extubation and Decannulation



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| <b>Artificial Resuscitators (Bag Valve Units)</b><br>Types of Artificial Resuscitators- Manual, Expired Air, Flow/ Oxygen powered<br>Specification and standards<br>Manual Resuscitators- Types, parts<br>Indications and Techniques<br>Hazards Associated with Manual Resuscitators<br>Inspection & Troubleshooting<br>T- piece resuscitator        |
| <b>Bronchoscopy</b><br>Types- Flexible and Rigid<br>Parts, physics and principle of flexible bronchoscopes<br>Indications, Contraindications, Monitoring and Complications<br>Assessment of need and outcome<br>Upper airway, tracheal and bronchial anatomy- bronchoscopy approach<br>Infection control and sterilization of bronchoscopes          |
| <b>Vascular Procedures</b><br>Introduction to Vascular Procedures<br>Importance of Asepsis in Vascular procedures<br>Types, Indications and Techniques of Venous access- Peripheral IV cannulation, Central venous cannulation, PICC lines<br>Types, Indications and Techniques of Arterial Cannulation- Peripheral and Central Arterial Cannulation |
| <b>Intercostal Drains and Tubes</b><br>Basic principles of chest tube<br>Chest Drainage system- Indications, technical aspects, set up and maintenance<br>Troubleshooting                                                                                                                                                                            |
| <b>Circulatory Assist Devices</b><br>Extra Corporeal Life Support- ECLS- Types- ECMO, ECCO2R<br>Extracorporeal Membrane Oxygenation - ECMO Types, indication, contraindications, complications<br>Pump<br>Cannula<br>Oxygenator<br>Circuit<br>Sensors                                                                                                |
| <b>Blood Gas Analyzer</b>                                                                                                                                                                                                                                                                                                                            |

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| <p>Blood gas machine- Calibration and Quality control of blood gas measuring systems</p> <p>Blood gas sensor blocks</p> <p>POC testing</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p>Respiratory Monitoring</p> <p>Principles of Monitoring</p> <p>Oxygen Content</p> <p>Alveolar-Arterial Oxygen Tension Difference</p> <p>Alveolar gas equation</p> <p>PaO<sub>2</sub>/FiO<sub>2</sub> Ratio</p> <p>SpO<sub>2</sub>/FiO<sub>2</sub> Ratio</p> <p>Oxygenation Index</p> <p>Oxygen Saturation Index</p> <p>Respiratory Quotient</p> <p>V/Q ratio</p> <p>Quantification of Shunt</p> <p>Monitoring lung and chest wall resistance, compliance</p> <p>Minute ventilation- Wrights spirometry</p> <p>Peak inspiratory and expiratory flow meters- Indication, technique, contraindications</p> |
| <p>Cardiovascular Monitoring</p> <p>Central Venous Pressure</p> <p>Arterial BP monitoring</p> <p>Pulmonary Artery Pressure</p> <p>Cardiac output monitoring</p>                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <p>Neurologic Monitoring</p> <p>Conscious levels- Alert, Confused, Lethargic, Obtunded, Stupor, Coma</p> <p>Glasgow Coma Scale Score</p> <p>Pupillary Response, Corneal response, Eye movements</p> <p>Respiratory Rate and Pattern- Abnormal patterns</p> <p>Intracranial Pressure Monitoring</p>                                                                                                                                                                                                                                                                                                        |
| <p>Assessment and Monitoring of other systems</p> <p>Monitoring Renal Function</p> <p>Monitoring Liver Function</p> <p>Nutritional Monitoring: -</p> <ul style="list-style-type: none"> <li>• Assessment of Nutritional Status</li> <li>• Functional Assessment</li> </ul>                                                                                                                                                                                                                                                                                                                                |

- Metabolic Assessment
- Estimating Nutritional Requirements

## INTRODUCTION TO PULMONARY FUNCTION TESTING

### Types and Indications

- Airway function tests
- Lung volume and ventilation tests
- Diffusing capacity tests
- Blood gases and gas exchange tests
- Cardiopulmonary exercise tests
- Metabolic measurements

### Preliminaries to Patient Testing

- Before patient testing
- Patient preparation (pre-test instructions)
- Withholding medications
- Smoking cessation
- Other patient preparation issues
- Anthropometric measurements
- Physical assessment
- Pulmonary history

### Test Performance and Sequence

- Technologist-driven protocols
- Patient instruction

## PULMONARY FUNCTION TESTING EQUIPMENT

### Volume-Displacement Spirometers

- Water-seal spirometers
- Dry rolling seal spirometers
- Bellows-type spirometers

### Flow-Sensing Spirometers

- Turbines
- Pressure differential flow sensors
- Heated-wire flow sensors
- Pitot tube flow sensors
- Ultrasonic flow sensors
- Flow sensor summary
- Portable (office) spirometers

### PeakFlowmeters

### Body Plethysmographs

- Pressure plethysmographs
- Flow plethysmographs

### Breathing Valves

- Free breathing and demand valves
- Directional valves
- Gas-sampling valves

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| Pulmonary Gas Analyzers<br>Computers for Pulmonary Function Testing<br>Data acquisition and instrument control Pulmonary function data storage and programs                                                                                                                                                                                                                                                                                                                                                                 |                       |
| <b>SPIROMETRY:</b><br>Description, Technique, Significance and Pathophysiology<br>Acceptability and Repeatability for Spirometry Results<br>Vital Capacity<br>Forced Vital Capacity, Forced Expiratory Volume, and Forced Expiratory Flow<br>Flow-Volume Curve<br>Peak expiratory flow<br>Maximum Voluntary Ventilation<br>Before- and After-Bronchodilator Studies                                                                                                                                                         |                       |
| <b>DIFFUSION CAPACITY TESTS</b><br>Diffusion Capacity of Lung for Carbon Monoxide (DLCO) or Transfer Factor of Lung for Carbon Monoxide (TLCO)<br>Techniques<br>Description<br>Significance and pathophysiology                                                                                                                                                                                                                                                                                                             |                       |
| <b>LUNG VOLUMES, AIRWAY RESISTANCE AND GAS DISTRIBUTION TESTS</b><br>Lung Volumes: Functional Residual Capacity, Residual Volume, Total Lung Capacity, and Residual Volume/Total Lung Capacity Ratio<br>Description<br>Technique<br>Significance and pathophysiology<br>Airway Resistance and Conductance (Body plethysmograph)<br>Description<br>Technique<br>Significance and pathophysiology<br>Gas Distribution Tests: Single-Breath Nitrogen Washout, Closing Volume, and Closing Capacity<br>Description<br>Technique |                       |
| <b>CARDIOPULMONARY EXERCISE TESTING</b><br>Exercise<br>Exercise<br>Cardiovascular Monitors During Exercise<br>Heart rate and electrocardiogram<br>Blood pressure<br>Safety<br>Ventilation During Exercise<br>Equipment selection and calibration<br>Minute ventilation<br>Tidal volume and respiratory rate<br>Flow-volume loop analysis                                                                                                                                                                                    | Protocols<br>Workload |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Oxygen Consumption, Carbon Dioxide Production, and Respiratory Exchange Ratio During Exercise</p> <ul style="list-style-type: none"> <li>Oxygen consumption</li> <li>Carbon dioxide production</li> <li>Respiratory exchange ratio</li> <li>Anaerobic or ventilatory threshold</li> <li>Ventilatory equivalent for oxygen</li> <li>Ventilatory equivalent for carbon dioxide</li> <li>Oxygen pulse</li> </ul> <p>Exercise Blood Gases</p> <ul style="list-style-type: none"> <li>Arterial catheterization</li> <li>Arterial puncture</li> <li>Pulse oximetry</li> <li>Arterial oxygen tension during exercise</li> <li>Arterial carbon dioxide tension during exercise</li> <li>Acid-base status during exercise</li> <li>Exercise variables calculated from blood gases</li> </ul> <p>Cardiac Output During Exercise</p> <ul style="list-style-type: none"> <li>Noninvasive cardiac output techniques</li> <li>Direct Fick method</li> <li>Thermodilution method</li> <li>Cardiac output during exercise</li> <li>Symptoms scales</li> <li>Quality of test</li> <li>Interpretation strategies</li> </ul> |
| <p><b>BRONCHOPROVOCATION TESTS</b></p> <p>Bronchoprovocation challenge testing: Indications, Contraindications, Technique and Complications</p> <ul style="list-style-type: none"> <li>Methacholine Challenge</li> <li>Histamine Challenge</li> <li>Mannitol Challenge</li> <li>Exercise Challenge</li> <li>Eucapnic Voluntary Hyperventilation</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <p><b>SPECIALIZED PULMONARY FUNCTION TEST REGIMENS</b></p> <p>Respiratory Muscle Strength Testing: Description, Techniques, Significance and Pathophysiology</p> <p>Forced Oscillation – Impulse Oscillometry</p> <p>Preoperative Pulmonary Function Testing</p> <p>Pulmonary Function Testing for Disability</p> <ul style="list-style-type: none"> <li>Forced vital capacity and forced expiratory volume</li> <li>Diffusing capacity</li> <li>Exercise testing</li> </ul> <p>Metabolic Measurements: Indirect Calorimetry: Description, Techniques, Significance and Pathophysiology</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <p><b>QUALITY SYSTEMS IN PULMONARY FUNCTION LABORATORIES</b></p> <p>QualityManual</p> <p>Quality System Essentials</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

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| <p>Organization</p> <p>Facilities and safety Personnel</p> <p>Process management</p> <p>Control methods: mechanical and biologic</p> <p>Spirometry calibration and mechanical quality control</p> <p>Gas analyzers and DLCO systems</p> <p>Body plethysmographs</p> <p>Calibration and quality control</p> <p>Path of Workflow</p> <p>Pre-test process</p> <p>Testing</p> <p><b>Post-testing</b></p> |
| <p><b>PEADRIATIC PULMONARY FUNCTION TESTING</b></p> <p>Spirometry</p> <p>Bronchoprovocation Challenges</p> <p>Lung Volumes</p> <p>Diffusion Capacity</p> <p>Infant, Toddler, and Preschool Pulmonary Function Testing</p> <p>Standards for Testing –</p> <p>Variability in reference sets and predicted values for pediatrics</p>                                                                    |
|                                                                                                                                                                                                                                                                                                                                                                                                      |
| Spirometry calibration – Volume calibration                                                                                                                                                                                                                                                                                                                                                          |
| Vital Capacity measurement                                                                                                                                                                                                                                                                                                                                                                           |
| Forced Vital Capacity measurement                                                                                                                                                                                                                                                                                                                                                                    |
| Maximum Voluntary Ventilation Measurement                                                                                                                                                                                                                                                                                                                                                            |
| Peak Flow meter measurement                                                                                                                                                                                                                                                                                                                                                                          |
| Pre and Post-bronchodilator test                                                                                                                                                                                                                                                                                                                                                                     |
| Diffusion capacity Tests – DL <sub>CO</sub> -Single breath                                                                                                                                                                                                                                                                                                                                           |
| Bodyplethysmography measurement – Lung volumes                                                                                                                                                                                                                                                                                                                                                       |
| Bodyplethysmography measurement – Airway resistance and conductance                                                                                                                                                                                                                                                                                                                                  |

## **SUBSIDIARY SUBJECTS**

### ***SOCIOLOGY***

#### **Teaching Hours: 20 Course Description**

This course will introduce student to the basic sociology concepts, principles and social process, social institutions [in relation to the individual, family and community and the various social factors affecting the family in rural and urban communities in India will be studied.

#### **Introduction:**

Meaning – Definition and scope of sociology

Its relation to Anthropology, Psychology, Social Psychology

Methods of Sociological investigations – Case study, social survey, questionnaire, interview and opinion poll methods.

Importance of its study with special reference to health care professionals

**Social Factors in Health and Disease:**

Meaning of social factors

Role of social factors in health and disease

**Socialization:**

Meaning and nature of socialization

Primary, Secondary and Anticipatory socialization Agencies of socialization

**Social Groups:**

Concepts of social groups, influence of formal and informal groups on health and sickness. The role of primary groups and secondary groups in the hospital and rehabilitation setup.

**Family:**

The family, meaning and definitions Functions of types of family Changing family patterns

Influence of family on individual's health, family and nutrition, the effects of sickness in the family and psychosomatic disease and their importance to physiotherapy

**Community:**

Rural community: Meaning and features – Health hazards to rural communities, health hazards to tribal community.

Urban community – Meaning and features – Health hazards of urbanities Culture and Health:

Concept of Health Concept of culture Culture and Health

Culture and Health Disorders Social Change:

Meaning of social changes Factors of social changes

Human adaptation and social change Social change and stress

Social change and deviance

Social change and health programme

The role of social planning in the improvement of health and rehabilitation Social

Problems of disabled:

Consequences of the following social problems in relation to sickness and disability remedies to prevent these problems

Population explosion Poverty and unemployment Beggary

Juvenile delinquency Prostitution Alcoholism

Problems of women in employment



**Social Security:**

Social Security and social legislation in relation to the disabled

**Social Work:**

Meaning of Social Work

The role of a Medical Social Worker

**Reference Books:**

1. Sachdeva & Vidyabhushan, Introduction to the study of sociology
2. Indrani T.K., Text book of sociology for graduates nurses and Physiotherapy students, JP Brothers, New Delhi 10

**INDIAN CONSTITUTION**

Prescribed for the First Year students of all degree classes

**Unit-I:** Meaning of the term 'Constitution'. Making of the Indian Constitution 1946-1950.

**Unit-II:** The democratic institutions created by the constitution Bicameral system of Legislature at the Centre and in the States.

**Unit-III:** Fundamental Rights and Duties their content and significance.

**Unit – IV:** Directive Principles of States Policies the need to balance Fundamental Rights with Directive Principles.

**Unit – V:** Special Rights created in the Constitution for: Dalits, Backwards, Women and Children and the Religious and Linguistic Minorities.

**Unit-VI:** Doctrine of Separation of Powers legislative, Executive and Judicial and their functioning in India.

**Unit – VII:** The Election Commission and State Public Service commissions.

**Unit – VIII:** Method of amending the Constitution.

**Unit – IX:** Enforcing rights through Writs:

**Unit – X:** Constitution and Sustainable Development in India.

**Reference Books:**

1. J.C. Johari: The Constitution of India- A Politico-Legal Study-Sterling Publication, Pvt. Ltd. New Delhi.
2. J.N . Pandey: Constitution Law of India, Allahbad, Central Law Agency, 1998.
3. Granville Austin: The Indian Constitution – Corner Stone of a Nation-Oxford, New Delhi, 2000.

**ENVIRONMENT SCIENCE AND HEALTH**

**Introduction to Environment and Health**

Sources, health hazards and control of environmental pollution Water

The concept of safe and wholesome water. The requirements of sanitary sources of water.

Understanding the methods of purification of water on small scale and large scale.

Various biological standards, including WHO guidelines for third world countries.

Concept and methods for assessing quality of water.

Domestic refuse, sullage, human excreta and sewage their effects on environment and health, methods and issues related to their disposal.

Awareness of standards of housing and the effect of poor housing on health.

Role of arthropods in the causation of diseases, mode of transmission of arthropods borne diseases, methods of control

**Recommended Books.**

Text Book of Environmental Studies for under graduate courses By Erach Bharucha  
Reprinted in 2006, Orient Longman Private Limited /Universities Press India Pvt. Ltd.

## **Third Year**

### **Paper – I Respiratory Therapy – Clinical**

#### **ESSENTIALS OF CRITICAL CARE**

##### **Course Description**

This course is intended to introduce principles of critical care and the importance of the initial care of critically ill/injured patients to the Respiratory Therapy Students, who upon their graduation will spend most of their time in ICU settings.

##### **Learning Objectives**

By the end of this course students will be able to

- Explain the initial and ongoing assessment of critically ill or injured patients.
- Understand common ICU cases, disease presentation and the disease process
- Identify and understand diagnostic tests that are commonly used in ICUs, that includes imaging and laboratory tests.
- Evaluate the findings of assessment and interpret abnormal physiological parameters and observations to identify patients who are likely to have a critical physiological decline.
- Assist and be the part of ICU team, in dealing with sudden deterioration of the critically ill patient

- Develop and integrate clinical skills and academic knowledge in order to practice advanced assessment, life support and therapeutic skills, within the scope of practice.
- Prepare equipment and devices related to cardiorespiratory support and airway management in emergency and elective scenarios
- Act as a patient advocate, when it comes to patient safety and quality assurance in the caring of critically ill patients.
- Engage in the delivery of high-quality evidence based multidisciplinary care as either a team member or team leader, upon the crisis scenarios.

### **Course Outline**

| SI No | Topic                                                                                                                                                                                                                                                      |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.    | <b>Assessment of Critically Ill</b><br>Subjective and Objective Patient Assessment<br>Neurological Assessment<br>Respiratory Assessment<br>Cardiovascular and Circulatory Assessment including Hemodynamics<br>GI Assessment                               |
| 2.    | <b>Monitoring in Critical Care</b><br>Waveform monitoring- CVP, Arterial line, TCM, PAP, SpO2, ETCO2, ECG, Cardiac output monitoring, Thermo-dilution methods<br>Bundles of Care in ICU- VAP bundle, Vascular bundle, Sepsis bundle, FAST                  |
| 3.    | Diagnostic Tests in Critical Care<br>Imaging in ICU like Chest X-rays, Ultrasonography, Echocardiography<br>Chest CT- types and abnormal findings<br>Laboratory interpretations, that include hematology, microbiology, biochemistry and pathology reports |
| 4.    | Resuscitation in ICU<br>Advanced Resuscitation in ICU                                                                                                                                                                                                      |

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|           | <p>Post cardiac arrest care</p> <p>Targeted temperature management</p> <p>Extracorporeal CPR</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>5.</b> | <p>Acute Respiratory Failure, Mechanical Ventilation and other Adjuncts</p> <p>Types of Respiratory Failure, Clinical manifestations, Diagnosis, Pathophysiology, Pharmacological adjuncts and other aspects management</p> <p>Disease specific noninvasive ventilation strategies and HFNC</p> <p>Disease specific invasive ventilation strategies and hybrid modes</p> <p>ECLS including VV-ECMO, VA-ECMO, ECCO2R- Indications, types of cannula, monitoring, troubleshooting, weaning and decannulation</p>                                                                                                   |
| <b>6.</b> | <p>Oxygenation, Circulation and Acid-Base Disorders</p> <p>Principles of Oxygen therapy- Oxygen cascade, Oxygen content in blood, Cardiac output</p> <p>Oxygen balance- Global perfusion, ODC, SAO<sub>2</sub>, SVO<sub>2</sub>, SCVO<sub>2</sub></p> <p>Determinants of Oxygen balance- Oxyhemoglobin saturation, Central venous pressure, NIBP, Arterial BP and waveforms, Lactate, SCVO<sub>2</sub></p> <p>Acid base disorders- Acute and Chronic Respiratory Acidosis and Alkalosis, Acute and Chronic Metabolic Acidosis and Alkalosis, Compensatory Mechanisms, Anion gap, Differential diagnosis etc.</p> |
| <b>7.</b> | <p>Circulatory impairments</p> <p>Clinical features, mechanism and pathophysiology of different types of shock.</p> <p>Systemic changes in warm and cold shock</p> <p>Fluid resuscitation and responsive assessment in shock- PLR, IVC Collapsibility, SBP variation, SVR etc.</p>                                                                                                                                                                                                                                                                                                                               |
| <b>8.</b> | <p>Basics of Neuro and Neurosurgical Care</p> <p>Ischemic and hemorrhagic stroke- ICU management</p> <p>Intracranial Pressure and Cerebral perfusion pressure and its importance</p> <p>Brain protective ventilation strategy</p> <p>Brain death and apnea tests</p>                                                                                                                                                                                                                                                                                                                                             |
| <b>9.</b> | ICU Pharmacology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

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|            | <p>Antiarrhythmics, Anticoagulants and thrombolytics</p> <p>Inotropes and other vasoactive drugs</p> <p>Analgesics and Sedatives- Classification and indications</p> <p>Skeletal muscle relaxants- Classification and indications</p> <p>Sedation Scale: Richmond Agitation-Sedation Scale (RASS), Ramsay's Sedation Scale</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>10.</b> | <p>Common ICU scenarios and management</p> <p>Sepsis- Definition, Stages, Resuscitation and Management guidelines</p> <p>Inter and Intra hospital transport of Ventilated patients- Checklist, Assessment, Preparation, Troubleshooting and Stabilization</p> <p>Pulmonary Embolism</p> <p>Life threatening electrolyte disturbances</p> <p>GI Bleed</p> <p>Acute pancreatitis</p> <p>Hepato-pulmonary Syndrome</p> <p>OP Poisoning</p> <p>Leptospirosis, Malaria, Dengue</p>                                                                                                                                                                                                                                                                                                      |
| <b>11.</b> | <p>Common ICU Procedures</p> <p>Oral and Nasal Endotracheal Intubation- Indication, Contraindication, Complications</p> <p>Percutaneous Tracheostomy- Indication, Contraindication, Complications</p> <p>Arterial Line Insertion- Indication, Sites, Contraindication, Complications</p> <p>Central Line Insertion- Indication, Sites, Contraindication, Complications</p> <p>Needle Thoracocentesis- Site, Indication, Contraindication, Complications</p> <p>Intercostal Drainage insertion- Indication, Site, Contraindication and Complications</p> <p>Bronchoscopy- Indication, Contraindication, Complications</p> <p>Pericardiocentesis- Site, Indication, Contraindication, Complications</p> <p>Peripherally Inserted Central Catheter- Indication, Contraindication,</p> |

|  |               |
|--|---------------|
|  | Complications |
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| <b>12.</b> | Basics of Obstetric Critical Care<br>Hypertensive disorders- Eclampsia, Pre-eclampsia<br>Amniotic Fluid Embolism    |
| <b>13.</b> | Ethics in Critical Care Medicine<br>Do Not Attempt Resuscitate Scenarios and End of the Life Care<br>Organ donation |

## **CARDIOPULMONARY REHABILITATION**

### **Course Description**

This course provides important aspect of managing chronic pulmonary diseases. The course deals with historical perspective, basic concepts, family education and home care as a part of pulmonary rehabilitation.

### **Learning Objectives**

By the end of this course students will be able to:

1. Describe the historical perspective of pulmonary rehabilitation.
2. Explain the basic concepts of pulmonary rehabilitation.
3. Select and assess the chronic respiratory disease patients for pulmonary rehabilitation and family education.
4. Discuss on nutritional assessment and support.
5. Explain the behavioral medicine psychological, cognitive and social factors in pulmonary rehabilitation.
6. Enumerate the preventive aspects for the patient with chronic lung disease.
7. List the exercises in the rehabilitation of patients with respiratory disease.
8. Discuss on home mechanical ventilation.
9. Have the background knowledge and skills required for the rehabilitation of non – COPD lung disease and rehabilitation for the pediatric patient with pulmonary disease.

10. Have the background knowledge and skills required for physical medicine interventions and rehabilitation of the patient with neuromuscular weakness and surgical therapy for COPD patients.

## Course Outline

| SI No     | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1.</b> | <b>OVERVIEW OF PULMONARY REHABILITATION</b><br>Definition, Rationale for Pulmonary Rehabilitation<br>Pulmonary Rehabilitation and Integrated Care of the Respiratory Patient<br>History of Pulmonary Rehabilitation<br>Evidence-Based Guidelines on Pulmonary Rehabilitation<br>Positioning Pulmonary Rehabilitation within the GOLD 2017 Guidelines<br>Current status of Pulmonary Rehabilitation                                                                                                                                                                                                                                                                                                                                    |
| <b>2.</b> | <b>SELECTING AND ASSESSING THE PULMONARY REHABILITATION CANDIDATE</b><br>Patient Selection<br>Patient Assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>3.</b> | <b>EXERCISE ASSESSMENT AND TRAINING</b><br>Rationale for Exercise Training in Chronic Lung Disease<br>Mechanisms of Exercise Intolerance in Chronic Respiratory Disease<br>Exercise Assessment, Field Tests (Walking Tests)<br>Graded Exercise Test and Cardiopulmonary Exercise Tests<br>Functional Performance Assessment<br>Exercise Prescription<br>Oxygen Titration<br>Volume, Pattern and Progression of Exercise Training<br>Resistance Exercise Testing<br>Other Tests of Muscular Training<br>Flexibility Training<br>Patient Safety<br>Precautions in Pulmonary Hypertension<br>Exercise Induced Hypoxemia<br>Home exercise Considerations<br>Emergency Procedures<br>Documentation of the Evaluation and Treatment Session |
| <b>4.</b> | <b>COLLABORATIVE SELF MANAGEMENT AND PATIENT EDUCATION</b><br>Developing an Individualized Self-Management Program<br>Implementing Self-Management Training                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |



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| <b>5.</b>  | <b>PSYCHOSOCIAL ASSESSMENT AND INTERVENTION</b><br>Assessment of Psychosocial Functioning<br>Interventions to Improve Psychosocial Functioning<br>Psychosocial Provider                                                     |
| <b>6.</b>  | <b>NUTRITIONAL ASSESSMENT AND INTERVENTION</b><br>Compromised Nutritional Status in Pulmonary Disease<br>Diet Intake and COPD<br>Assessment of Nutritional Status<br>Nutrition Support                                      |
| <b>7.</b>  | <b>PATIENT CENTERED EVIDENCE BASED OUTCOMES</b><br>Timing and Analyzing Outcomes<br>Patient Centered Outcome Measures                                                                                                       |
| <b>8.</b>  | <b>DISEASE SPECIFIC APPROACHES IN PULMONARY REHABILITATION</b><br>Obstructive Lung Disease<br>Restrictive Lung Disease<br>Pulmonary Hypertension<br>Lung cancer<br><b>Pulmonary Rehabilitation and the Surgical Patient</b> |
| <b>9.</b>  | <b>PROGRAM MANAGEMENT</b><br>Interdisciplinary Team<br>Program content<br>Administrative aspects of Program management<br>Post rehabilitation Maintenance<br>Strategies for Program success                                 |
| <b>10.</b> | <b>COLLABORATIVE SELF MANAGEMENT AND PATIENT EDUCATION</b><br>Developing an Individualized Self-Management Program<br>Implementing Self-Management Training                                                                 |
| <b>11.</b> | <b>PSYCHOSOCIAL ASSESSMENT AND INTERVENTION</b><br>Assessment of Psychosocial Functioning<br>Interventions to Improve Psychosocial Functioning<br>Psychosocial Provider                                                     |
| <b>12.</b> | <b>NUTRITIONAL ASSESSMENT AND INTERVENTION</b><br>Compromised Nutritional Status in Pulmonary Disease<br>Diet Intake and COPD<br>Assessment of Nutritional Status<br>Nutrition Support                                      |
| <b>13.</b> | <b>PATIENT CENTERED EVIDENCE BASED OUTCOMES</b><br>Timing and Analyzing Outcomes<br>Patient Centered Outcome Measures                                                                                                       |
| <b>14.</b> | <b>DISEASE SPECIFIC APPROACHES IN PULMONARY REHABILITATION</b><br>Obstructive Lung Disease<br>Restrictive Lung Disease<br>Pulmonary Hypertension                                                                            |

|            |                                                                                                                                                                                                                 |
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|            | <p>Lung cancer</p> <p><b>Pulmonary Rehabilitation and the Surgical Patient</b></p>                                                                                                                              |
| <b>15.</b> | <p>PROGRAM MANAGEMENT</p> <p>Interdisciplinary Team</p> <p>Program content</p> <p>Administrative aspects of Program management</p> <p>Post rehabilitation Maintenance</p> <p>Strategies for Program success</p> |
| 1.         | <p>Polysomnogram Channels</p> <p>EEG Channels</p> <p>EOG Channels</p> <p>EMG Channels</p> <p>EKG Channels</p> <p>Respiratory Channels</p> <p>SpO2</p> <p>Body Position</p>                                      |

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| 1. | <p>Scoring of Sleep and Events</p> <p>Apnea- Hypopnea Index</p> <p>Sleep staging Rules</p> <p>Arousal Rules</p> <p>Cardiac Rules</p> <p>Movement rules</p> <p>Respiratory rules</p> <p>Sleep Study Times, Formulas, and Calculations</p> |
| 2. | <p>Pharmacology in Sleep Medicine</p> <p>Hypnotics</p> <p>Stimulants</p> <p>Sedatives</p> <p>Antipsychotics and antidepressants</p> <p>Effect of medication on MSLT and MWT</p>                                                          |
| 3. | <p>Other Interventions and Therapeutics</p> <p>Dental Sleep Medicine</p> <p>Surgical and Pharmacologic Treatment of Sleep Disorders</p>                                                                                                  |

|  |                                               |
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|  | Sleep Hygiene<br>Patient and Family Education |
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### *PRACTICAL EXAMINATION*

One common practical for all the three papers with equal weight age of marks i.e. 40 practical marks for each paper.

# **Paper – II Respiratory Therapy – Applied**

## **Mechanical Ventilation**

### **Course Description**

This course is designed to build the knowledge for Respiratory Therapy students, about the basic terminologies and technical aspects of mechanical ventilation. This course also covers the working principles of mechanical ventilators, different modes of ventilation and various monitoring aspects.

### **Learning Objectives**

By the end of this course students will be able to:

- Understand the basic terminologies and technical concepts of Mechanical Ventilation.
- Differentiate between Volume Ventilation, Pressure Ventilation and other hybrid modes.
- Identify Indications, complications, and physiologic effects of mechanical ventilation.
- Apply appropriate ventilator, initial mode & ventilator parameters
- Understand the concept of Noninvasive Ventilation
- Identify various types of technical and clinical problems encountered during mechanical ventilation of critically ill patients, and describe the steps that can be used to protect a patient when problems occur.

## Course Outline

| Topic                                                                                                                                                                                                                                                                                                                   |
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| <b>Terminologies and Functional Concepts of Mechanical Ventilation</b><br>Physiological terms and Concepts related to Mechanical Ventilation<br>Normal Mechanics of Spontaneous Ventilation<br>Lung Characteristics and Time Constants<br>Types of Mechanical Ventilation<br>Pressures in Positive Pressure Ventilation |
| Technical aspects of Mechanical Ventilator<br>Historical Perspective on Ventilator Classification<br>Internal Function<br>Power Source or Input Power<br>Control Systems and Circuits<br>Power Transmission and Conversion System<br>Calibration of specific ventilators                                                |
| Mechanical delivery of a Breath<br>Basic Model of Ventilation in the Lung during Inspiration<br>Factors Controlled and Measured During Inspiration<br>Overview of Inspiratory Waveform Control<br>Phases of a Breath and Phase Variables<br>Types of Breaths<br>Chatburn's classification- Nomenclature                 |
| Assessing and establishing the need for Mechanical Ventilation<br>Respiratory Failure<br>Patient History and Diagnosis<br>Physiological Measurements in Acute Respiratory Failure<br>Overview of Criteria for Mechanical Ventilation<br>Possible Alternatives to Invasive Ventilation                                   |
| Modes of Mechanical Ventilation<br>Modes of Invasive Ventilation<br>Modes of Non-invasive ventilation<br>Dual and hybrid Modes of Ventilation                                                                                                                                                                           |

Initial Ventilator Settings

Determinants during Volume controlled Ventilation

Special considerations

Determinants during Pressure controlled Ventilation

Special considerations

Setting Baseline Pressure– PEEP

Determinants during dual controlled and hybrid ventilations

Selection of other parameters- FiO<sub>2</sub>, Sensitivity- Pressure and flow, Alarms, Sigh

Overview of Disease specific ventilation- Initial settings

- Chronic Obstructive Pulmonary Disease, Asthma
- Neuromuscular Disorders, Closed Head Injury
- Pneumonia, Acute Respiratory Distress Syndrome, ILD and Cardiogenic Pulmonary Edema

Patient Assessment on Mechanical Ventilation

Documentation/Charting

Initial assessment and serial assessments

Airway Pressure monitoring

Vital Signs, Blood Pressure, and Physical Examination of the Chest

Management of Endotracheal Tube and Tracheostomy Tube Cuffs

Monitoring Compliance and Airway Resistance

Assessment of Respiratory Function

Noninvasive Measurements of Blood Gases

Pulse Oximetry

Capnography (Capnometry)

Exhaled Nitric Oxide Monitoring

Transcutaneous Monitoring

Indirect Calorimetry and Metabolic Measurements

Overview of Indirect Calorimetry

Respiratory Mechanics

Hemodynamic Monitoring

Review of Cardiovascular Principles

Hemodynamic Measurements

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| <p>Interpretation of Hemodynamic Profiles</p> <p>Clinical Applications</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p>Sedatives, Analgesics and Muscle Relaxants</p> <p>Sedatives and Analgesics</p> <p>Muscle relaxants</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <p>Noninvasive Positive-Pressure Ventilation</p> <p>Types of Noninvasive Ventilation Techniques</p> <p>Indications for Noninvasive Positive-Pressure Ventilation</p> <p>Patient Selection Criteria</p> <p>Equipment Selection for Noninvasive Ventilation</p> <p>Selection of Patient Interface</p> <p>Setup and Preparation for Noninvasive Ventilation</p> <p>Monitoring and Adjustment of Noninvasive Ventilation</p> <p>Aerosol Delivery in Noninvasive Ventilation</p> <p>Complications of Noninvasive Ventilation</p> <p>Weaning from and Discontinuing Noninvasive Ventilation</p> |
| <p>Disease Specific Ventilation Strategies</p> <p>Chronic Obstructive Pulmonary Diseases, Asthma</p> <p>Neuromuscular Disorders, Closed Head Injury</p> <p>Pneumonia, Acute Respiratory Distress Syndrome, Pulmonary Edema ILD</p>                                                                                                                                                                                                                                                                                                                                                        |
| <p>Ventilator Graphics</p> <p>Relationship of Flow, Pressure, Volume, and Time</p> <p>Scalars, Curves, and Loops</p> <p>Assessment of Pulmonary Mechanics</p> <p>Assessing Patient-Ventilator Asynchrony</p> <p>Advanced Applications</p>                                                                                                                                                                                                                                                                                                                                                 |
| <p>Patient-Ventilator Management Strategies</p> <p>Troubleshooting Ventilation Abnormalities</p> <p>Common Methods of Changing Ventilation Based on PaCO<sub>2</sub> and pH</p> <p>Metabolic Acidosis and Alkalosis</p> <p>Mixed Acid–Base Disturbances</p> <p>Increased Physiological Dead Space</p> <p>Increased Metabolism and Increased Carbon Dioxide Production</p>                                                                                                                                                                                                                 |

Intentional Iatrogenic Hyperventilation

Permissive Hypercapnia

Airway Clearance during Mechanical Ventilation

Secretion Clearance from an Artificial Airway

Administering Aerosols to Ventilated Patients

Postural Drainage and Chest Percussion

Flexible Fiberoptic Bronchoscopy

Additional Patient Management Techniques and Therapies in Ventilated Patients

- Sputum and Upper Airway Infections
- Fluid Balance
- Psychological and Sleep Status
- Patient Safety and Comfort
- Transport of Mechanically Ventilated Patients within an Acute Care Facility

### **Acute Respiratory Distress Syndrome and Mechanical Ventilation**

Acute Respiratory Distress Syndrome

Pathophysiology- The inflammatory Cascade

Changes in Computed Tomogram with ARDS

Lung-Protective Strategies: Setting Tidal Volume and Pressures in ARDS

Long-Term Follow-Up on ARDS

Pressure–Volume Loops in ARDS

Recruitment Maneuvers in ARDS

Prone ventilation

The Importance of Body Position during Positive Pressure Ventilation

Basics of Oxygenation using  $\text{FIO}_2$ , PEEP Studies, and Pressure–Volume Curves for establishing

Basics of Oxygen Delivery to the Tissues

Positive End-Expiratory Pressure and Continuous Positive Airway Pressure

- PEEP Ranges
- Indications for PEEP and CPAP



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| <ul style="list-style-type: none"> <li>• Initiating PEEP Therapy</li> <li>• Identifying Optimum PEEP</li> <li>• Use of Pulmonary Vascular Pressure Monitoring with PEEP</li> <li>• Contraindications and Physiological Effects of PEEP</li> <li>• Weaning From PEEP</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <p><b>Extra-pulmonary Effects of Mechanical Ventilation</b></p> <p>Effects of Positive-Pressure Ventilation on Heart and the great vessels</p> <p>Adverse Cardiovascular Effects of Positive-Pressure Ventilation</p> <p>Factors Influencing Cardiovascular Effects of Positive-Pressure Ventilation</p> <p>Beneficial Effects of Positive-Pressure Ventilation on Heart Function in Patients with Left Ventricular Dysfunction</p> <p>Physiological Effects and Complications of Mechanical Ventilation</p> <p>Effects of Mechanical Ventilation on Intracranial Pressure, Renal Function, Liver Function, and Gastrointestinal Function</p> <p>Effects of Mechanical Ventilation on Intracranial Pressure and Cerebral Perfusion</p> <p>Renal Effects of Mechanical Ventilation</p> <p>Effects of Mechanical Ventilation on Liver and Gastrointestinal Function</p> <p>Nutritional Complications during Mechanical Ventilation</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>1.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p><b>Effects of Positive-Pressure Ventilation on the Pulmonary System</b></p> <p>Lung Injury with Mechanical Ventilation</p> <p>Effects of Mechanical Ventilation on Gas Distribution and Pulmonary Blood Flow</p> <p>Respiratory and Metabolic Acid–Base Status in Mechanical Ventilation</p> <p>Air Trapping (Auto-PEEP)</p> <p>Hazards of Oxygen Therapy with Mechanical Ventilation</p> <p>Increased Work of Breathing</p> <p>Ventilator- Mechanical and Operational Hazards</p> <p>Complications of the Artificial Airway</p> |
| <b>2.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>Ventilator-Associated Events</p> <p>Epidemiology</p> <p>Ventilator associated infections- Ventilator-Associated Pneumonia, Types</p>                                                                                                                                                                                                                                                                                                                                                                                             |

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|  | Pathogenesis of Ventilator-Associated Pneumonia<br>Diagnosis of Ventilator-Associated Pneumonia<br>Treatment of Ventilator-Associated Pneumonia<br>Strategies to Prevent Ventilator-Associated Pneumonia |
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| <b>3.</b> | Troubleshooting during Mechanical Ventilation<br>Identifying the Patient in Sudden Distress<br>Patient-Related Problems<br>Ventilator-Related Problems<br>Common Alarm Situations<br>Use of Graphics to Identify Ventilator Problems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>4.</b> | Liberation and Discontinuation from Mechanical Ventilation<br>Liberation/ Weaning Techniques<br>Titration of ventilation during Weaning<br>Closed-Loop Weaning<br>Evaluation of Clinical Criteria for Weaning<br>Pathology of Ventilator Dependence<br>Assessment of weaning readiness<br>Assessment during a Spontaneous Breathing Trial<br>Spontaneous Breathing Trial Failure<br>Non-respiratory Factors That May Complicate Weaning<br>Sedation Strategies and Protocols<br>Weaning Protocols<br>Extubation- Readiness criteria and techniques<br>Extubation failure and Reintubation criteria<br>Role of Tracheostomy in Weaning<br>Long-Term Care Facilities for Patients Requiring Prolonged Ventilation<br>Weaning in Long-Term Ventilation Units<br>Weaning from Non-invasive ventilation<br>Withholding and Withdrawing Ventilator Support |
| <b>5.</b> | Long-Term Ventilation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

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|           | <p>Goals of Long-Term Mechanical Ventilation and Patient Selection</p> <p>Preparation for Discharge to the Home</p> <p>Equipment Selection for Home Ventilation</p> <p>Complications of Long-Term Positive Pressure Ventilation</p> <p>Expiratory Muscle Aids and Secretion Clearance</p> <p>Tracheostomy Tubes, Speaking Valves, and Tracheal Buttons</p> <p>Ancillary Equipment and Equipment Cleaning for Home Mechanical Ventilation</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>6.</b> | <p>Advances and Adjuncts in Mechanical Ventilation</p> <p>Airway Pressure Release Ventilation</p> <p>High-Frequency Oscillatory Ventilation: Technical Aspects, Initial Settings, Indication and Exclusion Criteria, Monitoring, Assessment, and Adjustment</p> <p>Liquid Ventilation</p> <p>Advanced technologies like Automatic Tube Compensation, Closed loop weaning, Intelligent ventilation</p> <p>Advanced modes like Adaptive Support Ventilation, Pressure Regulated Volume Control, Proportional Assist Ventilation, Volume Support Ventilation</p> <p>Anesthesia machine- Components and working principles</p> <p>Heliox Therapy: Gas Flow through the Airways, indications, complications, Devices</p> <p>Inhaled Nitric Oxide: Technical Aspects, Initial Settings, Indication and Exclusion Criteria, Monitoring, Assessment, and Adjustment</p> <p>Neurally Adjusted Ventilatory Assist- Adjuncts</p> <p>Monitoring the Electrical Activity of the Diaphragm</p> <p>Diaphragm Electrical Activity Monitoring</p> <p>Diaphragmatic pacemaker</p> |

# **Emergency Medical Care**

## **Course Description**

This course is intended to introduce principles of emergency care and the importance of the immediate care of acutely ill/injured patients to the Respiratory Therapy Students, who upon their graduation will have to extend their professional expertise in Emergency Departments (ED), as a part of Multidisciplinary team of Physicians and Nurses.

## **Learning Objectives**

By the end of this course students will be able to:

- Recognize the life-threatening ED cases, disease presentation and the disease process.
- Identify patients who are acutely ill or can rapidly decline to cardiopulmonary failure.
- Perform initial and ongoing assessment of acutely ill or injured patients.
- Evaluate the findings of assessment and interpret abnormal physiological parameters and observations to identify patients who are likely to have a critical and immediate physiological decline.
- Identify and understand diagnostic tests that are commonly used in Emergency rooms, that includes imaging and laboratory tests.

- Develop and integrate clinical skills and academic knowledge in order to practice advanced assessment, life support and therapeutic skills, within the scope of practice.
- Participate in multi-disciplinary team approach to recognize, report and respond to patients experiencing acute physiological deteriorations, within the scope of practice.
- Engage in the delivery of high-quality evidence based multidisciplinary care as either a team member or team leader, upon the crisis scenarios.

### **Course Outline**

| <b>Sl No</b> | <b>Topic</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
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| <b>1.</b>    | <b>Patient Assessment in Emergency Department</b><br>Triage<br>Objective and Subjective Patient Assessment<br>Vital Signs Assessment<br>Systemic assessment including; Cardiovascular and Circulatory Assessment, Airway and Respiratory Assessment and Neurological Assessment (GCS, PEARL).<br>Focused History and Physical Assessment in Trauma Patients, including Head to Examination and the mnemonic DCAP-BTLS-TIC<br>Focused History and Physical Assessment in Medical Patients, including the mnemonic SAMPLE<br>Ongoing Assessment in Emergency Department |
| <b>2.</b>    | <b>Diagnostic Tests in Emergency Department</b><br>Imaging in ED like Chest and skeletal X-rays, Focused Assessment of Sonography in Trauma (FAST), Lung Ultrasonography and Echocardiography<br>Basics of laboratory investigations like Blood routine, Cardiac Enzymes and Septic markers                                                                                                                                                                                                                                                                           |

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| <b>3.</b> | <p>Airway Management and Ventilation</p> <p>Airway Adjuncts in Emergency Medicine; including video laryngoscopy, bronchoscopy guided intubation and surgical airways.</p> <p>Drugs used during airway stabilization- Sedatives, Analgesics, Muscle relaxants, Antiarrhythmics etc.</p> <p>Acute ventilation strategies- Invasive and Non-invasive ventilation</p>                |
| <b>4.</b> | <p>Respiratory Emergencies</p> <p>Types of Respiratory Failure, Clinical manifestations, Diagnosis, Pathophysiology, Pharmacological adjuncts and Other aspects management</p> <p>Upper airway emergencies and management</p> <p>Lower airway emergencies and management</p> <p>Parenchymal emergencies and management</p> <p>Respiratory emergencies due to CNS involvement</p> |
| <b>5.</b> | <p>Cardiac Emergencies</p> <p>Life threatening arrhythmias</p> <p>Recall of Cardiac arrest and resuscitation</p> <p>Acute Coronary Syndrome- STEMI, N-STEMI and Unstable Angina</p> <p>Congestive Heart Failure and management</p> <p>Cardiac tamponade</p> <p>Cardiac contusion</p>                                                                                             |
| <b>6.</b> | <p>Circulatory Emergencies</p> <p>Mechanism, pathophysiology and management of</p> <ul style="list-style-type: none"> <li>• Hypovolemic shock</li> <li>• Cardiogenic shock</li> <li>• Obstructive shock</li> </ul> <p>Distributive shock- Septic, Neurogenic, Anaphylactic etc.</p>                                                                                              |
| <b>7.</b> | <p>Neurological Emergencies</p> <p>Traumatic brain injury</p> <p>Ischemic and hemorrhagic stroke</p> <p>Brain protective ventilation strategy</p>                                                                                                                                                                                                                                |
| <b>8.</b> | <p>Poisoning and Toxicology</p> <p>Introduction and Principles of Management</p>                                                                                                                                                                                                                                                                                                 |

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|           | <p>OP poisoning, Aluminum Phosphide</p> <p>Caustic ingestion</p> <p>Drug overdose and management- Acetaminophen, Aspirin, Benzodiazepines, TCA</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>9.</b> | <p>Trauma Emergencies</p> <p>Systemic Trauma and management- Thoracic Trauma, Head and Neck Trauma</p> <p>Blunt and Penetrating Trauma</p> <ul style="list-style-type: none"> <li>• Management of Impaled Objects- Face and elsewhere</li> </ul> <p>Stabilization of Cervical Spine</p> <p>Log roll and Spine immobilization</p> <p>Burns</p> <ul style="list-style-type: none"> <li>• Types of burns</li> <li>• Wallace's rule of nine and other assessment criteria</li> <li>• Management of specific types of burns</li> </ul> <p>Inhalational Injuries</p> <p>Carbon monoxide poisoning and management</p> <p>Electrical Injuries- Cardiac complications, Rhabdomyolysis, Compartment syndrome</p> |

| <b>PRACTICAL</b> |                                                 |
|------------------|-------------------------------------------------|
| <b>no.</b>       | <b>Topics to be covered</b>                     |
| 1.               | Triage and Initial systemic assessment          |
| 2.               | Focused Physical examination                    |
| 3.               | Head to Toe examination in Trauma               |
| 4.               | Helmet removal /C-Spine stabilization /Log roll |
| 5.               | Preparation of Airway carts                     |
| 6.               | Arrhythmia recognition and interventions        |
| 7.               | Inter hospital transport of ventilated patients |

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| 8.  | Airway management in Trauma                      |
| 9.  | Clinical and Technical aspects of defibrillation |
| 10. | Interpretation of CXR                            |
| 11. | Airway and Lung Ultrasound                       |

## **Advanced Cardiopulmonary Diagnostics**

### **Course Description**

This course will familiarize the respiratory therapy students with advanced diagnostic procedures and methods used to diagnose a patient's clinical condition with special reference to cardiopulmonary function.

### **Learning Objectives**

By the end of this course students will be able to:

- Describe the indications, technical aspects, procedure involved with various cardiopulmonary diagnostics.
- Perform diagnostic tests to identify the basic functional areas of lung and related structures and how different diseases variably affect these structures on diagnostic tests.
- Recognize and interpret abnormal findings and be able to clinically correlate the cardiopulmonary derangements.



## Course Outline

| SI No | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| 1.    | <b>ADVANCED ELECTROCARDIOGRAM INTERPRETATION</b><br>Evidence of Cardiac Ischemia, Injury, or Infarction <ul style="list-style-type: none"> <li>ST segment – T wave changes is ischemia, injury and infarction</li> <li>Assessing Chest Pain</li> </ul> Electrocardiogram Patterns with Chronic Lung Disease<br><b>Core pulmonale, COPD, pulmonary embolism</b><br>Electrocardiogram Patterns with Heart failure and Electrolyte imbalance<br><b>Changes in heart failure, changes in hyper or hypokalemia</b><br><b>Axis Deviation</b> <ul style="list-style-type: none"> <li>Left axis deviation</li> <li>Right axis deviation</li> </ul> <b>Evolution of electrocardiographic changes-</b> <ul style="list-style-type: none"> <li>Localization of ischemia or infarction, Noninfarction Q waves, Primary and secondary T wave change</li> </ul> <b>Electrolyte and Metabolic ECG abnormalities-</b> <ul style="list-style-type: none"> <li>Cardiac arrhythmias, Ventricular premature beats, Supra-ventricular, tachycardias, Atrial flutter/fibrillation, Ventricular Tachycardia/Ventricular fibrillation, Atrio Ventricular block, Prolonged PR interval, Mobitz type 1 and 2 block, Complete heart block,</li> </ul> <b>Electrical Therapies-</b> <ul style="list-style-type: none"> <li>Recall- Defibrillator, Cardioverter, Pacer</li> <li>Indications, Contraindications and Complications of Electrical therapies.</li> <li>Electrophysiological Changes during electrical therapies</li> </ul> |
| 2.    | Advanced Cardiopulmonary Imaging<br>✓ Introduction and their importance in Respiratory Therapy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 3.    | Computed Tomography of Chest<br>Basic physics, principles, technical and safety aspects<br>Thoracic Anatomy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

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|           | <p>Types- Standard, High resolution, CT Angiography.</p> <p>Windows- Lung, Mediastinal and Bone</p> <p>Indications, Contraindications</p> <p>Preparation of patient</p> <p>Approach to CT Interpretation</p> <p>Review common pathologies</p> <p>CT Pulmonary angiogram</p>                                                                                                                     |
| <b>4.</b> | <p>Magnetic Resonance Imaging of Thorax</p> <p>Basic physics, principles, technical and safety aspects</p> <p>Thoracic Anatomy</p> <p>Indications, Contraindications</p> <p>Preparation of patient and safety</p> <p>Image interpretation- Image Views and Image weights</p> <p>Review common pathologies</p>                                                                                   |
| <b>5.</b> | <p>Ventilation Perfusion Scan (V/Q Scan)</p> <p>Principle and Techniques</p> <p>Indication</p> <p>Contraindications, risks and safety</p> <p>Interpretation- Normal and Abnormal</p> <p>Classification of V/Q scan interpretation</p>                                                                                                                                                           |
| <b>6.</b> | <p>Ultrasonography</p> <p>Physics</p> <p>Machine and Modes</p> <p>Knobology and technical specifications</p> <p>Lung Ultrasound- Normal and abnormal signs</p> <p>Airway Ultrasound- Normal and abnormal signs</p> <p>Diaphragmatic Ultrasound- Normal signs, diaphragmatic thickness and excursion- decision making in respiratory care</p> <p>Infection control practices in ICU sonology</p> |
| <b>7.</b> | <p>Bronchoscopy</p> <p>Basic physics, principles, technical and safety aspects</p> <p>Indications and contraindications</p> <p>Complications</p>                                                                                                                                                                                                                                                |

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|           | <p>Applied anatomy of upper respiratory tract, trachea and bronchi-<br/>Bronchoscopy approach<br/>Bronchoscopy in ventilated patients<br/>Assessment of need and assessment of outcome<br/>Preparation, procedure, monitoring and post-procedural plans<br/>Infection control practices in bronchoscopy<br/>Endobronchial Ultrasound</p>                                                                                                                                                                                                                        |
| <b>8.</b> | <p>Tread Mill Tests and Holter Monitoring<br/>Exercise physiology, protocols, Lead systems, Patient preparation<br/>ST segment displacement – types and measurement, Non<br/>electrocardiographic observations<br/>Exercise test indications, contra-indications and precautions<br/>Cardiac arrhythmias and conduction disturbances during stress<br/>testing, Emergencies in the stress testing laboratory.<br/>Principles of Holter Recording, Connections of the Holter recorder,<br/>Holter Analysis<br/>Guidelines for ambulatory electrocardiography</p> |
| <b>9.</b> | <p>Echocardiography<br/>Principles and physics of echocardiography<br/>Types of echo- TTE, TEE<br/>Modes- M- Mode and 2D transthoracic echocardiography, Views used<br/>in transthoracic echocardiography<br/>Doppler echocardiography: pulsed, continuous wave and color<br/>Preparation of ICU patients for TEE, Monitoring and Post procedural<br/>stabilization</p>                                                                                                                                                                                         |

### *PRACTICAL EXAMINATION*

One common practical for all the three papers with equal weight age of marks  
i.e. 40 practical marks for each paper.

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## **Paper – III Respiratory Therapy – Advance**

### **Neonatal Respiratory Care**

#### **Course Description**

This course is an introduction to the respiratory therapy student on the Neonatal respiratory physiology and mechanics and management of cardiopulmonary disorders.

#### **Learning Objectives**

By the end of this course students will be able to:

- Describes about the fetal lung development and the gas exchange
- To train the student about neonatal resuscitation guidelines.
- Focusses on assessment and monitoring of the neonatal patient.
- Describes about the respiratory diagnostics for the pediatric population.
- Also focusses on the pathophysiology, salient features and treatment of major neonatal disorders.

## Course Outline

| SI No | Topic                                                                                                                                                                                                                                                                                                                                                                                                         |
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| 1.    | <b>DEVELOPMENT OF RESPIRATORY SYSTEM</b><br><b>Fetal development</b><br>Fetal lung development<br>Fetal gas exchange and circulation<br>Surfactant Production and Metabolism<br>Composition of Surfactant<br>Functions of Surfactant<br>Artificial Surfactant- Semi-Synthetic & Synthetic<br><b>Postnatal development</b><br>Transition from intrauterine to extrauterine life<br>Post-natal lung development |
| 2.    | <b>Neonatal Resuscitation</b><br>Preparation for resuscitation<br>Initial steps of newborn care<br>Positive-pressure ventilation<br>Airway management: Endotracheal tubes and laryngeal mask<br>Chest compression<br>Medication<br>Post Resuscitation care<br>Resuscitation and stabilization of babies born preterm                                                                                          |
| 3.    | Thermoregulation<br>Thermoneutral environment<br>Mechanisms of heat loss<br>Hypothermia<br>Prevention of hypothermia<br>Kangaroo mother care                                                                                                                                                                                                                                                                  |
| 4.    | Examination and assessment of the neonatal patients<br>Gestational age and size assessment<br>Physical examination of the neonate                                                                                                                                                                                                                                                                             |

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|           | Neurological assessment<br>Pulmonary examination<br>Non pulmonary examination<br>Laboratory assessment<br>Radiographic chest assessment                                                                                                                                                                                                                                        |
| <b>5.</b> | Neonatal Pulmonary Disorders<br>Respiratory distress syndrome<br>Meconium aspiration syndrome<br>Neonatal pneumonia<br>Apnea of prematurity<br>Transient Tachypnea of the neonate<br>Bronchopulmonary dysplasia<br>Asphyxia in the neonate – Hypoxic-ischemic encephalopathy<br>Pulmonary hemorrhage<br>Pulmonary Air Leak<br>Persistent pulmonary hypertension of the neonate |
| <b>6.</b> | Surgical Disorders of newborn<br>Choanal atresia<br>Cleft Palate<br>Congenital diaphragmatic hernia<br>Tracheoesophageal fistula<br>Congenital cardiac defects                                                                                                                                                                                                                 |
| <b>7.</b> | Noninvasive hemodynamic monitoring techniques<br>Pulse oximetry: Different measurement devices, principles<br>Capnography<br>Transcutaneous monitoring<br>Colorimetry                                                                                                                                                                                                          |
| <b>8.</b> | Invasive hemodynamic monitoring techniques<br>Blood gas sampling<br>Arterial puncture<br>Capillary blood gas sampling<br>Continuous invasive monitoring<br>Central venous catheterization                                                                                                                                                                                      |

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|            | Pulmonary artery catheterization                                                                                                                                                                                                                                                                                         |
| <b>9.</b>  | <b>THERAPEUTIC APPROACHES IN TREATMENT FOR NEONATAL DISORDERS</b><br>Oxygen therapy<br>Assessment of need<br>Targeted saturation in newborns<br>Complications<br>Delivery devices<br>Heated humidified high flow nasal cannula (HHHFNC)                                                                                  |
| <b>10.</b> | Surfactant Replacement Therapy<br>Need for surfactant therapy<br>Techniques of surfactant delivery- Early/late rescue, INSURE, MIST, LISA<br>Types of surfactants<br>Assessment of the outcome                                                                                                                           |
| <b>11.</b> | Non-Invasive Mechanical Ventilation of Newborns<br>Continuous Positive airway pressure (CPAP)<br>Non-invasive Positive pressure ventilation (NIPPV)<br>Interfaces selection and fit<br>Indications, contraindications and complications of NIV<br>Physiological effects<br>Monitoring the patient and ventilator circuit |
| <b>12.</b> | Invasive mechanical ventilation of newborns<br>Indications and contraindications of invasive ventilation<br>Types of mechanical ventilation<br>Modes of Ventilation<br>Improvement of oxygenation and ventilation - adjustments of ventilator setting<br>Weaning and Extubation                                          |
| <b>13.</b> | <b>Unconventional modes of Ventilation</b><br>High Frequency ventilation<br>Nitric oxide therapy<br>Extracorporeal membrane oxygenation                                                                                                                                                                                  |

| PRACTICAL |                                                                                                                                                                                                                                  |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| no.       | Topics covered                                                                                                                                                                                                                   |
| 1.        | <b>NEONATAL RESUSCITATION</b> <ul style="list-style-type: none"> <li>• Initial steps of resuscitation</li> <li>• PPV devices</li> <li>• Route of Drug administration</li> <li>• Medication</li> </ul>                            |
| 2.        | <b>THERMOREGULATION</b> <ul style="list-style-type: none"> <li>• Heat loss</li> <li>• Strategies to prevent heat loss</li> </ul>                                                                                                 |
| 3.        | <b>ASSESSMENT OF NEWBORN</b> <ul style="list-style-type: none"> <li>• Initial steps of assessments</li> <li>• APGAR scoring</li> <li>• BALLARD Scoring</li> <li>• DOWN Scoring</li> <li>• Silverman- Anderson Scoring</li> </ul> |
| 4.        | <b>MONITORING IN ICU</b> <ul style="list-style-type: none"> <li>• Equipment's required</li> <li>• Pulse oximetry types</li> <li>• Pulmonary artery catheters</li> </ul>                                                          |
| 5.        | <b>NEONATAL CHEST X-RAY</b> <ul style="list-style-type: none"> <li>• Normal Chest X-ray</li> <li>• Pulmonary Diseases</li> <li>• Congenital Heart Diseases</li> <li>• Artificial airways and lines</li> </ul>                    |
| 6.        | <b>NON-INVASIVE VENTILATION STRATEGIES</b> <ul style="list-style-type: none"> <li>• CPAP setting</li> <li>• HHHFNC setting</li> </ul>                                                                                            |
| 7.        | <b>INVASIVE VENTILATION STRATEGIES</b> <ul style="list-style-type: none"> <li>• Initiation</li> <li>• Management</li> <li>• Weaning</li> <li>• Extubation</li> </ul>                                                             |
| 8.        | <b>UNCONVENTIONAL MODES OF VENTILATION</b> <ul style="list-style-type: none"> <li>• High Frequency Ventilation</li> </ul>                                                                                                        |



- Inhaled Nitric oxide therapy
- Extracorporeal membrane oxygenation

## **Paediatric Respiratory Care**

### **Course Description**

This course provides students with the knowledge and tools to improve respiratory care of infants and children.

### **Learning Objectives**

By the end of this course students will be able to:

- Differentiate the anatomic and physiological differences between adult and child.
- Perform initial assessment of a pediatric patient at bedside
- Describe the pathophysiology, salient features and treatment of pediatric cardiopulmonary disorders.
- Assist physician in decision making process and respiratory care procedures

### **Course Outline**

| SI No     | Topic                                                                                                                       |
|-----------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>1.</b> | <b>General Examination and assessment of a child</b><br>Physical examination<br>Airway and thoracic radiographic assessment |
| <b>2.</b> | <b>Respiratory Disorders</b><br>Airway disorders<br>Croup                                                                   |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p>Epiglottitis<br/>Tonsillitis<br/>Adenoiditis<br/>Bronchiolitis</p> <p><b>Pediatric Asthma</b></p> <p>Pediatric lung and related disorders<br/>Pneumonitis, Pneumonia<br/>Cystic fibrosis<br/>Pediatric sleep-disordered breathing<br/>Acute respiratory distress syndrome / Pediatric acute respiratory syndrome</p> <p><b>Disorders of the pleura</b></p> <p>Neurological and neuromuscular disorders</p> <p><b>Surgical disorders in childhood that requires respiratory care</b></p> |
| 3. | <p>Cardiovascular Disorders<br/>Dysrhythmias<br/>Congenital heart diseases- Cyanotic and Acyanotic and Management</p> <p><b>Heart Failure</b></p>                                                                                                                                                                                                                                                                                                                                          |
| 4. | <p>Acutely ill or Injured child<br/>Major Trauma<br/>Drowning<br/>Burns<br/>Poisoning and Envenomation</p>                                                                                                                                                                                                                                                                                                                                                                                 |
| 5. | <p>Pediatric Resuscitation<br/>Systematic approach to the seriously ill or injured child<br/>Recognition of respiratory distress and failure<br/>Management of respiratory distress and failure<br/>Recognition of shock<br/>Management of shock<br/>Recognition and management of arrhythmia's<br/>Recognition and management of cardiac arrest<br/>Post resuscitation management<br/>Assessment and Resuscitation<br/>Sedation and Analgesia</p>                                         |
| 6. | <p>Hemodynamic monitoring<br/>Non-invasive monitoring techniques</p> <p><b>Invasive monitoring techniques</b></p>                                                                                                                                                                                                                                                                                                                                                                          |
| 7. | <p>Respiratory Care Procedures<br/>Administration of gas mixtures- Oxygen &amp; Heliox therapy</p> <ul style="list-style-type: none"> <li>• Assessment of need</li> <li>• Precautions &amp; Hazards</li> </ul>                                                                                                                                                                                                                                                                             |

|     |                                                                                                                                                                                                                                                                                                                                                                                  |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     | <ul style="list-style-type: none"> <li>• Delivery devices</li> <li>• Outcome Assessment</li> </ul> <p>Establishment of artificial airway</p> <ul style="list-style-type: none"> <li>• Orotracheal / Nasotracheal intubation</li> <li>• Laryngeal mask airway</li> <li>• Tracheostomy</li> <li>• Management of difficult airway</li> </ul> <p>Pediatric flexible bronchoscopy</p> |
| 8.  | <p>Non-invasive Respiratory Support</p> <p>Assessment of need for non-invasive ventilation</p> <p>Techniques of non-invasive ventilation</p> <p>High Flow Nasal Cannula</p>                                                                                                                                                                                                      |
| 9.  | <p>Invasive mechanical ventilation</p> <p>Need for invasive ventilation</p> <p>Initial ventilatory settings</p> <p>Monitoring in mechanically ventilated patient</p> <p>Weaning and Extubation from mechanical ventilation</p>                                                                                                                                                   |
| 10. | <p>Unconventional modes of ventilation</p> <p>High frequency ventilation</p> <p>Inhaled nitric oxide therapy</p>                                                                                                                                                                                                                                                                 |
| 11. | <p>Extracorporeal Membrane Oxygenation in Pediatrics</p>                                                                                                                                                                                                                                                                                                                         |
| 12. | <p>Pediatric Home Care</p> <p>Oxygen therapy at home</p> <p>Tracheostomy management</p> <p>Home mechanical ventilation</p>                                                                                                                                                                                                                                                       |

## **Biostatistics and Research methodology**

### **Course Description**

This course familiarizes the students of respiratory therapy with the basic research tool and its role in health sciences. This course enables them to collect data, organize and analyse them to generate scientific evidence

## Learning Objectives

By the end of this course students will be able to:

- Explain the role of statistics in health care service
- Differentiate different variables and use different scales of measurement
- Perform basic statistical tests,
- Perform probability, sampling, statistical distributions
- Use appropriate software packages for performing statistical analysis

## Course Outline

| SI No | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.    | <b>Introduction to Biostatistics:</b><br>Definition of Biostatistics<br>Characteristics of statistical data<br>Role of statistics in health science<br><b>Variables</b><br>Qualitative & Quantitative<br>Continuous & Discrete<br>Nominal & Ordinal<br><b>Scales of Measurement</b><br>Nominal<br>Ordinal<br>Interval<br>Ratio                                                                                                                             |
| 2.    | <b>Tabular presentation of data :</b><br>Types of class intervals: Inclusive, Exclusive & Open ended<br>Frequency, Relative and Cumulative frequency<br>Frequency Table<br><b>Tabular presentation of data</b><br>Types of class intervals: Inclusive, Exclusive & Open ended<br>Frequency, Relative and Cumulative frequency<br>Frequency Table<br><b>Diagrammatic presentation of data:</b><br>Bar diagram: Simple, Clustered and Stacked<br>Pie diagram |
| 3.    | Measures of Location<br>(Definition, computation, merits, demerits & application)<br>Mean<br>Median<br>Mode<br>Quartiles                                                                                                                                                                                                                                                                                                                                   |

|           | Percentiles                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>4.</b> | Measures of Variation<br>(Definition, computation, merits, demerits & application)<br>Range<br>Inter-quartile range<br>Variance<br>Standard deviation<br><br>Coefficient of variation                                                                                                                                                                                                             |
| <b>5.</b> | Sampling<br>Population & Sample<br>Reasons for sampling<br>Errors in sampling<br>Non probability & probability sampling (comparison)<br>Probability Sampling (Method, Merits & Demerits)<br>Simple random<br>Stratified<br>Systematic<br>Cluster<br>Non-Probability                                                                                                                               |
| <b>6.</b> | Normal Distribution<br>Concept Normal curve and its properties<br>Reference Range<br>Exercises<br>Skewness and Kurtosis<br>Concept<br>Types                                                                                                                                                                                                                                                       |
| <b>7.</b> | Correlation & Regression<br>Concept<br>Scatter diagrams<br>Pearson's and Spearman's correlation coefficient (No computation)<br>Properties of correlation coefficient<br>Assumptions & Interpretation<br>Dependent and Independent variables<br>Simple Linear Regression equation<br>Interpretation of intercept and slope (No computation)<br>Assumptions of simple linear regression Prediction |
| <b>8.</b> | Research<br>Principles of Research Methodology<br>Introduction to the Research process- Terminologies used in research                                                                                                                                                                                                                                                                            |

|            |                                                                                                                                                                                                                                                                                                                                        |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            | <p>Classifications of Research Methods, Research designs</p> <p>Types of research (for example; pure research, applied research, experiment vs. non-experiment research, and clinical trials)</p> <p>Quantitative vs. qualitative research</p> <p>Prospective vs. retrospective studies</p> <p><b>Methods in Literature Review</b></p> |
| <b>9.</b>  | <p>Data Collection</p> <p>Methods of Data Collection</p> <p>Observation</p> <p>Interview</p> <p>Focus groups</p> <p><b>Questionnaire</b></p>                                                                                                                                                                                           |
| <b>10.</b> | <p>How to do a Research</p> <p>Research Proposal, Synopsis, Abstract</p> <p>Research topics</p> <p>Literature review</p> <p>Research questions and hypothesis</p> <p><b>Referencing Styles</b></p>                                                                                                                                     |
| <b>11.</b> | <p>Evidence-based Practice (EBP)</p> <p>Definition of EBP</p> <p><b>Implementing EBP in healthcare setting</b></p>                                                                                                                                                                                                                     |
| <b>12.</b> | <p>Epidemiology</p> <p>Definition</p> <p>Uses</p> <p>Descriptive Epidemiology Designs</p> <p>Case Reports</p> <p>Case Series</p> <p>Cross Sectional studies</p> <p><b>Ecological descriptive studies</b></p>                                                                                                                           |

## **Patient assessments and diagnostics**

### **Medical History and Interview**

#### Patient Interview

- Principles of Communication
- Structuring the Interview
- Questions and Statements Used to Facilitate
- Conversational Interviewing
- Alternative Sources for a Patient History

Cardiopulmonary History and Comprehensive Health History

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| <ul style="list-style-type: none"> <li>• Variations in Health Histories</li> <li>• General Content of Health Histories</li> <li>• Review of Systems Chief Complaint</li> <li>• History of Present Illness</li> <li>• Past History</li> <li>• Family History</li> <li>• Occupational and Environmental History</li> </ul> <p>Reviewing the Patient's Medical Record</p> <ul style="list-style-type: none"> <li>• Admission Note</li> <li>• Physician Orders</li> <li>• Progress Notes</li> <li>• DNAR/DNR Status</li> </ul> <p>Assessment Standards for Patients with Pulmonary Dysfunction</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  |
| <p>Clinical Laboratory Studies</p> <p>Clinical Laboratory Overview</p> <ul style="list-style-type: none"> <li>• Phases of Laboratory Testing</li> <li>• Composition of Blood</li> <li>• Specimen Integrity and Effect on Test Results</li> <li>• Laboratory Test Parameters</li> </ul> <p>Hematology</p> <ul style="list-style-type: none"> <li>• Complete Blood Count</li> <li>• Erythrocyte Sedimentation Rate</li> <li>• Coagulation Screening Tests</li> </ul> <p>Chemistry</p> <ul style="list-style-type: none"> <li>• Basic Metabolic Panel</li> <li>• Renal Panel</li> <li>• Hepatic Panel</li> <li>• Lipid Panel</li> <li>• Cardiac Biomarkers</li> </ul> <p>Microbiology</p> <ul style="list-style-type: none"> <li>• Pre-analytical Phase: Specimen Selection, Collection, and Transport</li> <li>• Microscopic Examination of Specimens Culture and Sensitivity</li> <li>• Examination of Pulmonary Secretions Bronchoalveolar Lavage</li> <li>• Pleural Fluid Examination</li> </ul> <p>Histology and Cytology</p> <p>Skin Testing</p> <p>Recommended Laboratory Tests</p> |  |  |
| <p>Electrocardiogram Interpretation</p> <p>Electrocardiogram: Cardiac Electrophysiology.</p> <p>Conduction system of the Heart</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Basic Electrocardiogram Waves</p> <ul style="list-style-type: none"> <li>• Electrocardiogram Paper and Measurements</li> <li>• Normal ECG waves</li> <li>• Evaluating Heart Rate</li> </ul> <p>Electrocardiogram Leads</p> <ul style="list-style-type: none"> <li>• Limb Leads</li> <li>• Chest Leads</li> <li>• Evaluating the Mean QRS Axis</li> </ul> <p>Steps of Electrocardiogram Interpretation</p> <p>Normal Sinus Rhythm</p> <p>Causes and Manifestations of Dysrhythmias</p> <p>Identification of Common Dysrhythmias</p> <p>Tachy-arrythmias</p> <ul style="list-style-type: none"> <li>• Premature Atrial Contraction, Sinus tachycardia, Supraventricular tachycardia, Junctional rhythm, Atrial flutter, Atrial fibrillation, Premature Ventricular Contraction, Ventricular tachycardia</li> </ul> <p>Cardiac Arrest Rhythms</p> <ul style="list-style-type: none"> <li>• Pulseless Ventricular Tachycardia, Ventricular Fibrillation, Pulseless Electrical Activity (PEA), Asystole</li> </ul> <p>Brady-arrythmias</p> <ul style="list-style-type: none"> <li>• Sinus Bradycardia, Sick Sinus syndrome, Junctional rhythms</li> </ul> <p>Heart Blocks</p> <ul style="list-style-type: none"> <li>• First, Second, Third degree heart block, left bundle branch block</li> </ul> |
| <p>Documentation</p> <p>General Purposes of Documentation</p> <p>The Joint Commission and Legal Aspects of the Medical Record</p> <p>Types of Medical Records Organizing Patient Information</p> <p>Charting Methods</p> <ul style="list-style-type: none"> <li>• Subjective, Objective, Assessment, and Plan (SOAP) Charting</li> <li>• Assessment, Plan, Implementation, and Evaluation (APIE) Charting</li> <li>• Problem, Intervention, and Plan (PIP) Charting</li> <li>• Situation, Background, Assessment, and Recommendation (SBAR) Charting</li> <li>• Hospital Medical Record keeping and Electronic medical reports</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <p>Older Patient Assessment</p> <p>Patient-Clinician Interaction</p> <ul style="list-style-type: none"> <li>• Principles of Communication</li> <li>• Reducing Communication Barriers</li> </ul> <p>Age-Related Sensory Deficit</p> <ul style="list-style-type: none"> <li>• Hearing Impairment</li> <li>• Vision Impairment</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aging of the Organ Systems <ul style="list-style-type: none"> <li>• Age-Related Changes Pulmonary Defense Mechanisms Unusual Presentations of Illness</li> </ul> Patient Assessment <ul style="list-style-type: none"> <li>• Vital Signs</li> <li>• Inspection and Palpation Pulmonary Auscultation</li> <li>• Cardiac Auscultation</li> </ul> Diagnostic Tests <ul style="list-style-type: none"> <li>• Gas Exchange</li> <li>• Laboratory Values</li> </ul> Comprehensive Geriatric Assessment <ul style="list-style-type: none"> <li>• Functional Ability</li> </ul> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### Topics covered

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### MEDICAL HISTORY TAKING, PATIENT INTERVIEW. REVIEWING MEDICAL RECORDS.

### ASSESSMENT OF CARDIOPULMONARY SYMPTOMS

#### BASIC PATIENT ASSESSMENT AND OBTAINING VITAL SIGNS

- Measuring body temperature
- Measuring the pulse
- Measuring Respiratory rate
- Assessing blood pressure
- Auscultation of breath sounds

#### PATIENT ASSESSMENT: INSPECTION, PALPATION, PERCUSSION

- Chest Landmarks for Assessment
- Assessment techniques and abnormal findings
- Preexamination and other considerations
- Examination of head and neck
- Inspection, Palpation and Percussion of thorax
- Examination of the Precordium
- Auscultation of heart sounds
- Examination of abdomen
- Examination of extremities

#### NEUROLOGIC ASSESSMENT

- Assessing Consciousness
- Glasgow Coma Scale
- Mini-Mental State Examination
- Assessment of Consciousness in the Intensive Care Unit
- Cranial Nerve Examination
- Sensory Examination
- Motor Examination
- Deep Tendon, Superficial, and Brainstem Reflexes
- Coordination, Balance, and Gait Examination
- Observing Ancillary Testing of the Neurologic System
- Brain Death evaluation

**ARTERIAL BLOOD GAS SAMPLING**

- Anatomical landmarks for Arterial puncture
- Complications of arterial puncture
- Blood gas sampling error
- Supplies needed for arterial puncture
- Arterial puncture techniques
- Indwelling arterial catheter sampling
- Supplies for capillary sampling
- Capillary sampling techniques
- Systematic interpretation of arterial blood gas report
  - Oxygenation assessment
  - Acid base assessment

**DOCUMENTATION AND GOAL ASSESSMENT**

- The medical record
- Goal assessment and documentation
- Documentation guidelines and abbreviations

### *PRACTICAL EXAMINATION*

One common practical for all the three papers with equal weight age of marks i.e. 40 practical marks for each paper

## **SUBSIDIARY SUBJECTS**

### **BIO STATISTICS**

Time Allotted: 20 Hours

#### **Course Description:**

Introduction to basic statistical concepts: methods of statistical analysis; and interpretation of data

#### **Behavioral Objectives:**

Understands statistical terms.

Possesses knowledge and skill in the use of basic statistical and research methodology.

#### **Unit – I : Introduction**

Meaning, definition, characteristics of statistics. Importance of the study of statistics.

Branches of statistics.

Statistics and health science including nursing. Parameters and estimates.

Descriptive and inferential statistics. Variables and their types.

Measurement scales

#### **Unit – II : Tabulation of Data**

**Raw data, the array, frequency distribution. Basic principles of graphical representation.**

Types of diagrams - histograms, frequency polygons, smooth frequency polygon, commulative frequency curve, ogive.

Normal probability curve.

**Unit - III: Measure of Central Tendency**

Need for measures of central tendency

Definition and calculation of mean - ungrouped and grouped

Meaning, interpretation and calculation of median ungrouped and grouped.

Meaning and calculation of mode.

Comparison of the mean, and mode.

Guidelines for the use of various measures of central tendency.

**Unit - IV: Measure of Variability** Need for measure of dispersion. The range, the average deviation. The variance and standard deviation.

Calculation of variance and standard deviation ungrouped and grouped. Properties and uses of variance and SO

**Unit -V: Probability and Standard Distributions.** Meaning of probability of standard distribution. The Binominal distribution.

The normal distribution.

Divergence from normality - skewness, kurtosis.

**Unit - VI: Sampling Techniques**

Need for sampling - Criteria for good samples. Application of sampling in Community.

Procedures of sampling and sampling designs errors. Sampling variation and tests of significance.

**Unit - VII: Health Indicator**

Importance of health Indicator.

Indicators of population, morbidity, mortality, health services. Calculation of rates and ratios of health.

**Recommended Books.**

B.K. Mahajan & M. Gupta (1995) Text Book of Preventive & Social Medicine, 2002,17th Edition Jaypee Brothers.

## **BASICS IN COMPUTER APPLICATIONS**

### **Time allotted: 20 hours**

The course enables the students to understand the fundamentals of computer and its applications.

### **Introduction to Data processing :**

Features of computers, Advantages of using computers. Getting data into / out of computers. Role of computers. What is Data processing? Application areas of computers involved in Data processing. Common activities in processing. Types of Data processing, Characteristics of information. What are Hardware and Software?

### **Hardware Concepts :**

Architecture of computers, Classification of computers, Concept of damage. Types of storage devices. Characteristics of disks, tapes, Terminals, Printers, Network. Applications of networking concept of PC System care, Floppy care, Data care.

### **Concept of Software.**

Classification of software : System software. Application of software. Operating system. Computer system. Computer virus. Precautions against viruses. Dealing with viruses.

Computers in medical electronics Basic Anatomy of Computers

### **Principles of programming**

Computer application - principles in scientific research ; work processing, medicine, libraries, museum , education, information system.

### **Data processing**

Computers in physical therapy - principles in EMG, Exercise testing equipment, Laser.

### **No Practical or Viva voce examination**

**REGULATIONS & CURRICULUM OF  
GRADUATE PARAMEDICAL COURSE  
  
BACHELOR OF SCIENCE IN  
  
OPTOMETRY  
  
2020**



**Sri Siddhartha  
Academy of Higher Education  
Deemed-to-be-University**

**Established under Section 3 of the UGC Act, 1956  
MHRD, GOI No. F.9-31/2006-U.3 (A) Dtd. 30th May 2008**

**Agalakote, B.H. Road, Tumkur – 572107, Karnataka, India**

# SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

(DEEMED TO BE UNIVERSITY)

Declared under Section 3 of the UGC Act, 1956, MHRD GOI No. F.9-31/2006-U.3 (A) Dated: 30/05/2008

Accredited 'A' Grade by NAAC

**Agalakote, B.H.Road, Tumkur - 572 107.KARNATAKA, INDIA.**

Ph. 0816- 2275516, Fax : 0816-2275510 website: sahetumkur.ac.in email: info@sahe.in



No. SSAHE/ACA-S&C(AHSP)/18/2022

Date: 01/09/2022

## NOTIFICATION

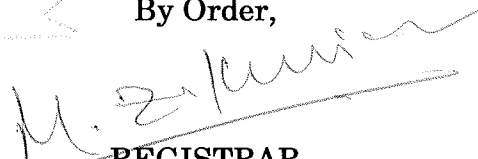
Sub: Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Optometry.

- Ref: 1). Proceedings of BOS Allied Health Sciences Programmes held on 06/04/2021  
2). Proceedings of the Academic Council meeting held on 19/08/2021  
3). Proceedings of the Board of Management held on 29/08/2022

In exercise of the powers vested under section 6 of 6.4 of MoA / Rules of SSAHE, the Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Optometry is notified herewith as per Annexure.

The above Regulations shall be applicable to the students admitted to the said course from the academic year 2020-21 onwards.

By Order,

  
**REGISTRAR**

**Sri Siddhartha Academy of Higher Education**  
**TUMKUR - 572 107, Karnataka.**

To,  
Dean / Principal, Sri Siddhartha Medical College & Hospital,

Copy to

- 1) Office of the Chancellor, SSAHE, for kind information,
- 2) PA to Vice-Chancellor / PA to Registrar / Controller of Examinations / Finance Officer, SSAHE
- 3) The Director (AHSP), SSAHE
- 4) All Officers of the Academy Examination Branch / Academic Section
- 5) Guard File / Office copy.

# **REVISED ORDINANCE GOVERNING REGULATIONS & CURRICULUM OF BACHELOR OF SCIENCE IN OPTOMETRY- 2020**

## **1. ELIGIBILITY FOR ADMISSION**

A candidate desiring to join the four years programme leading to the B.Sc. Optometry degree

- a. should have passed the Two year Pre University examination conducted by Department of Pre University Education, Karnataka State with English as one of the subjects and Physics, Chemistry, Biology / Maths as optional subjects. The candidate shall have passed the subjects of English, Physics, Chemistry, Biology / Maths individually also.

OR

- b. Shall have passed any other examination conducted by Boards/Councils/Intermediate examination established by State Governments/Central Government and recognized as equivalent to two year Pre University examination by the Sri Siddhartha Academy of Higher Education /Association of Indian Universities (AIU) with English as one of the subjects and Physics, Chemistry and Biology as optional Subjects and the candidate shall have passed subjects of English, Physics, Chemistry, Biology / Maths individually also.
- c. Shall have passed Intermediate examination in Science of an Indian University/Board/Council or other recognized examining bodies with Physics, Chemistry and Biology, which shall include a practical test in these subjects and also English as compulsory subject. The candidate shall have passed subjects of English, Physics, Chemistry, Biology / Maths individually also.
- d. Shall have passed first year of the three year degree course of a recognized University with Physics, Chemistry and Biology including a practical test in these subjects provided the examination is an 'University Examination' provided that the candidate shall have passed subjects of English, Physics, Chemistry, Biology / Maths individually in the pre university or other examinations mentioned in the clauses above.
- e. Shall have passed B.Sc. Examination of an Indian University, provided that he/she has passed the B.Sc. examination with not less than two of the following subjects : Physics, Chemistry, Biology (Botany, Zoology) provided the candidate has passed subjects of English, Physics, Chemistry Biology / Maths individually in the qualifying examinations mentioned in clauses a, b and c.
- f. Candidates with two years diploma from a recognized Government Board in Optometry shall have passed class 12 [10+2] with Physics, Chemistry and Biology, as subjects or candidates



with 3 years diploma from a recognized Government Board in Optometry should have studied Physics, Biology and Chemistry as subjects during the tenure of the course.

Lateral entry to second year of B.Sc.Optometry for candidates who have passed diploma program from the Government Boards and recognized by SSAHE, fulfilling the conditions specified above under Sl. No. 5 and these students are eligible to take admission on lateral entry system only in the same subject studied at diploma level for the academic

**Note:**

- a. The candidate shall have passed individually in each of the subjects.
- b. Candidates who have completed diploma or vocational course through Correspondence shall not be eligible for any of the courses mentioned above

**1.2 AGE:** A candidate should have completed the age of 17 years as on 31<sup>st</sup> December of the year of admission.

**1.3 SELECTION**

Selection of the candidates should be based on the merit in the entrance examination held by the University or competent authority.

**2. DURATION OF THE COURSE**

The student shall undergo a period of certified study extending over 4 academic years including one year internship. Project exams at end of 4<sup>th</sup> year.

**3. MEDIUM OF INSTRUCTION:**

The medium of instruction and examination shall be in English.

**4. SCHEME OF EXAMINATION:**

There shall be three examinations one each at the end of 1st, 2nd , 3rd year and project and exit examination at the end of the 4<sup>th</sup> year.

**5. ATTENDANCE**

Every candidate should have attendance not less than 80% of the total classes conducted in theory and practical's separately in each calendar year calculated from the date of commencement of the term to the last working day as notified by the University in each of the subjects prescribed to be

eligible to appear for the university examination. A candidate pursuing the course shall study in the college for the entire period as a full time student. No candidate should join any other course of study or appear for any other examination conducted by this university or any other university in India or abroad during the period of registration.

A candidate lacking in the prescribed attendance should not be permitted to appear for the examination in that subject(s)

## **6. INTERNAL ASSESSMENT (IA):**

1<sup>st</sup> Year B.Sc. Optometry  
Theory - 20 marks

2<sup>nd</sup> & 3<sup>rd</sup> year B.Sc. Optometry  
Theory – 20 Marks

There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an academic year. The average marks of the two tests will be calculated and reduced to 20. The marks of IA shall be communicated to the University at least 15 days before the commencement of the University examination. The University shall have access to the records of such periodical tests. The marks of the internal assessment must be displayed on the notice board of the respective colleges with in a fortnight from the date test is held. If a candidate is absent for any one of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight

\* There shall be no University Practical Examination in First year.

## **8. TEACHING HOURS**

The number of hours of teaching theory and practical, subject wise in first year, second year and third year are shown in Table-I, Table-II and Table-III

**Table - I Distribution of Teaching Hours in First Year Subjects**

| Subject                                              | Method / Number of Hours |            |
|------------------------------------------------------|--------------------------|------------|
|                                                      | Theory                   | Practicals |
| General Anatomy & General physiology                 | 90                       | 40         |
| Basic Biochemistry & Nutrition                       | 70                       | 30         |
| Ocular Anatomy ,ocular Physiology& biochemistry      | 90                       | 40         |
| Physical & Geometric Optics & principles of lighting | 180                      | 70         |
| Computer Basics & Computer Programming               | 40                       | 40         |
| Functional English& Communications                   | 30                       | -          |
| Mathematics                                          | 30                       | -          |
| Kannada                                              | 20                       |            |
| Basic Accountancy                                    | 20                       |            |

**Table - II Distribution of Teaching Hours in Second Year Subjects**

| Subject                                                        | Method / Number of Hours |            |
|----------------------------------------------------------------|--------------------------|------------|
|                                                                | Theory                   | Practicals |
| Optometric Optics & Dispensing optometry                       | 120                      | 100        |
| Clinical Examination Of Visual System & Optometric Instruments | 120                      | 100        |
| Visual optics                                                  | 90                       | 60         |
| Pharmacology, Microbiology & Pathology                         | 60                       | 40         |
| Medical Psychology                                             | 20                       | -          |
| Clinics                                                        | -                        | 270        |

**Table - III Distribution of Teaching Hours in Third Year Subjects**

| Main Subject                                                   | Method / Number of Hours |            |
|----------------------------------------------------------------|--------------------------|------------|
|                                                                | Theory                   | Practicals |
| Contact Lenses                                                 | 60                       | 60         |
| Systemic & Ocular diseases                                     | 90                       | 70         |
| Low Vision Aids & Geriatric Optometry                          | 30                       | 30         |
| Practice management, law in optometry & occupational optometry | 50                       | 30         |
| ,Research Methodology& Biostatistics                           | 50                       | -          |
| Pediatric Optometry, Advances In Optometry & Binocular Vision  | 90                       | 80         |
| Clinics & Special Clinics                                      | -                        | 270        |

**Table - IV Distribution of Teaching Hours in Fourth Year Subjects**

|                                       |   |        |
|---------------------------------------|---|--------|
| Project                               | - | 1 year |
| CLINICAL POSTING & SPECIALITY POSTING |   |        |

### **9. Schedule of Examination:**

The university shall conduct two examinations annually at an interval of not less than 4 to 6 months as notified by the university from time to time. A candidate who satisfies the requirement of attendance, progress and conduct as stipulated by the university shall be eligible to appear for the university examination. Certificate to that effect shall be produced from the Head of the institution along with the application for examination and the prescribed fee.

## **10. Scheme of Examination**

There shall be three examinations, one each at the end of I, II and III year. Marks for First Year, second year, Third year and fourth year University theory and practical Examinations are shown in the Table .

### **First year Examination:**

The University examination for 1st year shall consist of Written Examination & Practical.

### **Second & Third year examination:**

The University examination for 2nd and 3rd year shall consist of Written Examination & Practical.

### **Fourth YEAR EXAMINATION:**

The project assessment & Exit practical examination

#### **Written Examinations consists of**

- ☐ 04 papers in the 1st year
- ☐ 04 papers in the 2nd Year
- ☐ 06 papers in the 3rd Year.

#### **Practical examination:**

- ☐ Practical examinations, at the end 1st Year.
- ☐ Practical examinations, at the end 2nd Year.
- ☐ Practical examinations at the end of the 3rd year.

#### **University Examination – Subjects and Distribution of Marks**

**Non- University Examination:** These are internal examination subject for which no university assessment would be made.

## Bachelors in Optometry University Examination – Subjects and Distribution of Marks

### 10.1 FIRST Year Examination

| Subject                                                    | University Examination |          |            |           | Total |
|------------------------------------------------------------|------------------------|----------|------------|-----------|-------|
|                                                            | Theory                 | Internal | Practicals | Viva Voce |       |
| Basic Biochemistry & Nutrition                             | 80                     | 20       | -          | -         | 100   |
| General Anatomy(sec A)                                     | 40                     | 10       |            |           | 100   |
| General physiology(sec B)                                  | 40                     | 10       |            |           |       |
| Ocular I Anatomy , ocular Physiology & Ocular biochemistry | 80                     | 20       | -          | -         | 100   |
| Physical & Principles of Lighting (sec A)                  | 40                     | 10       | 80         | 20        | 200   |
| Geometric Optics (sec B)                                   | 40                     | 10       |            |           |       |
| Non- University Examination ( SUBSIDIARY )                 |                        |          |            |           |       |
| Subject                                                    | Theory                 |          | Internal   |           | Total |
| Computer programming*                                      | 80                     |          | 20         |           | 100   |
| English*                                                   | 80                     |          | 20         |           | 100   |
| Mathematics                                                | 80                     |          | 20         |           | 100   |
| Basic Accounts                                             | 80                     |          | 20         |           | 100   |
| Computer Basics                                            | 80                     |          | 20         |           | 100   |

Note: I A = Internal Assessment

\*Main Subjects shall have University Examination. There shall be one subject University Practical Examination.

\*\*Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges

## 10.2 SECOND Year Examination

| Subject                                               | University Examination |          |            |           | Total |
|-------------------------------------------------------|------------------------|----------|------------|-----------|-------|
|                                                       | Theory                 | Internal | Practicals | Viva Voce |       |
| Optometric Optics & Dispensing<br>Optometry           | 80                     | 20       | -          | -         | 100   |
| Visual Optics                                         | 80                     | 20       | -          | -         | 100   |
| CEVS & Optometric instruments                         | 80                     | 20       | -          | -         | 100   |
| Microbiology, Pathology(sec A)<br>Pharmacology(sec B) | 40<br>40               | 10<br>10 | -          | -         | 100   |
| Clinical practical examination                        | -                      |          | 80         | 20        | 100   |
|                                                       |                        |          |            |           |       |
| Non- University Examination (SUBSIDIARY SUBJECTS)     |                        |          |            |           |       |
| Subject                                               | Theory                 |          | Internal   |           | Total |
| Medical Psychology*                                   | 80                     |          | 20         |           | 100   |
| Communications & Public relations*                    | 80                     |          | 20         |           | 100   |

**\*\*Subsidiary subjects:** Examination for subsidiary subjects shall be conducted by respective colleges

### 10.3 THIRD Year Examination

| Subject                                                          | University Examination |          |           |           | Total |
|------------------------------------------------------------------|------------------------|----------|-----------|-----------|-------|
|                                                                  | Theory                 | Internal | Practical | Viva Voce |       |
| Low Vision Aids & Geriatric Optometry                            | 80                     | 20       | -         | -         | 100   |
| Contact Lens                                                     | 80                     | 20       | -         | -         | 100   |
| Research Methodology & Statistics                                | 80                     | 20       |           |           | 100   |
| Systemic diseases (sec A)                                        | 40                     | 10       | -         | -         | 100   |
| Ocular Diseases (sec B)                                          | 40                     | 10       |           |           |       |
| Practice Management & law in optometry<br>(sec A)                | 40                     | 10       | -         | -         | 100   |
| Occupational Optometry (sec B)                                   | 40                     | 10       |           |           |       |
| Pediatric Optometry, Binocular vision &<br>Advances in Optometry | 80                     | 20       | -         | -         | 100   |
| Clinics & Specialties                                            | -                      |          | 160       | 40        | 200   |
|                                                                  |                        |          |           |           |       |

| <b>Non- University Examination(Subsidiary Subjects)</b> |        |          |  |            |
|---------------------------------------------------------|--------|----------|--|------------|
| Subject                                                 | Theory | Internal |  | Total      |
| Public health, Epidemiology                             | 80     | 20       |  | <b>100</b> |

**\*\*Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges**



## **FOURTH year**

| Subject                                  | University Examination |          |           |           | Total |
|------------------------------------------|------------------------|----------|-----------|-----------|-------|
|                                          | Theory                 | Internal | Practical | Viva Voce |       |
| Project                                  |                        |          | 80        | 20        | 100   |
| Clinical Examination- “EXIT EXAMINATION” |                        |          | 160       | 40        | 200   |

### **11. Eligibility for Examination**

To be eligible to appear for University examination a candidate

- Shall have undergone satisfactorily the approved course of study in the subject/subjects for the prescribed duration.
- Shall have attended atleast 80% of the total number of classes in theory and practical/clinical to become eligible to appear for the examination in that subject/subjects.
- Shall fulfill any other requirement that may be prescribed by the university from time to time.

### **12. Criteria for pass**

For declaration of pass in any subject in the university examination, a candidate shall pass both in theory and practical/clinical examination components separately as stipulated below:

- The theory component comprises of marks obtained in the University written paper. For a pass in theory, a candidate shall secure not less than 50%. For a pass in practical/clinical examination, a candidate shall secure not less than 50%, marks in aggregate, i.e., marks obtained in university practical/clinical examination and viva voce added together.
- A candidate not securing 50% marks in aggregate in Theory or Practical/Clinical examination in a subject shall be declared to have failed in that subject and is required to appear for both Theory and Practical/Clinical again in the subsequent examination in that subject.

### **13. Carry over benefit**

#### **13.1 First year examination:**

A candidate who fails in any one of the four main subject of first year shall be permitted to carry over that subject to second year. However, he/she must pass the carry over subject before appearing for second year examination.

#### **13.2 Second year examination.**

A candidate is permitted to carry over any one main subject to the third year but shall pass this subject before appearing for the third year examination.

### **13.3 Third year examination.**

A candidate shall pass all the subjects of the third year examinations to be eligible for internship.

### **14. Declaration of Class**

- a. A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with distinction.
- b. A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 65% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in First Class.
- c. A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than 65% of grand total marks prescribed will be declared to have passed the examination in Second Class.
- d. A candidate passing a university examination in more than one attempt shall be placed in Pass class irrespective of the percentage of marks secured by him/her in the examination.

The marks obtained by a candidate in the subsidiary subjects shall not be considered for award of Class or Rank. [Please note, fraction of marks should not be rounded off clauses (a), (b) and (c)]

### **15. Eligibility for the award of Degree:**

A candidate shall have passed in all the subjects of first, second and third year to be eligible for a compulsory 12 months of rotational internship. On completion of 12 months of the internship with pass criteria in outgoing clinical assessment exams (EXIT EXAMS) the candidate is then eligible for the award of degree.

## 15. Distribution of Type of Questions and Marks

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>First year</b> ) |                  |                          |
|------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                          | No. of Questions | Marks for Each Questions |
| Long Essay                                                 | 1                | 10                       |
| Short Essay                                                | 5                | 5                        |
| Short Notes Type                                           | 5                | 3                        |
| Short Answer Type                                          | 10               | 2                        |
| MCQ's                                                      | 10               | 1                        |

- |                                                     |                  |
|-----------------------------------------------------|------------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks   |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks   |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks   |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks   |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks   |
|                                                     | <b>Total= 80</b> |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Second and Third Year</b> ) |                  |                          |
|-----------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                     | No. of Questions | Marks for Each Questions |
| Long Essay                                                            | 1                | 10                       |
| Short Essay                                                           | 5                | 5                        |
| Short Notes Type                                                      | 5                | 3                        |
| Short Answer Type                                                     | 10               | 2                        |
| MCQ's                                                                 | 10               | 1                        |

- |                                                     |                  |
|-----------------------------------------------------|------------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks   |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks   |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks   |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks   |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks   |
|                                                     | <b>Total= 80</b> |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Subsidiary subjects</b> ) |                  |                          |
|---------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                   | No. of Questions | Marks for Each Questions |
| Essay Type                                                          | 3 (2 x 10)       | 10                       |
| Short Essay Type                                                    | 8 (6 x 5)        | 05                       |
| Short Answer Type                                                   | 12 (10 x 3)      | 03                       |

# **INTERNSHIP**

## **COMPULSORY ROTATORY INTERNSHIP FOR B.Sc. OPTOMETRY**

Twelve-month compulsory rotational postings during which students have to work in the following areas:

1. General Optometry department and General Ophthalmology department – 1 month
2. Speciality refraction with Retina and Cornea Ophthalmology department– 1 month
3. Paediatric refraction with Paediatric ophthalmology – 1 month
4. LASIK investigation – 1 month
5. Cataract investigation – 1 month
6. HFA and Glaucoma ophthalmology department – 1 month
7. Contact lens – 1 month
8. Low vision and Rehabilitation department – 1 month
9. Vision therapy – 1 month
10. Ocularistry and Electrodiagnostics – 1 month
11. Opticals – 1month
12. Community Refraction – 1month

Students must be able to assist independently the following procedures at the end of their internship postings;-

1. General Optometry department, Community refraction and General Ophthalmology department:

Students should get well versed in handling refraction cases like

- General Refraction
- Aphakia
- Emergency cases like redness/trauma
- Refract all kinds of refractive error

- Refract ectatic conditions of cornea
  - Post-Operative refraction
  - Follow up cases of any infection – Chalazion/Stye/Conjunctivitis
  - Differential diagnosis and diagnosis of anterior chamber infections
  - Troubleshoot
  - Appropriate referral
2. Speciality refraction with Retina and Cornea Ophthalmology department
    - Complete speciality refraction work-up
    - Differential diagnosis and diagnosis of retinal conditions
    - Differential diagnosis and diagnosis of corneal conditions
    - Refraction for all post-operative retinal and corneal conditions
    - To know the management for retinal and corneal condition
    - To understand and decide the prognosis of every condition
    - Appropriate referral
  3. Paediatric refraction with Paediatric ophthalmology
    - Complete paediatric work-up
    - All syndromes
    - Aphakia
    - Hereditary conditions
    - Pedigree charting
    - Cycloplegic refraction
    - Decide about prescription for paediatric age groups
  4. LASIK investigation and Cataract investigation
    - Appropriate history taking
    - Able to perform the investigation using appropriate diagnostic tool
    - Able to interpret the reports post investigation
    - To decide if the patient can undergo LASIK or cataract surgery
  5. HFA and Glaucoma ophthalmology department
    - Able to perform the HFA for all kinds of patients with any HFA strategy
    - Able to interpret the HFA reports and understand the prognosis of Glaucoma
    - To diagnose the type of Glaucoma
    - To know the management of all types of Glaucoma
    - Appropriate referral
  6. Contact lens
    - Soft lens/Soft toric
    - RGP CL
    - ROSE K
    - Miniscleral CL
    - Cosmetic CL
    - Bandage CL

- Troubleshoot
  - Steven Johnson's syndrome
  - Sjogren syndrome
  - Aphakia
  - Post-surgery
  - High astigmatism – Keratoconus/PMD
  - Patient care and maintenance
7. Low vision and Rehabilitation
- Complete low vision work-up
  - Distance and Near magnification trial
  - Prescribe appropriate devices according to the condition
  - Appropriate referral
  - To understand and know to rehabilitate a low vision patient according to their needs
8. Vision therapy
- Complete Binocular vision work up
  - To diagnose every condition appropriately
  - To decide about the appropriate therapy for every condition
  - Diplopia charting and Hess charting
  - DMR and Prism trial for diplopia
  - Perceptual skill assessment
  - To work on defective perceptual skill appropriately
9. Ocularistry and Electrodiagnostics
- Orbital diseases
  - Evisceration, Enucleation and Exenteration
  - Fitting and Removal of customised eye – Fitting assessment
  - Materials used
  - Processing and Fabrication techniques
  - Patient care and hygiene
10. Opticals
- To decide and choose the appropriate spectacle lens and frame according to the power
  - Ocular measurements
  - Lens coatings
  - Frame fitting and adjustments
  - Dispensing

**NOTE: AT THE END OF INTERNSHIP THERE WILL BE A PRACTICAL EXAM.  
(EXIT EXAM)**

# FIRST YEAR B.Sc. OPTOMETRY SYLLABUS

- Physical Optics & principle of lighting (Sec A) Geometric Optics (Sec B)
- General Anatomy (Sec A) & Physiology (Sec B)
- Ocular Anatomy, Physiology & Ocular biochemistry
- General Biochemistry & Nutrition

## PHYSICAL OPTICS (THEORY)

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | HOURS |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | Nature of light: An overview<br>Corpuscular Theory, Wave Theory, quantum theory and dual nature                                                                                                                                                                                                                                                                                                                                                                                    | 02    |
|       | Simple Harmonic Motion<br>Definition, Mathematical representation, energy in SHM, combination of two SHMs (along a line and at right angles). Waves : Transverse and Longitudinal, mathematical representation of a wave, wave fronts, path difference and phase difference, coherent waves, Numerical.                                                                                                                                                                            | 10    |
|       | Interference of light<br>Theory of interference-Conditions for interference, Young's double slit experiment, Expression for fringe width, Intensity distribution of the double slit interference pattern, condition for good contrast.                                                                                                                                                                                                                                             | 10    |
|       | Interference in thin films: Reflection phase shifts, optical path length. Interference in thin parallel films of uniform thickness, variable thickness (air wedge, Newton's rings), their applications to antireflection coatings, optical flatness of reflecting surfaces, determination of : wavelength, refractive index, thickness of thin films, radius of curvature, Michelson interferometer, Numerical                                                                     | 10    |
| 2     | Diffraction – Introduction, Fresnel and Fraunhofer diffraction.<br>Fresnel diffraction: Rectilinear propagation of light, Zone plate, Theory of Fresnel's half period zone. Numerical.<br>Fraunhofer Diffraction: Diffraction pattern from single slit, Double slit. Diffraction pattern due to N Slits-Theory of plane transmission grating. Resolving power of the diffraction grating. Numerical.                                                                               |       |
| 3     | Polarization – Review of light as a transverse wave. Polarization phenomenon due to reflection, refraction and scattering Brewster's and Malus' laws. Polaroids. Double refraction, retardation plates, Nicol prism as a device to produce polarized light, dichroism, equation to polarization ellipse, elliptical, circular and linear polarizations, their production and detection<br><br>Optical activity, Lorentz half shade polarimeter, determination of specific rotation | 10    |
| 4     | Absorption and scattering: General and selective absorption, Distinction between absorption and scattering, absorption by solids, liquids and gases, scattering: Rayleigh, Mie and Raman scattering.                                                                                                                                                                                                                                                                               | 08    |
| 5     | Radiometry and Photometry – Electromagnetic spectrum, Radiometry, Photometry, sources                                                                                                                                                                                                                                                                                                                                                                                              |       |

|   |                                                                                                                            |           |
|---|----------------------------------------------------------------------------------------------------------------------------|-----------|
|   | of optical radiation and detectors of radiation.                                                                           | 06        |
| 6 | Laser basics:Introduction, Einstein quantum theory of radiation, Essentials of a laser, Ruby laser, Holography, Numerical. | 08        |
| 7 | FiberOptics: Structure,Optics of propagation, Attenuation, Distortion, Numerical.                                          | 6         |
| 8 | The particle nature of radiation :Photoelectric effect, Compton effect(no derivation of Compton shift equation), Numerical | 6         |
|   | <b>TOTAL</b>                                                                                                               | <b>86</b> |

### PHYSICAL OPTICS - PRACTICAL

Any 10 of the following experiments

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | HOURS     |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1     | <b>EXPERIMENTS</b> <ol style="list-style-type: none"> <li>1. Air wedge</li> <li>2. Newton's rings</li> <li>3. Biprism</li> <li>4. Michelson's interferometer</li> <li>5. Refractive index of a liquid using a hollow prism</li> <li>6. Refractive indices of an anisotropic crystal</li> <li>7. Variation of refractive index with wavelength</li> <li>8. Diffraction grating – minimum deviation/normal incidence method</li> <li>9. Resolving power of a telescope</li> <li>10. Polarimeter</li> <li>11. Photo diode characteristics</li> <li>12. Ultrasonic interferometer</li> <li>13. Numerical aperture of optical fibres</li> <li>14. Wave length of a laser light using grating.</li> <li>15. Photoelectric effect.</li> <li>16. Planck's constant</li> </ol> | 35        |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>35</b> |

### RECOMMENDED BOOKS

1. Fundamentals of Optics – 4<sup>th</sup> edition – Francis.A.Jenkins and Harvey.E.White.
2. A textbook of Optics – N.Subrahmanyam and Brij Lal.
3. Introduction to optics – Frank.L.Pedrotti and Leno.S.Pedrotti.
4. Physics for scientists and Engineers with modern Physics, Vol 2, 6<sup>th</sup> Edition, Serway and Jewett



## GEOMETRICAL OPTICS – THEORY

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                     | HOURS |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | Properties of light: Classification of optics based on the nature and properties of light. The rectilinear propagation of light, Umbra and Penumbra, Speed of light in vacuum and in a stationary media, Beam, pencil and ray of light, Laws of reflection and refraction, Refractive index, Optical path, Graphical construction for refraction, Principle of reversibility, Fermat's principle (only qualitative discussion), Colordispersion. Numerical | 8     |
| 2     | Plane surfaces and Prisms: Parallel beam, the critical angle and total reflection, Plane parallel plate, Refraction by a prism, Minimum deviation, Thin prisms, Graphical method of ray tracing, Direct vision prisms, Reflection of divergent rays, Refraction of divergent rays, Images formed by paraxial rays. ophthalmic prisms. Numerical.                                                                                                           | 08    |
| 3     | Spherical surfaces: Introduction, Focal points and focal lengths, Image formation, Virtual images, conjugate points and planes, Convention of signs, Graphical constructions (parallel ray method only), Magnification, Vergence and reduced vergence, Gaussian formula. Numerical.                                                                                                                                                                        | 08    |
| 4     | Spherical mirrors – focal points, focal lengths, image formation, mirrors and vergence, reflection matrix, aspheric mirrors                                                                                                                                                                                                                                                                                                                                | 02    |
| 5     | Thin lenses: Lenses, Focal points and focal lengths, Imageformation: graphical method (parallel ray and oblique ray methods) and derivation of lens formula,conjugate points and planes. Lateral magnification,Virtual images, Lens makers' formula,Power of a thin lens, Thin lenses in contact, without contact. Numerical.                                                                                                                              | 06    |
| 6     | Thick lenses: Imageformation: graphical method (both parallel ray and oblique ray methods), Focal points, principal points, nodal points and optical center, thick lens formulas (no derivation). Numerical                                                                                                                                                                                                                                                | 08    |
| 7     | Matrix methods in paraxial optics: Introduction, Translation matrix, Refraction matrix, Reflection matrix and Thick lens and thin lens matrices. Numerical.                                                                                                                                                                                                                                                                                                | 08    |
| 8     | Aberration theory :Spherical (coma, astigmatism, curvature of field and distortion) and chromatic aberrations and their minimization including GRIN systems(qualitative description only).                                                                                                                                                                                                                                                                 | 08    |
| 9     | Optics of the Eye: Biological structure of the eye, Optical representation of the eye, Functions of the eye, Errors of refraction and their correction, Laser therapy for ocular defects. Depth of focus                                                                                                                                                                                                                                                   | 08    |
| 10    | Aperture and stops :Field stop and Aperture stop, Entrance and exit pupils, chief ray, Front stop, stop between two lenses, two lenses with no stop, field of view                                                                                                                                                                                                                                                                                         | 06    |
| 11    | Optical Instruments – The Camera, eye and its refractive anomalies, simple magnifier, compound microscope and telescopes. 4 Hours                                                                                                                                                                                                                                                                                                                          | 08    |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 78    |

## GEOMETRIC OPTICS – PRACTICALS

**Practical: 3 Hours/week**

Any 10 of the following experiments

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | HOURS        |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 1     | <ol style="list-style-type: none"><li>1. Law of reflection</li><li>2. Law of refraction</li><li>3. Critical angle of glass</li><li>4. Angle of minimum deviation using I-d curve</li><li>5. <math>f</math> &amp; <math>\mu</math> of convex lens</li><li>6. <math>f</math> &amp; <math>\mu</math> of concave lens</li><li>7. <math>f</math> of convex mirror</li><li>8. <math>f</math> of concave mirror</li><li>9. <math>\mu</math> of solid</li><li>10. <math>\mu</math> of liquid</li><li>11. Angle of the prism – using spectrometer</li><li>12. Determination of Cauchy's constant</li><li>13. <math>\mu</math> of the material of the crown and flint glasses for Na light</li><li>14. Dispersive power of a prism</li><li>15. Verification of inverse square law of radiation using a photometer</li><li>16. Photometer - determination of transmission coefficient</li></ol> | 45           |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>45Hrs</b> |

## PRINCIPLES OF LIGHTING:

| SL NO | TOPICS                                                                                                                            | HOURS |
|-------|-----------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | Visual tasks: factors affecting visual tasks                                                                                      | 2     |
| 2     | Modern theory on light & colour: synthesis of light                                                                               | 2     |
| 3     | Additive & subtractive synthesis of colour                                                                                        | 2     |
| 4     | Light sources: Modern light sources – spectral energy distribution – luminous efficiency – colour temperature – colour rendering] | 2     |
| 5     | Illumination: Luminous flux, candela, solid angle, illumination, utilization factor, depreciation factors, illumination laws      | 2     |
| 6     | Lighting installation: glare, luminaries, lighting fixtures, types of lighting                                                    | 2     |

|   |                                                                  |    |
|---|------------------------------------------------------------------|----|
|   |                                                                  |    |
| 7 | Photometry: measurement of illumination, photometers and filters | 2  |
| 8 | Eye care and lighting – special care with VDU.                   | 2  |
|   |                                                                  | 16 |

### RECOMMENDED BOOKS

1. Fundamentals of Optics – 4th edition – Francis.A.Jenkins and Harvey.E.White.
2. A textbook of Optics – N.Subrahmanyam and Brij Lal.
3. Introduction to optics – Frank.L.Pedrotti and Leno.S.Pedrotti.
4. Physics for scientists and Engineers with modern Physics, Vol 2, 6th Edition, Serway and Jewett
5. Introductory lighting (Illuminating engineering society of North America)
6. Environmental vision (Pitts)

### GENERAL ANATOMY

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                  | HOURS |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | Introduction- Anatomy and it's sub-division, planes of the body, terms in relation of structures, Regional Anatomy, organ system, osteology of orbital bones                                                                                                                                                                                                                                                                            | 45    |
| 2     | Tissues of the body [ Histology of the body tissues]<br>2.1 Epithelium<br>2.2 Connective tissue<br>2.3 Bone and cartilage<br>2.4 Muscles: Skeletal, smooth, cardiac<br>2.5 Blood vessels<br>2.6 Neuron, Neuroglia<br>2.7 Glands, exocrine and endocrine, lacrimal gland in detail<br>2.8 Skin and appendages<br>2.9 Lymphoid Tissues<br>2.10 Ganglia                                                                                    |       |
| 3     | Organ systems: [General plan]<br>3.1 Locomotor system: Bones, muscles, joints<br>3.2 Cardiovascular systems: Heart, Regional blood vessels- arteries, veins<br>3.3 Lymphatic system including immune system<br>3.4. Digestive system<br>3.5. Respiratory system<br>3.6. Reproductive system<br>3.7. Endocrine system<br>3.8. Central nervous system- spinal and brain stem, cerebellum, cerebrum, spinal, cranial nerves<br>3.9 ganglia |       |

## RECOMMENDED BOOKS

- |                                      |                           |
|--------------------------------------|---------------------------|
| 1. Human anatomy                     | B.D.Chourasia             |
| 2. Text book of human anatomy        | H.Gray                    |
| 3. Anatomy and Physiology of the eye | A.K.Khurana, Indu Khurana |
| 4. Clinical anatomy of the eye       | S.Snell, A.Lemp           |
| 5. Text book of Anatomy              | Vishram Singh             |

## GENERAL PHYSIOLOGY

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | HOURS |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | 1.1. Cell structure and organization<br>1.2 Gene action<br>1.3. Tissue organization – Epithelium<br>1.4. Connective tissue - Collagen fibers- elastic fibers- areolar fibers- cartilage- bone<br>1.5. Contractile tissue- striated – skeletal –cardiac- non striated –plain myoepithelial<br>1.6. General principles of cell physiology<br>1.7. Electrophysiology of cells<br>1.8. Physiology of skeletal muscles                                                                                                                                                                                                                                                                                                                                                                     | 45    |
| 2     | Blood<br>2.1 Composition<br>2.2 Volume measurement and variations<br>2.3 Plasma proteins- classification and functions<br>2.4 RBC's- development, morphology and measurement- functions and dysfunctions<br>2.5 WBC's- development – classifications - morphology–functions and dysfunctions<br>2.6. Platelets –morphology-development, functions and dysfunctions<br>2.7 Clotting- factors- mechanism- anticoagulants- dysfunctions<br>2.8. Blood grouping –classifications- importance in transfusion, Rh factor & incompatibility<br>2.9. Suspension stability<br>2.10. Osmotic fragility<br>2.11. Reticulo endothelial system<br>Spleen                      – lymphatic tissue<br>Thymus                   - Bone marrow<br>Immune system       - cellular - humoral- autoimmune |       |
| 3     | Digestion<br>3.1. General arrangement<br>3.2. Salivary digestion – functions and regulations<br>3.3. Gastric digestion –functions and regulations<br>3.4. Pancreatic digestion- functions and regulations<br>3.5. Intestinal digestion – functions and regulations<br>3.6. Liver and Bile<br>3.7. Absorption<br>3.8. Motility-Deglutition-Gastric-Intestinal-Vomiting-Defecation<br>3.9. Functions of large intestine<br>3.10. Neurohumoral regulations of alimentary functions, summary                                                                                                                                                                                                                                                                                              |       |
| 4     | Excretion<br>4.1. Body fluids – distribution, measurement and exchange<br>4.2. Kidney –structure of nephron – mechanism of urine formation-composition of urine and abnormal constituents- urinary bladder and micturition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |    |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 5  | <p>Endocrine system</p> <p>5.1. Hormone mechanism – negative feedbacks- tropic action – Permissive action – cellular actions</p> <p>5.2. Hypothalamic regulation</p> <p>5.3. Hormones, Actions &amp; Regulations of</p> <ul style="list-style-type: none"> <li>✓ Hypophysis</li> <li>✓ Thyroid</li> <li>✓ Adrenal Cortex &amp; medulla</li> <li>✓ Parathyroid</li> <li>✓ Islets of pancreas</li> <li>✓ Miscellaneous</li> </ul> <p>5.4. Common clinical disorders</p> |    |
| 6  | <p>Reproduction</p> <p>6.1. Male reproductive system- control and regulation-semen analysis</p> <p>6.2. Female Reproductive system- Uterus -ovaries- menstrual cycle- Regulation</p> <p>-Pregnancy and delivery-breast – family planning</p>                                                                                                                                                                                                                          |    |
| 7  | <p>Respiration</p> <p>7.1. Mechanics of respiration</p> <p>7.2. pulmonary function tests</p> <p>7.3. Transport of respiratory gases</p> <p>7.4. neural and chemical regulation of respiration</p> <p>7.5.hypoxia cyanosis- dyspnoea- asphyxia</p>                                                                                                                                                                                                                     |    |
| 8  | <p>Circulation</p> <p>8.1. Heart: myocardium- innervation- transmission of cardiac Impulse-Events during cardiac cycle-cardiac output</p> <p>8.2. Peripheral circulation: Peripheral resistance- Arterial blood pressure measurements- factors regulating variation – capillary circulation-venous circulation</p> <p>8.3. Special circulation: coronary – cerebral</p> <p>4.4.miscellaneous</p>                                                                      |    |
| 9  | <p>Nervous system</p> <p>9.1. Neuron – conduction of impulse – synapse – receptor</p> <p>9.2. Sensory organization- pathways and perception. Reflexes</p> <p>9.3. cerebral cortex – functions</p> <p>9.4. Thalamus- basal ganglia – Cerebellum – Hypothalamus</p> <p>9.5. Autonomic nervous system- motor control of movements, posture and equilibrium- conditioned reflex, Eye hand co-ordination. Sleep, consciousness, behavior , memory</p>                      |    |
| 10 | <p>Environmental Physiology</p> <p>10.1. Body temperature regulation [including skin physiology]</p> <p>10.2. Exposure to low and high atmospheric pressure</p>                                                                                                                                                                                                                                                                                                       |    |
| 11 | <p>Special senses [elementary]</p> <p>11.1. Olfaction- Taste- Hearing- vision</p>                                                                                                                                                                                                                                                                                                                                                                                     |    |
|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 45 |

## GENERAL PHYSIOLOGY - DEMONSTRATION

|   |                                                                                                                                                                                                                                          |    |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1 | Microscope & Haemocytometer                                                                                                                                                                                                              |    |
| 2 | Blood<br>2.1. RBC count<br>2.2. Hb<br>2.3. WBC count<br>2.4. Differential count<br>2.5. Hct Demonstration<br>2.6. ESR<br>2.7. Blood group and Rh type<br>2.8. Bleeding time and clotting time                                            | 20 |
| 3 | Digestion – Test salivary digestion                                                                                                                                                                                                      |    |
| 4 | Excretion<br>4.1. Examination of urine <ul style="list-style-type: none"> <li>✓ Specific Gravity</li> <li>✓ Albumin</li> <li>✓ Sugar</li> <li>✓ Microscopic examination for cells and cyst</li> </ul>                                    |    |
| 5 | Endocrinology & Reproduction<br>5.1. Dry experiments in the form of cases showing different endocrine Disorders                                                                                                                          |    |
| 6 | Respiratory system<br>6.1. Clinical examination of respiratory system<br>6.2. Spirometry<br>6.3. Breath holding test<br>6.4. Endurance test                                                                                              |    |
| 7 | Cardiovascular system<br>7.1. Clinical examination of circulatory system <ul style="list-style-type: none"> <li>✓ Measurement of blood pressure and pulse rate</li> <li>✓ Effect of exercise on blood pressure and pulse rate</li> </ul> |    |
| 8 | Central Nervous System<br>8.1. Sensory system<br>8.2. Motor system<br>8.3. Cranial system<br>8.4. Superficial and deep reflexes<br>8.5. Test for hearing                                                                                 |    |
|   |                                                                                                                                                                                                                                          | 20 |

### RECOMMENDED BOOKS

- |                                          |                                   |
|------------------------------------------|-----------------------------------|
| 1. Text book if medical physiology       | Guyton                            |
| 2. Human physiology                      | AK Jain, Indu Khurana             |
| 3. Human physiology                      | Chatterjee                        |
| 4. Adler's physiology of the eye         | Robert.A.Moses, William.M.Hart.Jr |
| 5. Text book ocular anatomy & physiology | AK Khurana                        |

### OCULAR PHYSIOLOGY

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | HOURS |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | <ol style="list-style-type: none"><li>Protective mechanisms in the eye.</li><li>Precorneal tear film and lacrimation</li><li>Extrinsic ocular muscles, their action and control of their movements.</li><li>Coats of the eyeball</li><li>Corneal physiology – Hydration, Metabolism, Corneal wound healing, Transparency, Permeability</li><li>Aqueous humour - Production, Circulation, Drainage and Intra ocular pressure</li><li>Vitreous Humour</li><li>Iris – pupil reaction</li><li>Crystalline lens and accommodation – Presbyopia</li><li>Retina – Physiology of RPE, Scotopic &amp; Photopic vision, neural signal, retinal synapses, Photo transduction, Information processing, Retinal metabolism</li><li>Vision- general aspects of sensation</li><li>Pigments of the eye and photo chemistry</li><li>The visual stimulus, refractive errors</li><li>Visual acuity and its principle of measurments</li><li>Visual perception- binocular vision, stereoscopic vision, optical illusion</li><li>Visual pathway, central &amp; cerebral connections, lesions of pathways &amp; effects</li><li>Colour vision, colour vision defects and diagnostic tests</li></ol> | 30    |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 30    |

### RECOMMENDED BOOKS

- |                                    |                                   |
|------------------------------------|-----------------------------------|
| 1. Text book if medical physiology | Guyton                            |
| 2. Human physiology                | Choudhary                         |
| 3. Human physiology                | Chatterjee                        |
| 4. Adler's physiology of the eye   | Robert.A.Moses, William.M.Hart.Jr |

## OCULAR ANATOMY

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1  | <b>1.1 Introduction to anatomical terminologies</b> – cross section of eyeball<br><b>1.2 Ocular Adnexa</b><br>a. Eye Brows<br>b. Eyelids – Structure, Facial spaces, Arterial supply, nerve supply, venous & lymphatic drainage<br>c. Conjunctiva – general arrangements, structure, glands, arteries, veins, caruncle, plica semilunaries<br><b>1.3 Lacrimal System</b> – Lacrimal Gland, Drainage, Tear film<br><b>1.4 Extraocular Muscles</b> - anatomy, innervations, actions | 30 |
| 2  | <b>Cornea:</b> layers, cellular structures, refractive properties                                                                                                                                                                                                                                                                                                                                                                                                                 |    |
| 3  | <b>Coats of eye ball</b><br>Sclera (Episclera & Sclera)<br>Choroid, Ciliary body, Iris<br>Retina<br>(Detailed anatomy, cellular structure, blood supply and nerve supply)                                                                                                                                                                                                                                                                                                         |    |
| 4  | <b>Aqueous, anterior chamber, Intraocular pressure, vitreous body</b>                                                                                                                                                                                                                                                                                                                                                                                                             |    |
| 5  | <b>Pupil &amp; Pupillary pathway and its lesions</b>                                                                                                                                                                                                                                                                                                                                                                                                                              |    |
| 6  | <b>Crystalline lens</b> – structure, suspension, accommodation                                                                                                                                                                                                                                                                                                                                                                                                                    |    |
| 7  | <b>Orbit</b><br>Orbital margin, Walls of orbital cavity<br>Orbital structure & Foramen<br>Surface anatomy, Relations of bony orbit, Orbital Muscles                                                                                                                                                                                                                                                                                                                               |    |
| 8  | <b>Cranial Nerves</b><br>1. Optic nerve<br>2. Oculomotor nerve<br>3. Trochlear Nerve<br>4. Abducent nerve<br>5. Facial Nerve<br>(Nuclei, course, relationship with brain, ocular contribution in detail)                                                                                                                                                                                                                                                                          |    |
| 9  | <b>Visual Pathway</b> – Definition, anatomy of visual pathway, visual reflexes, Lesions of visual pathway                                                                                                                                                                                                                                                                                                                                                                         |    |
| 10 | <b>Ocular Embryology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |
|    | Total                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |
| 3  | Demonstration<br>3.1. Practical dissection of Bull's eye<br>3.2. Practical demonstration of orbital structures                                                                                                                                                                                                                                                                                                                                                                    |    |



## OCULAR BIOCHEMISTRY

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                      | HOURS |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | Importance of ocular biochemistry in clinical optometric practice                                                                                                                                                                                                                                                                                                           | 30    |
| 2     | Tear film<br>✓ Composition - Lipid layer - Aqueous layer - Mucoïd layer - Tear Secretion Functions & dysfunction – Diagnostic tests – Tear substitutes – Recent development                                                                                                                                                                                                 |       |
| 3     | Cornea<br>✓ Biochemical composition of epithelium – bowman’s layer-stroma- Descemet’s layer- endothelium-functions- corneal metabolism –nutrient uptake- energy-transparency- barrier mechanism-pump action-irrigating solutions –aging and other anomalies-recent developments                                                                                             |       |
| 4     | Lens<br>✓ Composition-metabolism-glucose utilization- sorbitol pathways- Glutathione and ascorbic acid transport- transparency- cataract formation- aging photo oxidation- sugar cataract- cataract and ascorbic acid – medical therapy- recent developments                                                                                                                |       |
| 5     | Aqueous humour<br>✓ Composition- function-Ciliary body-aqueous humour production-IOP- Glaucoma                                                                                                                                                                                                                                                                              |       |
| 6     | Vitreous humour<br>✓ Structure-composition functions- vitreous biochemical pathology- Intraocular gels- recent developments                                                                                                                                                                                                                                                 |       |
| 7     | Retina<br>✓ Pigment epithelium-structure-composition-photoreceptor cells-rhodopsin – lipids renewal- inner segment – Pigment epithelium – choroid- metabolism and function- phagocytosis- vitamin A- retinal function and metabolism. Retinal neurochemistry Monoamines-acetyl choline- gaba-aminoacids- taurine- neuropeptides. Biochemical correlates of retinal diseases |       |
| 8     | Free Radicals and Antioxidants<br>Mechanism of Lipid Peroxidation- oxidative damage to the lens- vulnerability of the Retina to Free Radicals – Antioxidants in the Retina and RPE – Vitamin E – Ascorbate – Carotenoids                                                                                                                                                    |       |
|       |                                                                                                                                                                                                                                                                                                                                                                             | 30    |

## GENERAL BIOCHEMISTRY & NUTRITION

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | HOURS |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | Carbohydrate Chemistry; Definition, general classification with examples, composition, sources, properties and functions of Monosaccharides, Disaccharides, Oligosaccharides and Polysaccharides. Glycosaminoglycans (mucopolysaccharides-in detail)                                                                                                                                                                                                                                                                                                                                                                                  | 4     |
| 2     | Lipid Chemistry ; Definition, general classification Definition, classification, and functions of Fatty acids, Cholesterol, Essential fatty acids , Phospholipids and their importance                                                                                                                                                                                                                                                                                                                                                                                                                                                | 3     |
| 3     | Amino-acid Chemistry; Amino acid chemistry: Definition, Classification, Peptide bonds, Peptides: Definition, Biologically important peptides. Protein chemistry: Definition, Classification, Functions of proteins, Collagens, Plasma proteins, Muscle proteins                                                                                                                                                                                                                                                                                                                                                                       | 6     |
| 4     | Enzymes; Definition, Active site, Cofactor (Coenzyme, Activator), Proenzyme. Classification with examples, Factors effecting enzyme activity, Mechanism of enzyme action. Diagnostic enzymology (clinical significance of enzymes)                                                                                                                                                                                                                                                                                                                                                                                                    | 5     |
| 5     | Nucleotide and Nucleic Acid Chemistry; Nucleotide chemistry: Nucleotide composition, functions of free nucleotides in body. Nucleic acid (DNA and RNA) chemistry: Difference between DNA and RNA, Structure of DNA (Watson and Crick model), Functions of DNA. Structure and functions of tRNA, rRNA, mRNA.                                                                                                                                                                                                                                                                                                                           | 3     |
| 6     | Digestion and Absorption; General characteristics of digestion and absorption, Digestion and absorption of carbohydrates, proteins and lipids. Disorders of digestion and absorption – Lactose intolerance,                                                                                                                                                                                                                                                                                                                                                                                                                           | 3     |
| 7     | Fundamentals of Biological oxidative reactions-ATP formation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3     |
| 8     | Carbohydrate Metabolism; Introduction, Glycolysis – Aerobic, Anaerobic, Citric acid cycle, HMP Shunt pathway,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 4     |
| 9     | Lipid Metabolism; Introduction to lipid metabolism, Lipolysis, $\beta$ -oxidation of fatty acids, Ketone body metabolism: Ketone body formation (ketogenesis), utilization (ketolysis), ketosis, Rothera's test. Cholesterol metabolism: degradation, cholesterol transport Hypercholesterolemia and its effects (atherosclerosis and coronary heart diseases) Hypocholesterolemic agents,                                                                                                                                                                                                                                            | 5     |
| 10    | Amino acid and Protein Metabolism; Catabolism of amino acids - Introduction, transamination, deamination, Fate of ammonia, transport of ammonia, Urea cycle Specialized products formed from amino acids - from glycine, arginine, methionine, phenylalanine and tyrosine.                                                                                                                                                                                                                                                                                                                                                            | 3     |
| 11    | Vitamins ; Definition, classification according to solubility, Individual vitamins( Water soluble & fat soluble) - Sources, Coenzyme forms, functions, RDA, digestion, absorption and transport, deficiency and toxicity                                                                                                                                                                                                                                                                                                                                                                                                              | 8     |
| 12    | Mineral Metabolism;Definition, Sources, RDA, Digestion, absorption, transport, excretion, functions, disorder of Individual minerals - Calcium, phosphate, iron, Magnesium, fluoride, selenium, molybdenum, copper. Phosphate, calcium and iron in detail                                                                                                                                                                                                                                                                                                                                                                             | 5     |
| 13    | Cell Biology;Introduction, Cell structure, Cell membrane structure and function, various types of absorption. Intracellular organelles and their functions, briefly on cytoskeleton                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2     |
| 14    | Nutrition; Introduction, Importance of nutrition Calorific values, Respiratory quotient – Definition, and its significance Energy requirement of a person - Basal metabolic rate: Definition, Normal values, factor affecting BMR Special dynamic action of food Physical activities - Energy expenditure for various activities. Calculation of energy requirement of a person Balanced Diet Recommended dietary allowances Role of carbohydrates in diet: Digestible carbohydrates and dietary fibers Role of lipids in diet Role of proteins in diet: Quality of proteins - Biological value, net protein utilization, Nutritional | 8     |

|                                             |                                                                                                                                                                                                |    |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|                                             | aspects of proteins-essential and non-essential amino acids. Nitrogen balance Nutritional disorders                                                                                            |    |
| 15                                          | Acid-Base balance; Acids, bases and buffers, pH. Buffer systems of the body, blood buffers, mechanism of buffer action. H <sup>+</sup> and pH measurements.                                    | 3  |
| 16                                          | Measles and associated eye disorders, low birth weight                                                                                                                                         | 2  |
| 17                                          | Free radicals – Biological Reactions-Oxidants- antioxidants, -diseases –Therapeutic uses of antioxidants                                                                                       | 3  |
|                                             |                                                                                                                                                                                                | 70 |
| <b>GENERAL BIOCHEMISTRY – DEMONSTRATION</b> |                                                                                                                                                                                                |    |
| 1                                           | 1.Reaction of monosaccharides- disaccharides- qualitative<br>2.Estimation of Glucose<br>3.Estimation of proteins- ninhydrin reaction<br>4.Estimation of Vitamin C<br>5.Eatimation of Vitamin A |    |
|                                             |                                                                                                                                                                                                | 20 |

**GENERAL BIOCHEMISTRY DEMONSTATION; -20 hours**

1. Reactions of monosaccharide's-disaccharides- qualitative
2. Estimation of Glucose
3. Estimation of proteins- Ninhydrin
4. Estimation of Vitamin A
5. Estimation of Vitamin c

**Total theory hours; 70**

**Practical- 20**

Recommended Text books

1. Text book of Biochemistry Sathyanarayan
2. Text book of Biochemistry A.C Deb
3. Text book of Biochemistry S.K dasgupta
4. Biochemistry of the eye David. R. whilehart

## FUNCTIONAL ENGLISH AND COMMUNICATION

| SL NO | TOPICS                                                                                                                                                                                                                      | HOURS         |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1     | Functional English -Grammar<br>✓ Components of a sentence – Verb -Transformation of sentences – Voice - Reported speech - Positive/ negative -Statement/ Interrogative - Subject verb agreement - Common errors – Exercises | 30            |
| 2     | Vocabulary<br>✓ Synonyms and antonyms - Idioms and phrases – Similies -Words denoting assemblage                                                                                                                            |               |
| 3     | Writing skills<br>✓ Note making – Summarizing - Report writing - Letter writing -Expansion of an idea – Comprehension                                                                                                       |               |
|       | <b>COMMUNICATION</b>                                                                                                                                                                                                        |               |
| 1     | Introduction<br>✓ Communication process - Elements of communication - Barriers of communication and how to overcome them                                                                                                    |               |
| 2     | <i>Speaking</i><br>✓ Importance of speaking efficiently - Voice culture - Preparation of speech - secrets of good delivery - Audience psychology handling - Presentation skills - Conference/ Interview technique           |               |
| 3     | <i>Listening</i><br>✓ Importance of listening - Self-awareness about listening -Action plan execution - Barriers in listening - Good and persuasive listening                                                               |               |
| 4     | <i>Reading</i><br>✓ What is efficient and fast reading? - What is Awareness of existing reading habits - Tested techniques for improving speed - Improving concentration and comprehension through systematic study         |               |
| 5     | <i>Memory</i><br>✓ What is memory, Brain- mind potential? - Systems for memorizing - Summary page - Building positive mental habits                                                                                         |               |
| 6     | <i>Nonverbal Communication</i><br>✓ Basics of nonverbal communication                                                                                                                                                       |               |
| 7     | Self-awareness<br>✓ Self-image - Self talk – Relaxation - Personality development                                                                                                                                           |               |
|       |                                                                                                                                                                                                                             | <b>30 Hrs</b> |

## MATHEMATICS

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | HOURS         |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1     | Trigonometry<br>1.1. Measurements of angles- Definition of radian and its magnitude<br>1.2. Trigonometrical ratios- relations between them – simple problems - Signs of trigonometric ratios- ratios of well-known angles - Applications of trigonometrical ratios to solving simple problems on refraction and reflection<br>1.3.Idea of allied angles – Formulae only for Sin [A+ B], Cos [A+B],Tan [ A+B], Sin 2A, Cos 2A, Tan 2A in terms of products of trigonometrical ratios Sin A, Cos A, Tan A in terms of ratios of A/2- Problems | 30            |
| 2     | Differential Calculus<br>2.1. Functions and Limits- $\lim_{x \rightarrow 0} \frac{\sin x}{x}$<br>2.2. Differentiation – Algebraic and trigonometric functions –inverse trigonometric functions – successive differentiation- second order differentiation                                                                                                                                                                                                                                                                                   |               |
| 3     | Algebra<br>3.1 Revision of simple linear and quadratic equations<br>3.2 Theory of indices- Logarithms – common and Napierian<br>Permutations, Combinations and binomial theorem                                                                                                                                                                                                                                                                                                                                                             |               |
| 4     | Integral calculus<br>4.1 Integration of algebraic and trigonometric functions<br>4.2 Integration by substitution and by parts – Definite Integrals                                                                                                                                                                                                                                                                                                                                                                                          |               |
| 5     | Geometrical application of integration<br>5.1 Simple concepts of area , volume , length of arc and surface of revolution                                                                                                                                                                                                                                                                                                                                                                                                                    |               |
| 6     | Matrices<br>6.1.Determinants - matrix algebra                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |
| 7     | Vectors<br>7.1Simple concepts – scalars, vectors , dot and cross product                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>30 Hrs</b> |

## BASIC ACCOUNTANCY

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | HOURS     |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|       | 1. Introduction - Terms used in accounts - Principles of accountancy<br>2. Journal and journalizing<br>3. Ledger and ledger posting<br>4. Trial balance <ul style="list-style-type: none"> <li>✓ Subsidiary books</li> <li>✓ Cash book</li> <li>✓ Petty cash book</li> <li>✓ Sales register</li> <li>✓ Purchase register</li> </ul> 5. Bank reconciliation<br>6. Depreciation and other adjustments<br>7. Balance sheet and profit and loss account statements<br>Preparation of final accounts<br>8. Income tax and Sales tax [General ideas only] | 20        |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>20</b> |

## COMPUTER BASICS

| SL NO | TOPICS                                                                                                                                                                                                                                         | HOURS |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | Introduction to computers                                                                                                                                                                                                                      | 30    |
| 2     | Definition <ul style="list-style-type: none"> <li>✓ Input</li> <li>✓ Output</li> <li>✓ CPU</li> </ul>                                                                                                                                          |       |
| 3     | Input output devices (types)                                                                                                                                                                                                                   |       |
| 4     | Basis of computer system <ul style="list-style-type: none"> <li>✓ Switching computer on &amp; off</li> <li>✓ What is bias?</li> <li>✓ Computer generations</li> </ul>                                                                          |       |
| 5     | Keyboard practices                                                                                                                                                                                                                             |       |
| 6     | Definitions of terms <ul style="list-style-type: none"> <li>✓ Desktop</li> <li>✓ Software</li> </ul>                                                                                                                                           |       |
| 7     | Computer systems: Hardware & software definitions                                                                                                                                                                                              |       |
| 8     | Windows'98 <ul style="list-style-type: none"> <li>✓ Definition &amp; Why</li> <li>✓ Calculator - Word pad - Short cuts - Start menu - Media player - Note pad - Win amp – Paint - Control panel</li> </ul>                                     |       |
| 9     | Microsoft word <ul style="list-style-type: none"> <li>✓ Opening, saving, deleting, typing, print , Page border, spelling, table, grammar, margin, Clip art, BIU, word art, Colour text &amp; background, Picture drawing using word</li> </ul> |       |
| 10    | Excel <ul style="list-style-type: none"> <li>✓ Formulas - Design charts- Format tables</li> </ul>                                                                                                                                              |       |
| 11    | PowerPoint <ul style="list-style-type: none"> <li>✓ Designing a presentation - Inserting some animation with sound</li> </ul>                                                                                                                  |       |
| 12    | Internet & its applications <ul style="list-style-type: none"> <li>✓ Interconnection to HTML</li> <li>✓ E- mailing – Browsing - Chatting</li> </ul>                                                                                            |       |

## SECOND YEAR B.Sc. OPTOMETRY SYLLABUS

- Optometric Optics& Dispensing Optics
- Visual Optics
- Optometric Instruments & Clinical Examination of Visual System
- Pathology & Microbiology (Sec A) Pharmacology (Sec B)

### OPTOMETRIC OPTICS (THEORY)

| SL NO | TOPICS                                                                                                                                                                                                                    | HOURS |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | Introduction – Light, Mirror, Reflection, Refraction and Absorption                                                                                                                                                       | 1     |
| 2     | Prisms – Definition, properties, Refraction through prisms, Thickness difference, Base-apex notation, uses, nomenclature and units, Sign Conventions, Fresnel's prisms, rotary prism                                      | 5     |
| 3     | Lenses – Definition, units, terminology used to describe, form of lenses                                                                                                                                                  | 3     |
| 4     | Vertex distance and vertex power, Effectivity calculations                                                                                                                                                                | 3     |
| 5     | Lens shape, size and types i.e. spherical, cylindrical, Sphero-cylindrical& Toric lenses<br>Astigmatic lenses, Methods of writing prescriptions<br>Axis Direction of astigmatic lenses<br>Properties of crossed cylinders | 2     |
| 6     | Transpositions – Simple, Toric and Spherical equivalent                                                                                                                                                                   | 2     |
| 7     | Prismatic effect, centration, decentration and Prentice rule, Prismatic effect of Plano-cylinder and Sphero-cylinder lenses                                                                                               | 6     |
| 8     | Spherometer & Sag formula, Edge thickness calculations                                                                                                                                                                    | 4     |
| 9     | Magnification in high plus lenses, Minification in high minus lenses                                                                                                                                                      | 3     |
| 10    | Tilt induced power in spectacles                                                                                                                                                                                          | 2     |
| 11    | Aberration in Ophthalmic Lenses                                                                                                                                                                                           | 2     |
| 12    | Raw materials – History and General Outline, Manufacturing of Ophthalmic Blanks – Glass & Plastics, Terminology used in Lens Workshops, Surfacing process from Blanks to lenses                                           | 6     |
| 13    | Definition & Materials (Glass, Plastics, Polycarbonate, Triology) types and characteristics                                                                                                                               | 5     |
| 14    | Properties (Refractive index, specific gravity, UV cut off, impact resistance – include drop ball test, abbe value, Center thickness)                                                                                     | 5     |
| 15    | Best form of lenses & Safety standards for Ophthalmic lenses (FDA, ANSI, ISI, Others)                                                                                                                                     | 3     |

|    |                                                                                                                                                                                                                                                                  |        |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 16 | Design of High Powered Lenses<br>Hi-index lenses, Calculation of Refractive index                                                                                                                                                                                | 3      |
| 17 | Bifocal designs, their manufacturing & uses<br>(Kryptok, Univis D, Executive, Invisible, Occupational)                                                                                                                                                           | 7      |
| 18 | Progressive Addition Lenses, modified near vision lenses (designs, advantages, limitations)                                                                                                                                                                      | 4      |
| 19 | Lens enhancements (Scratch resistant coatings – spin/dip, Anti-reflection coating, UV coating, Hydrophobic coating, anti-static coating)                                                                                                                         | 5      |
| 20 | Lens defects – Description and Detection                                                                                                                                                                                                                         | 3      |
| 21 | Glazing & edging (manual & automatic)                                                                                                                                                                                                                            | 3      |
| 22 | Special lenses <ul style="list-style-type: none"> <li>➤ Lenticulars</li> <li>➤ Aspherics</li> <li>➤ Fresnel lenses &amp; Prisms</li> <li>➤ Aniseikonic lenses</li> <li>➤ Photochromics</li> <li>➤ Polaroids</li> <li>➤ Tinted lenses – Tints, filters</li> </ul> | 8      |
| 23 | Project to ensure awareness on lens availability in Indian market                                                                                                                                                                                                |        |
| 24 | History of Spectacles, manufacturing overview, Definition, parts & measurements<br>Classification of frames – Materials (cover in detail), Colours and Temple position (advantages & disadvantages, where to use)                                                | 3      |
|    |                                                                                                                                                                                                                                                                  | 5      |
| 25 | Special purpose frames (sports, kids, reading)                                                                                                                                                                                                                   | 2      |
|    |                                                                                                                                                                                                                                                                  | 95 Hrs |

### DISPENSING OPTICS

| SL NO | TOPICS                                                                                                                        | HOURS |
|-------|-------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | Components of spectacle prescription & interpretation, transposition, Add and near power relation                             | 2     |
| 2     | Frame selection – based on spectacle prescription, professional requirements, age group, face shape                           | 4     |
| 3     | Measuring Inter-pupillary distance (IPD) for distance & near, bifocal height                                                  | 2     |
| 4     | Lens & Frame markings, Pupillary centers, bifocal heights, Progressive markings & adjustments – facial wrap, pantoscopic tilt | 2     |



|    |                                                                                                                                                                                           |    |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 5  | Recording and ordering of lenses (power, add, diameter, base, material, type, lens enhancements)                                                                                          | 2  |
| 6  | Neutralization – Hand & lensometer, axis marking, prism marking                                                                                                                           | 4  |
| 7  | Faults in spectacles (lens fitting, frame fitting, patient's complaints, description, detection and correction)                                                                           | 3  |
| 8  | Final checking & dispensing of spectacles to customers, counseling on wearing & maintaining of spectacles, Accessories – Bands, chains, boxes, sleeves, cleaners, screwdriver kit         | 2  |
| 9  | Spectacle repairs – tools, methods, soldering, riveting, frame adjustments                                                                                                                | 2  |
| 10 | Special types of spectacle frames <ul style="list-style-type: none"> <li>➤ Monocles</li> <li>➤ Ptosis crutches</li> <li>➤ Industrial safety glasses</li> <li>➤ Welding glasses</li> </ul> | 2  |
| 11 | Frame availability in Indian market                                                                                                                                                       |    |
|    |                                                                                                                                                                                           | 25 |

#### RECOMMENDED BOOKS

- |                                           |                                                           |
|-------------------------------------------|-----------------------------------------------------------|
| 1. Principles of Ophthalmic lenses        | M.O.Jalie – 2 <sup>nd</sup> edition                       |
| 2. System for ophthalmic dispensing       | Clifford.W.Brooks, Irwin.M.Borish                         |
| 3. Clinical Optics                        | Troy Fannin, Theodore Grosvenor – 2 <sup>nd</sup> edition |
| 4. Ophthalmic lenses & Dispensing         | M.O.Jalie – 2 <sup>nd</sup> edition                       |
| 5. Practical aspects of ophthalmic optics | Margaret Dowaliby – 4 <sup>th</sup> edition               |

#### VISUAL OPTICS (THEORY)

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                        | HOURS |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | 1.REVIEW OF GEOMETRIC OPTICS<br>1.1 Vergence and power<br>1.2 Conjugacy, Object space and image space<br>1.3 Sign convention<br>1.4 Spherical refracting surface<br>1.5 Spherical Mirror, catoptric power<br>1.6 Cardinal points<br>1.7 Magnification<br>1.8 Light and visual function , Clinical Relevance of: Fluorescence, Interference, Diffraction, Polarization, Bi-refringence, Dichroism<br>1.9 Aberration and application<br>Spherical and Chromatin | 5     |
| 2     | OPTICS OF OCULAR STRUCTURES<br>2.1 Cornea and aqueous                                                                                                                                                                                                                                                                                                                                                                                                         |       |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                |       |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|    | 2.2 Crystalline lens<br>2.3 Vitreous<br>2.4 Schematic and reduced eye                                                                                                                                                                                                                                                                                                                                          | 3     |
| 3  | Basic Aspects of Vision. <ul style="list-style-type: none"> <li>• Visual Acuity</li> <li>• Light and Dark Adaptation</li> <li>• Color Vision</li> <li>• Spatial and Temporal Resolution</li> <li>• Science of Measuring visual performance and Application to Clinical Optometry</li> </ul>                                                                                                                    | 5     |
| 4. | REFRACTIVE ANOMALIES AND THEIR CAUSES<br>4.1 Etiology of refractive anomalies<br>4.2 Contributing variabilities and their ranges<br>4.3 Populating distributions of anomalies<br>4.4 Optical component measurement<br>4.5 Growth of eye in relation to refractive errors                                                                                                                                       | 05    |
| 5  | VISUAL ACUITY<br>5.1 Definition, specification, Conversion, measurement & Recording (Distance&Near)<br>5.2 Test types (Distance & Near) – standard, choice, types, construction<br>5.3 Illumination of consultation room<br>5.4 Contrast sensitivity– Definition, charts available, measurements and recordings<br>5.5 Trial set & Trial frame& Phoropter – advantages and disadvantages                       | 5     |
| 6  | REFRACTIVECONDITIONS<br>Aetiology, optical condition, types, clinical features and management<br>1.1 Emmetropia/Ametropia<br>1.2 Myopia<br>1.3 Hyperopia<br>1.4 Astigmatism<br>1.5 Anisometropia And Aniseikonia<br>1.6 Presbyopia<br>1.7 Aphakia and pseudophakia, Biometry<br>1.8 Axial Vs Refractive Ametropia                                                                                              | 18    |
| 7  | ACCOMMODATION<br>7.1. Mechanism<br>7.2. Range & Amplitudes of accommodation<br>7.3. Anomalies of accommodation                                                                                                                                                                                                                                                                                                 | 03    |
| 8  | CONVERGENCE<br>8.1. Types, measurement & Anomalies<br>8.2. Relation between accommodation & convergence                                                                                                                                                                                                                                                                                                        | 02    |
| 9  | Retinoscopy (Static & Dynamic)<br>9.1. Principle, instrumentation & Types<br>9.2. Procedure & Interpretation of findings – Transposition & Spherical equivalent<br>9.3. Dynamic retinoscopy – various methods<br>9.4. Radical retinoscopy & Mohindra's near retinoscopy<br>9.5. Subjective refraction – Principle, astigmatic chart, binocular balancing & binocular refraction<br>9.6. Cycloplegic refraction | 12    |
| 10 | EFFECTIVE POWER & MAGNIFICATION<br>10.1. Ocular refraction Vs Spectacle refraction<br>10.2. Ocular accommodation Vs Spectacle accommodation<br>10.3. Spectacle magnification & Relative spectacle magnification<br>10.4. Retinal image blur – Depth of focus & Depth of field                                                                                                                                  | 02    |
|    |                                                                                                                                                                                                                                                                                                                                                                                                                | 60Hrs |

## VISUAL OPTICS - PRACTICAL

| SL NO   | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | HOURS     |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Part I  | 1. Study of purkinje images I & II, III & IV<br>2. Mathematical models of the eye- Emmetropia, Hyperopia, & Myopia<br>3. Effect of trial lenses & accessories in front of the eye                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>60</b> |
| Part II | 1. Visual acuity <ul style="list-style-type: none"> <li>✓ Measurement &amp; recording (Distance &amp; Near)</li> </ul> 2. Retinoscopy – Practice of retinoscopy (Dry & wet) in <ul style="list-style-type: none"> <li>✓ Emmetropia, Myopia, Hypermetropia, Astigmatism, Anisometropia, Presbyopia, Aphakia, Pseudophakia, media opacities, strabismus &amp; Eccentric fixation</li> <li>✓ Interpretation of retinoscopic findings</li> <li>✓ Subjective verification</li> <li>✓ Prescription writing</li> <li>✓ Methods of differentiating axial Vs Refractive ametropia</li> <li>✓ Dynamic retinoscopy – Methods</li> </ul> 3. Accommodation & Convergence <ul style="list-style-type: none"> <li>✓ Measurement of range &amp; Amplitude of accommodation</li> <li>✓ Measurement of Near point of Convergence</li> </ul> |           |
|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>60</b> |

### RECOMMENDED BOOKS

1. Duke Elder's practice of refraction
2. Clinical refraction
3. Primary care Optometry
4. Clinical pearls in refractive care

David Abrams – 10<sup>th</sup> edition  
 Irwin.M.Borish  
 Theodore Grosvenor – 4<sup>th</sup> edition  
 D.Leonard Werner, Leonard.J.Press

## OPTOMETRIC INSTRUMENTS

| <b>SL NO</b> | <b>TOPICS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>HOURS</b>                             |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| 1            | Pre examination history                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 02                                       |
| 2            | Refractive Instruments<br>1.1 Visual acuity charts, Features, Advantages & disadvantages, newer developments<br>1.2 . Trial case lenses – best form lenses<br>1.3 . Trial frame design – Phoropter – Advantages & Difficulties<br>1.4 . Retinoscope – Optics, types, adjustments & special features<br>1.5 . Autorefractometer – Schenier's and other optical principles, Features, Advantages & disadvantages, newer developments<br>1.6 Vision analyzer<br>1.7 Potential Acuity Meter,<br>1.8 Pupilometer ,                                                                                          | 10                                       |
| 3            | Corneal Diagnostics<br>Keratometer<br>1.1. Keratometric principle<br>1.2. Types – Bausch & Lomb, Javal-Schiottz models<br>1.3. Measurement, Documentation & Interpretation of data<br>Corneal topography<br>2.1. Placido's disc<br>2.2. Photokeratoscope<br>2.3. Topography Modelling System<br>2.4. ORBSCAN & PENTACAM<br>Aberrometer<br>3.1 Principle<br>3.2 Instrumentation, clinical procedure & Interpretation<br>Pachymeter<br>4.1 Principle, Types<br>4.2 Instrumentation & Clinical procedure, Indications                                                                                     | 18                                       |
| 4            | Lens checking instruments<br>3.1. Optometer principle<br>3.2. Badal & non-badal principle – advantages & disadvantages<br>3.3. Lens gauge or clock<br>3.4. Hand neutralization                                                                                                                                                                                                                                                                                                                                                                                                                         | 06                                       |
| 5            | Slit Lamp<br>4.1. Slit-lamp systems<br>4.2. Mechanical design<br>4.3. Illumination techniques<br>4.4. Accessories<br>4.5. Scanning laser devices                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 09                                       |
| 6            | Glaucoma Diagnostics<br>Tonometer<br>1.1. Types, principle & standardization (Schiottz, Applanation & NCT)<br>1.2. Measurement, documentation & interpretation of results<br>Field of Vision and Screening Devices<br>2.1. Introduction – Visual fields & boundaries of visual fields<br>2.2. Visual field screening devices – Central & Peripheral<br>2.3. Quantitative perimetry – Manual & Automated<br>2.4. Results & Analysis of visual field examination<br>Gonioscope<br>3.1. Principle & Instrumentation<br>3.2. Direct Gonioscope<br>3.3. Indirect Gonioscope<br>Optical Coherence Tomography | 07<br><br><br>15<br><br><br>04<br><br>05 |

|    |                                                                                                                                                                                                                                                                                                                                                                                                             |    |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|    | 4.1 Anterior and Posterior OCT<br>4.2 Principle & Instrumentation<br>4.3 Clinical Procedure & Interpretation<br>Glaucoma imaging& newer developments                                                                                                                                                                                                                                                        |    |
| 7  | Color vision testing devices<br>8.1. Color vision theories<br>8.2. Common color vision defects<br>8.3. Pseudoisochromatic test plates<br>8.4. Color arrangement tests<br>8.5. Interpretation & clinical significance of findings                                                                                                                                                                            | 09 |
| 8  | Ophthalmoscopes<br>10.1. Optical principle & Types<br>10.2. Direct ophthalmoscope – Instrumentation, Characteristics clinical procedure& Uses<br>10.3. Indirect ophthalmoscope – Instrumentation, Characteristics, clinical procedure & Uses<br>10.4. Direct ophthalmoscope Vs Indirect ophthalmoscope\<br>10.5 Fundus biomicroscope- Principle & Instrumentation, Characteristics clinical procedure& Uses | 08 |
| 9  | Ophthalmic Ultrasonography<br>14.1. Physics of Ultrasonography<br>14.2. A-scan – Procedure & clinical uses<br>14.3. B-Scan – Procedure & Clinical uses                                                                                                                                                                                                                                                      |    |
| 10 | Electrophysiology – ERG, VEP & EOG<br>Principle & Instrumentation, Characteristics clinical procedure&Uses,interpretation of report                                                                                                                                                                                                                                                                         | 06 |
| 11 | Fundus camera &Flourescine angiography                                                                                                                                                                                                                                                                                                                                                                      | 03 |

### CLINICAL EXAMINATION OF VISUAL SYSTEM

| SL NO | TOPICS                                                                                                                                                             | HOURS |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | History of the ophthalmic subject<br>1.1. Ocular history<br>1.2. Medical history<br>1.3. Family history<br>1.4. Systemic history                                   | 100   |
| 2     | Assessment of visual acuity<br>2.1. Distance & Near visual acuity<br>2.2. Color vision & Contrast sensitivity                                                      |       |
| 3     | Examination of Extra Ocular Muscle balance                                                                                                                         |       |
| 4     | Assessment of accommodation & Convergence                                                                                                                          |       |
| 5     | Pupil evaluation & Measurement of Inter pupillary distance (IPD)                                                                                                   |       |
| 6     | Slit Lamp examination<br>6.1. Examination of eye lids, conjunctiva & sclera<br>6.2. Examination of cornea & lens<br>6.3. Examination of iris, Ciliary body & pupil |       |
| 7     | Examination of Intra ocular pressure – Schiotz& Applanation                                                                                                        |       |
| 8     | Assessment of angle of anterior chamber                                                                                                                            |       |
| 9     | Ophthalmoscopy – Direct & Indirect                                                                                                                                 |       |
| 10    | Optic disc evaluation                                                                                                                                              |       |
| 11    | Examination of Lacrimal system                                                                                                                                     |       |
| 12    | Examination of orbit                                                                                                                                               |       |
| 13    | Macular function tests                                                                                                                                             |       |
| 14    | Visual field charting – Central & Peripheral                                                                                                                       |       |

## RECOMMENDED BOOKS

- |                                                  |                                                                       |
|--------------------------------------------------|-----------------------------------------------------------------------|
| 1. Optometric instrumentation                    | David.B.Henson                                                        |
| 2. Clinical ophthalmology (VOL-I)                | Thomas.D.Duane                                                        |
| 3. Primary care Optometry                        | Theodore Grosvenor – 4 <sup>th</sup> edition                          |
| 4. Clinical Procedures in Optometry              | J.BoydEskside, John.F.Amos, Jimmy.D.Bartlet – 1 <sup>st</sup> edition |
| 5. Automated static perimetry                    | Anderson & Patella – 2 <sup>ns</sup> edition                          |
| 6. Investigative techniques & Ocular examination | Sandip Doshi, William Harvey                                          |
| 7. Diagnosis of defective color vision           | Jennifer birch – 2 <sup>nd</sup> edition                              |

## Pharmacology

| SL No. |                  | TOPICS                                                                                                                                                                                                                                                                  | HOURS |
|--------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1      |                  | GENERAL PHARMACOLOGY                                                                                                                                                                                                                                                    | 5     |
|        |                  | 1.1 Introduction and sources of drugs<br>Routes of drug administration                                                                                                                                                                                                  | 1     |
|        |                  | 1.2 PHARMACOKINETICS –<br>Absorption and bioavailability<br>Distribution<br>Biotransformation<br>Excretion                                                                                                                                                              | 2     |
|        |                  | 1.3 PHARMACODYNAMICS-<br>Types and Mechanism of action<br>Factors affecting<br>Adverse drug reactions                                                                                                                                                                   | 2     |
| 2.     |                  | SYSTEMIC PHARMACOLOGY                                                                                                                                                                                                                                                   | 24    |
|        | 2.1 ANS          | Introduction, neurotransmitters and mechanism of action                                                                                                                                                                                                                 | 1     |
|        |                  | Ophthalmic Uses and adverse effects of drugs affecting autonomic nervous system.                                                                                                                                                                                        | 4     |
|        |                  | Skeletal muscle relaxants                                                                                                                                                                                                                                               | 1     |
|        | 2.2 CVS          | ANTI HYPERTENSIVES                                                                                                                                                                                                                                                      | 1     |
|        |                  | ANTIANGINAL DRUGS                                                                                                                                                                                                                                                       | 1     |
|        | 2.3 RENAL        | DIURETICS –EMPHASIS ON DRUGS USED IN OCCULAR DISORDER                                                                                                                                                                                                                   | 1     |
|        | 2.4 CNS          | SEDATIVE HYPNOTICS<br>ALCOHOL                                                                                                                                                                                                                                           | 1     |
|        |                  | GENERAL AND LOCAL ANESTHETICS                                                                                                                                                                                                                                           | 1     |
|        |                  | OPIOIDS                                                                                                                                                                                                                                                                 | 1     |
|        |                  | NON STEROIDAL ANTI INFLAMMATORY AGENTS                                                                                                                                                                                                                                  | 1     |
|        |                  | Antihistaminics mast cell stabilizers                                                                                                                                                                                                                                   |       |
|        | 2.5 CHEMOTHERAPY | General Chemotherapy<br>Examples/classification, antibacterial activity uses and adverse effects of Sulphonamides and fluoroquinolones<br>Beta lactam antibiotics<br>Tetracyclines and chloramphenicol<br>Macrolides<br>Aminoglycosides<br>Others: Polymyxin Bacitracin | 5     |
|        |                  | Specific chemotherapy- in brief                                                                                                                                                                                                                                         | 3     |

|   |                 |                                                                                                                                                                                                                                                                               |    |
|---|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|   |                 | Antifungal<br>Antiviral<br>Antitubercular<br>Antileprotics                                                                                                                                                                                                                    |    |
|   | 2.6<br>HORMONES | Corticosteroids<br>Antidiabetics                                                                                                                                                                                                                                              | 2  |
|   | 2.7 BLOOD       | Coagulants                                                                                                                                                                                                                                                                    | 1  |
| 3 |                 | OCCULAR PHARMACOLOGY                                                                                                                                                                                                                                                          | 4  |
|   |                 | 3.1 Ocular formulations and<br>Ocular routes of administration drug delivery system and special ocular drug<br>delivery system                                                                                                                                                | 2  |
|   |                 | 3.2 Ocular pharmacokinetics<br>Delivery methods of Ocular Medication: Residence in the conjunctival sac, drug<br>vehicles affect<br>drug delivery, advanced ocular delivery systems,                                                                                          | 1  |
|   |                 | 3.3 drugs induced Ocular toxicity                                                                                                                                                                                                                                             | 1  |
| 4 |                 | DIAGNOSTIC AND THERAPEUTIC APPLICATIONS OF DRUGS IN<br>OPHTHALMOLOGY                                                                                                                                                                                                          | 11 |
|   |                 | 4.1 DRUGS USED TO ASSIST IN OCULAR DIAGNOSIS<br>Anterior Segment and External Diagnostic Uses<br>Posterior Segment Diagnostic Uses                                                                                                                                            | 1  |
|   |                 | 4.2 Drugs and biological agents used in ocular surgery<br>Anesthetics used in ophthalmic procedures<br>Presurgical Antiseptics<br>Viscoelastic Substances<br>Ophthalmic Glue<br>Anterior Segment Gases<br>Vitreous Substitutes<br>Surgical Hemostasis and Thrombolytic Agents | 2  |
|   |                 | 4.3 Drug s used in treatment of<br>Glaucoma,<br>Esotropia<br>Ocular myasthenia                                                                                                                                                                                                | 1  |
|   |                 | 4.3 Pharmacotherapy of ocular infections-<br>Bacterial<br>Viral<br>Fungal and<br>Chlamydial<br>Protozoal                                                                                                                                                                      | 1  |
|   |                 | 4.4 Drugs used in allergic conditions, inflammatory<br>disorders and degenerative disorders of the eye                                                                                                                                                                        | 1  |
|   |                 | 4.5 Immune modulators in ophthalmic practice                                                                                                                                                                                                                                  | 1  |
|   |                 | 4.6 Other agents used in ophthalmic practice<br>Mydriatics and Miotics<br>Enzymes<br>Trace elements<br>Antioxidants<br>Wetting Agents,<br>Tear Substitutes,<br>Osmotic Agents                                                                                                 | 2  |
|   |                 | 4.7 Miscellaneous<br>Botulinum Toxin Type A in the Treatment of Strabismus,<br>Blepharospasm, and Related Disorders<br>Agents Used to Treat Blind and Painful Eye<br>VITAMIN A                                                                                                | 2  |

1. The pharmacological basis of therapeutics goodmanGilman 13th edition
2. Essentials of Medical Pharmacology KD tripathi
3. Bartlett and Jaanus: Clinical Ocular Pharmacology
4. T S MAUGER & E L CRAIG - MOSBY'S - OCULAR DRUG HANDBOOK

## MICROBIOLOGY

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | HOURS |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| I     | <ol style="list-style-type: none"> <li>1. Sterilization and Disinfection generally used in laboratory and hospital practice</li> <li>2. Details of common bacteria, viruses and other organisms</li> <li>3. Morphology and principles of cultivation of bacteria</li> <li>4. Common bacterial infections of the eye</li> <li>5. Common fungal infections of the eye</li> <li>6. Common viral infections of the eye</li> <li>7. Common parasitic infections of the eye</li> </ol> | 15    |

### RECOMMENDED BOOKS

1. Text book of microbiology- Ananth Narayan
2. Text book of microbiology- C.P haveja
3. Ocular Microbiology- pk Mukherjee, preetibandyopadya

## PATHOLOGY

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | HOURS |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|       | <ol style="list-style-type: none"> <li>1. General introduction</li> <li>2. Inflammation and repair</li> <li>3. Infections [Tuberculosis, Leprosy, Syphilis, Fungus, Virus, Chlamydiae]</li> <li>4. Genetic abnormality</li> <li>5. Hematology [Anemia, Leukemia, Bleeding disorders]</li> <li>6. Circulatory disturbances [Shock, edema, Thrombosis, Infarction, Embolism]</li> <li>7. Clinical pathology<br/>[Examination of urine and blood smears]</li> <li>8. Ophthalmic wound healing</li> <li>9. Eyelid [normal and pathology including inflammations and tumours]</li> <li>10. Cornea [Normal and pathology in degeneration and dystrophies]</li> <li>11. Lens [normal and pathology of cataract]</li> <li>12. Retina [normal and pathology in inflammatory diseases, infections]</li> <li>13. Intraocular tumours [Retinoblastoma and choroidal melanoma]</li> <li>14. Orbit [inflammation and neoplasia]</li> <li>15. Optic nerve [normal and tumours]</li> </ol> | 15    |



### RECOMMENDED BOOKS

1. General pathology- Harsh Mohan
2. Text book of Pathology - N.C.Dey
3. Basic Pathology- Robbins

### CLINICAL PSYCHOLOGY

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | HOURS |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|       | <ol style="list-style-type: none"><li>1. Introduction to psychology</li><li>2. Intelligence, Learning, Memory, Personality, Motivation</li><li>3. Body integrity- one's body image</li><li>4. Patient in his Milan</li><li>5. Self-concept of the therapist, Therapist patient relationship-some guidelines</li><li>6. Illness and its impact on the patients</li><li>7. Maladies of the age and their impact on the patient's own and others concept of his body image</li><li>8. Adapting changes in vision</li><li>9. Why Medical Psychology needs / demands commitment?</li></ol> | 20    |

### PUBLIC RELATIONS

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | HOURS  |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
|       | <ol style="list-style-type: none"><li>1. Media and public relations</li><li>2. Communication sensitivity - Oneway- twoway communication - Listening evaluation- Active listening</li><li>3. Persuasive communication - Barriers to communication</li><li>4. Interpersonal Relationship – conflict management</li><li>5. Group process - Case discussion</li><li>6. Creative problem solving</li><li>7. Public relation and education</li><li>8. PR relevance in Indian context- Discussions</li><li>9. Behaviour modification</li><li>10. Perception and personality</li><li>11. PR and hospitals</li><li>12. Leadership process</li><li>13. Conclusion- Relationship of these input to PR</li></ol> | 15     |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 15 Hrs |

## HOSPITAL PROCEDURE

| SL NO | TOPICS                                                                                                                                                                                                                                                                                  | HOURS         |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
|       | <ol style="list-style-type: none"><li>1. General idea about the role, importance and procedures of the following within the hospital set up]</li><li>2. Medical records</li><li>3. Medical photography</li><li>4. Computer networking system</li><li>5. Laboratory technology</li></ol> | 10            |
|       |                                                                                                                                                                                                                                                                                         | <b>10 Hrs</b> |

# THIRD YEAR B.Sc. OPTOMETRY SYLLABUS

- Contact Lens
- Systemic Diseases (SecA) and Ocular Diseases (Sec B)
- Low vision aids & Geriatric Optometry
- Research Methodology & Statistics
- Pediatric Optometry, Squint and Binocular Vision and advance in optometry
- Practice management, law in optometry (Sec A) & occupational optometry (Sec B)

## CONTACT LENS (THEORY)

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                | HOURS |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | 1.1. Introduction to CL (Definition /Types)<br>1.2 History of Contact Lens<br>1.3 Review of Ocular Anatomy & Physiology<br>A. Lids<br>B. Tearfilm<br>C. Lacrimal Apparatus<br>D. Cornea<br>E. Conjunctiva                                                                                                                                                                                                                                             | 6     |
| 2     | 2.1. Glossary of terms – Contact lenses<br>2.2. Optics of Contact Lens<br>A. Magnification & Visual Field<br>B. Accommodation & Convergence<br>C. Back/Front Vertex Power (Vertex Distance Calculation)<br>D. Axial & Refractive Ammetropia<br>2.3 Contact Lens materials<br>A. Monomer/Polymer<br>B. Properties of CL Material (RGP& SCL)<br>2.4 Manufacturing of CL (RGP, SCL& SOFT TORIC)<br>2.5. Indications & Contraindications                  | 12    |
|       | 3.1. Contact Lens Design & Parameters<br>A. RGP contact lens design<br>B. Soft Contact lens design<br>3.2 Preliminary Examination<br>A. Instruments & Its use in Contact Lens Practice (Pachymeter/Specular Microscopy/ Keratometer/Placido Disc /Corneal Topography, Slit Lamp Biomicroscope)<br>B. Steps of Preliminary Examination<br>C. Significance of each steps<br>3.3 Parameter Selection (Base Curve/ Diameter)<br>3.4. Fitting philosophies | 8     |

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|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|  | 4.1 Types of CL<br>A. Soft Contact Lens(SCL)<br>B. Soft toric Contact Lens (SOFT TORIC)<br>C. Rigid gas Permeable Contact Lens(RGP)<br>Indication, Parameter selection, Modification, Fitting assessment & Recording, Final Prescription, Dispensing & Follow up Visit with Examination for each type of CL<br>4.2 Fitting in astigmatism – Toric CL<br>A. Stabilization Technique<br>4.3 Handling of Contact Lens (RGP/SCL/SOFT TORIC)<br>A. Insertion& Removal (RGP/SCL/SOFT Toric)<br>B..Do's& Don'ts | 10        |
|  | 5.1. Wearing Modalities/Replacement Schedule<br>5.2 Care & Maintenance (RGP/SCL)<br>A. Cleaning Agent & Importance<br>B. Rinsing agent & Importance<br>C. Disinfecting Agent & Importance<br>D. Lubricating & Enzymatic Action<br>5.2 Lens care and hygiene, instructions, compliance<br>5.3. Contact Lens solutions<br>5.4 Care of contact lenses                                                                                                                                                       | 7         |
|  | 6.1 Contact Lens Deposits (RGP/SCL)<br>6.2 Complication of contact lens ( RGP /SCL)                                                                                                                                                                                                                                                                                                                                                                                                                      | 6         |
|  | 7.1 Speciality Contact Lens<br><br>A. Therapeutic Contact Lens (Indication / Fitting Assessment)<br>B. Pediatric Contact Lens Fitting (Aphakia& Pseudophakia)<br>C. Post Refractive Surgery<br>D. Fitting in irregular astigmatism – Keratoconus/PMD etc<br>E. Contact lenses for special purposes – Swimming, sports, occupational etc<br>F. Orthokeratology<br>7.2 Bifocal Contact Lens (Types/Indication/Fitting assessment)                                                                          | 7         |
|  | 8.1. Modifications of finished CL<br>8.2. Inspection& Verification of finished contact lenses                                                                                                                                                                                                                                                                                                                                                                                                            | 2         |
|  | Review of Contact lenses & Solutions available in India                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 01        |
|  | 10.1. Recent developments in contact lenses<br>10.2. Current contact lens research.                                                                                                                                                                                                                                                                                                                                                                                                                      | 1         |
|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>60</b> |

## CONTACT LENS PRACTICALS

| SL NO | TOPICS                                                                                                                                                                                                                                                                                            | HOURS |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | 1.1. Fitting& Dispensing of contact lenses in Myopia, Hyperopia, Astigmatism, Presbyopia, Anisometropia, Aphakia, Pseudophakia, Keratoconus, PMD etc<br>1.2. Paediatric contact lens fitting<br>1.3.CL fitting following ocular surgeries<br>1.4. Visit to factories manufacturing contact lenses | 20    |

### RECOMMENDED BOOKS

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Contact Lenses<br>2. Textbook of Contact Lenses<br>3. Contact Lens Practice<br>4. Color Atlas of Contact Lens<br>5. Contact Lens – The CLAO guide<br>6. IACLE – Contact Lens modules<br><br>7. Manual of Contact Lens prescribing & Fitting<br>8. Manual of Gas Permeable contact Lens<br>9. Clinical manual of specialized CL prescribing<br>10. Clinical Contact Lens Practice<br>11. Cosmetic Contact Lens & Artificial eyes<br>12. Common Contact Lens Complications<br>13. Anterior segment Complication of CL wear<br>14. Contact lens practice | Antony.J.Philips, Janet Stone<br>V.K.Dada – 4 <sup>th</sup> Edition<br>Ruben &Guillon<br>Montague Rubem<br>Peter.R.Castle<br>International Association of Contact Lens Educators,<br>Sydney, Australia<br>Milton.M.Hom – 3 <sup>rd</sup> edition<br>Edward.S.Bennet, Milton.M.Hom – 2 <sup>nd</sup> edition<br>Terry.R.Scheid<br>Edward.s.Bennet, Barry.A.weissman<br>Devendra Kumar & Gopal Krishnan<br>lyndon.W.Jones, Deborah.A.Jones<br>Joel Silbert – 2 <sup>nd</sup> edition<br>NatrhanEffron |
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## OCULAR DISEASES

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | HOURS |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | <b>EYELIDS</b><br>1.1 Eye lid anatomy review<br>1.2 Congenital anomalies<br>Blepharophimosis, Epicanthus, Cryptophthalmos, Coloboma, Hemangioma<br>1.3 Acquired disorders<br>External and Internal hordeolum, Chalazion, Lidoedema, Blepharitis,<br>Blepharospasm<br>1.4 Eyelid tumours<br>Evaluation, Benign lesions, Malignant tumours<br>1.5 Malpositioning disorders<br>Ectropion, Entropion, Trichiasis, Distichiasis, Symblepharon, Ankyloblepharon,<br>Eyelid retraction, Lagophthalmos, Poliosis, Madarosis<br>1.6 Ptosis<br>Classification, Clinical evaluation and Management<br>1.7 Eyelid trauma | 5     |
| 2     | <b>LACRIMAL SYSTEM</b><br>2.1 Lacrimal anatomy review<br>2.2 Methods of Lacrimal evaluation<br>2.3 Congenital and developmental anomalies<br>2.4 Infections of lacrimal system                                                                                                                                                                                                                                                                                                                                                                                                                               | 4     |

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|   | 2.5 Tumours of lacrimal system<br>2.6 Lacrimal trauma<br>2.7 Dry eye and Watering<br>Etiology , Clinical evaluation and Management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   |
| 3 | ORBIT<br>3.1 Orbital anatomy<br>3.2 Evaluation of orbital disorders<br>3.3 Congenital and developmental anomalies of orbit<br>Anophthalmos, Microphthalmos, Nanophthalmos, Cryptophthalmos, Hypertelorism, Craniofacial anomalies, Craniosynostosis<br>3.4 Orbital tumours<br>Dermoids, Hemangiomas, Rhabdomyosarcoma, Optic nerve glioma, Meningiomas,<br>3.5 Orbital inflammations<br>Preseptal cellulitis, Orbital cellulitis, Orbital periostitis, Cavernous sinus thrombosis, Sinus related disorders<br>3.7 Orbital trauma<br>Blow out fractures<br>3.8 Proptosis<br>Etiology, Classifications, clinical evaluation and Management<br>3.9 Graves Ophthalmopathy<br>Etiology, Examination, and Management<br>3.10 Enophthalmos<br>Etiology, Evaluation and Management                                                                                                                                                                                                                                                                                           | 4 |
| 4 | SCLERA<br>4.1 Sclera anatomy review<br>4.2 Blue sclera<br>4.3 Scleral Degenerations<br>Ectasia and staphyloma<br>4.4 Scleral Inflammations<br>Scleritis and episcleritis<br>4.5 Toxic and traumatic injuries of sclera                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2 |
| 5 | CONJUNCTIVA and CORNEA<br>5.1 Anatomy review<br><u>A) Conjunctiva</u><br>5.2 Examination techniques<br>5.3 Inflammations of Conjunctiva<br>Conjunctivitis (classification, etiology, evaluation and management)<br>5.4 Degenerative conditions<br>Pinguecula, Pterygium, Concretions<br>5.5 Symptomatic conditions<br>Hyperaemia, Chemosis, Ecchymosis, Xerosis, Discoloration, Papillae, Follicles, Hemorrhage<br>5.6 Cysts and tumours<br><u>B) Cornea</u><br>5.7 Congenital anomalies<br>Megalocornea, Microcornea, Cornea plana, Cloudy cornea<br>5.8 Corneal Dystrophies<br>Classifications, evaluation and management<br>5.9 Corneal degenerations<br>Arcus senilis, Hassal-henle bodies, Lipoid Keratopathy, Band shaped keratopathy, Salzmann's nodular degeneration, Droplet keratopathy, Pellucid Marginal Degeneration, Corneal guttata<br>5.10 Keratoconus and Keratoglobus<br>(Etiology, Classifications, Clinical evaluation and Management)<br>5.11 Corneal inflammations<br>✓ Keratitis/Ulcer (Etiology, Classifications, Evaluation and Management) | 6 |

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|   | <ul style="list-style-type: none"> <li>✓ Corneal oedema</li> <li>✓ Corneal opacity and neovascularization</li> </ul> <p>5.12 Miscellaneous ocular surface disorders</p> <ul style="list-style-type: none"> <li>✓ Keratoconjunctivitis Sicca</li> <li>✓ Steven Johnson Syndrome</li> <li>✓ Benign Mucosal Pemphigoid- ocular pemphigoid</li> <li>✓ Vitamin A deficiency</li> <li>✓ Trauma and burns</li> <li>✓ Metabolic diseases associated with corneal changes</li> </ul> <p>5.13 Corneal surgeries</p> <p>5.14 Slit lamp colour coding</p>                                                                                                                  |   |
| 6 | <p>LENS</p> <p>6.1 Normal lens anatomy, physiology and aging process</p> <p>6.2 Congenital and Developmental defects<br/>Aphakia, Lenticonus, Lentiglobus, Coloboma, Peters anomaly, Microspherophakia, Cataract</p> <p>6.3 Acquired lenticular defects<br/>Morphological cataract<br/>Drug induced cataract<br/>Traumatic cataract<br/>Metabolic cataract<br/>Complicated cataract<br/>Association with other ocular disorders and syndromes</p> <p>6.4 Cataract Management<br/>Surgical and non-surgical management<br/>Pre-operative evaluation<br/>Complications of cataract surgery</p> <p>6.5 Lens displacement<br/>Lens subluxation and dislocation</p> | 5 |
|   | <p>UVEA AND PUPIL</p> <p>7.1 Congenital anomalies<br/>Heterochromia, Aniridia, Coloboma, Corneal ectopia, Polycoria, Pupillary membrane</p> <p>7.2 Inflammations of Uvea<br/>Classification of uveitis<br/>Etiology and pathogenesis<br/>Clinical approach to uveitis<br/>Endophthalmitis and panophthalmitis<br/>Complications of uveitis<br/>Ocular involvement in AIDS</p> <p>7.3 Tumours of uvea</p> <p>7.4 Anomalies of pupillary reactions</p>                                                                                                                                                                                                           | 6 |
|   | <p>VITREOUS</p> <p>8.1 Developmental abnormalities<br/>Hereditary hyaloidoretinopathies<br/>Persistent hyperplastic primary vitreous</p> <p>8.2 Vitreous opacities<br/>Asteroid hyalosis<br/>Cholesterosis<br/>Pigment granules in vitreous<br/>Vitreous haemorrhage</p> <p>8.3 Posterior vitreous detachment<br/>Etiology, Clinical features and Management</p> <p>8.4 Trauma and vitreous</p> <p>8.5 Inflammations and vitreous</p> <p>8.6 Parasitic infestations</p> <p>8.7 Vitreous complications secondary to surgery</p>                                                                                                                                 | 2 |

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|  | <p>RETINA</p> <p>9.1 Applied anatomy</p> <p>9.2 Congenital and developmental anomalies<br/>Optic disc coloboma, Drusen, Hypoplasia, Medullated nerve fibers</p> <p>9.3 Retinopathy of prematurity<br/>Etiology, Stages, Clinical features and Management</p> <p>9.4 Retinal vascular diseases<br/>Diabetic retinopathy<br/>Associated with cardiovascular disease<br/>✓ Hypertensive retinopathy<br/>✓ Retinal artery and vein occlusions</p> <p>9.5 Retinal Inflammations<br/>Retinitis, Retinal vasculitis</p> <p>9.6 Retinal degenerations<br/>Retinitis pigmentosa, Lattice degenerations</p> <p>9.7 Macular disorders<br/>Hereditary diseases<br/>Central serous retinopathy<br/>Cystoid macular oedema<br/>Solar retinopathy<br/>Albinism<br/>Age related macular degeneration<br/>Macular holes</p> <p>9.8 Retinal detachment and Retinoschisis<br/>Etiology, Classifications, Clinical features and management</p> <p>9.9 Retinal tumours<br/>✓ Retinoblastoma<br/>✓ Retinal and optic nerve head astrocytomas<br/>✓ Lymphoid tumour</p> <p>9.11 Miscellaneous disorders<br/>Epiretinal membranes<br/>Intraocular foreign bodies<br/>Other metabolic disorders of retina<br/>Diseases of choroidal vasculature and Bruch's membrane<br/>Diseases of retinal pigment epithelium</p> <p>9.11 Fundus Drawing –colour coding</p> | 6 |
|  | <p>NEURO OPHTHALMOLOGY</p> <p>10.1 Applied anatomy review</p> <p>10.2 Neuro ophthalmic examination<br/>✓ History<br/>✓ Visual acuity<br/>✓ Colour vision<br/>✓ Pupillary evaluation<br/>✓ Ocular motility<br/>✓ Fundus examination<br/>✓ Visual field examination<br/>✓ Adjunctive tests</p> <p>10.3 Visual pathway and systems<br/>✓ Vascular supply to anterior and posterior visual systems<br/>✓ Visual pathway defects<br/>✓ Disorders of visual integration<br/>✓ Disorders of higher cortical functions<br/>✓ Disorders with ocular motility anomalies/diplopia</p> <p>10.4 Nystagmus<br/>Etiology, classifications, clinical evaluations and management</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 5 |



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|   | 10.5 Miscellaneous disorders <ul style="list-style-type: none"> <li>✓ Systemic disorders with neuro ophthalmologic signs</li> <li>✓ Optic neuropathy</li> <li>✓ Papilledema</li> <li>✓ Papillitis</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |    |
|   | <b>GLAUCOMA</b><br>11.1 Optic nerve, Anterior chamber and Aqueous Dynamics Review<br>11.2 Overview of glaucoma Diagnostic instruments<br>11.3 Evaluation of optic nerve head<br>11.4 Classification of glaucoma<br>11.5 Primary open angle glaucoma<br>Etiology, clinical features, diagnosis and management<br>11.6 Primary angle closure glaucoma<br>Etiology, clinical classification, clinical features, diagnosis and management<br>11.7 Developmental glaucoma<br>Congenital glaucoma, Infantile glaucoma and juvenile glaucoma<br>Syndromes with glaucoma<br>11.8 Secondary glaucoma<br>Pseudoexfoliation glaucoma, pigmentary glaucoma, Inflammation induced,<br>Neovascular glaucoma, Lens induced glaucoma, Traumatic glaucoma<br>11.9 Glaucoma management<br>Pharmacological and surgical management<br>11.10 Glaucoma screening | 5  |
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |
|   | <b>SYSTEMIC DISEASES</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |
| 1 | <b>ARTERIAL HYPERTENSION</b><br>1.1. Pathophysiology, classification, clinical examination, Diagnosis<br>1.2. Complications, management<br>1.3.Hypertension and the eye                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 30 |
| 2 | <b>DIABETES MELLITUS</b><br>2.1. Pathology, classifications, clinical features<br>2.2. Diagnosis, complications, management<br>2.3. Diabetes mellitus and the eye                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |
| 3 | <b>ACQUIRED HEART DISEASES- EMBOLISM</b><br>3.1. Rheumatic fever- Pathophysiology, classifications, diagnosis<br>complications and management<br>3.2. embolism<br>3.3.Subacute bacterial endocarditis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |    |
| 4 | <b>CANCER –INTRODUCTION</b><br>4.1. Definition, nomenclature, characteristics of benign and malignant<br>4.2. Grading of staging of cancer, diagnosis, principles of treatment<br>4.3.Neoplasia and the eye                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |
| 5 | <b>CONNECTIVE TISSUE DISEASES</b><br>5.1. Anatomy and pathophysiology: arthritis<br>5.2.Eye and connective tissue diseases                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |    |
| 6 | <b>THYROID DISEASE</b><br>6.1. Anatomy and physiology of thyroid gland<br>6.2. Classification of thyroid disease<br>6.3. Diagnosis, complications, clinical features, management<br>6.4.Thyroid disease and the eye                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |    |

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| 7  | TUBERCULOSIS<br>7.1. Etiology, pathology, clinical features, pulmonary tuberculosis, diagnosis, complication, treatment<br>7.2. Tuberculosis and the eye                                                                                                                                                            |        |
| 8  | 8.1. Herpes virus (Herpes simplex, Varicella Zoster, Cytomegalovirus, Epstein Barr Virus)<br>8.2. Herpes and the eye                                                                                                                                                                                                |        |
| 9  | Hepatitis (Hepatitis A, B, C) 2                                                                                                                                                                                                                                                                                     |        |
| 10 | Myasthenia Gravis                                                                                                                                                                                                                                                                                                   |        |
| 11 | HELMINTHIASIS<br>8.1. Classification of helminthic diseases, - schistosomiasis,<br>8.2. principles of diagnosis and management<br>8.3. Helminthic disease and the eye [Taenia., echinococcus, larva migrans]                                                                                                        |        |
| 12 | COMMON TROPICAL MEDICAL AILMENTS<br>9.1. Introduction to tropical diseases: malaria<br>9.2. Tropical diseases and the eye- leprosy, toxoplasmosis, syphilis, Trachoma                                                                                                                                               |        |
| 13 | MALNUTRITION<br>10.1. Etiology & nutritional disorders of the eye                                                                                                                                                                                                                                                   |        |
| 14 | INTRODUCTION TO IMMUNOLOGY<br>11.1. Introduction & components of immune system<br>11.2. Principles of immunity in health<br>11.3. Immunology in disease<br>11.4. Immunology and the eye                                                                                                                             |        |
| 15 | GENETICS<br>12.1. Introduction to genetics<br>12.2. Organisation of the cell<br>12.3. Chromosome structure and cell division<br>12.4. Gene structure and basic principles of genetics<br>12.5. Genetic disorders and their diagnosis<br>12.6. Genes and the eye<br>12.7. Genetic counseling and genetic engineering |        |
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|    |                                                                                                                                                                                                                                                                                                                     | 80 Hrs |

#### RECOMMENDED BOOKS

- |                                 |                                              |
|---------------------------------|----------------------------------------------|
| 1. Clinical Ophthalmology       | Jack.J.Kanski – 4 <sup>th</sup> edition      |
| 2. Textbook of Ophthalmology    | A.K.Khurana                                  |
| 3. Parson's diseases of the eye | Revised by Ramanjith Sihota & Radhika Tandon |
| 4. Glaucoma Handbook            | Anthony.B.Litwak                             |

#### LOW VISION AIDS (THEORY)

| SL NO | TOPICS                                                                                                                            | HOURS |
|-------|-----------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | Introduction<br>1.1. Definition & Classification<br>1.2. Causes of Low Vision<br>1.3. Optometrist's role in Low Vision management | 02    |

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| 2  | <p>Examination of a Patient with Low vision</p> <p>2.1. Case history</p> <p>2.2. Visual acuity</p> <ul style="list-style-type: none"> <li>✓ Distant vision – Charts, measurement &amp; Documentation</li> <li>✓ Near vision - Charts, measurement &amp; Documentation</li> <li>✓ Refraction – Significance &amp; Technique</li> <li>✓ Diagnostic procedures in low vision examination</li> </ul> <p>Screening for vision disability</p> <ul style="list-style-type: none"> <li>• A collaborative model of service delivery</li> <li>• Teaching other staff how to screen for vision disability and refer to you</li> <li>• Six sensory impairments, realistic simulations and performance signs</li> </ul> <p style="padding-left: 40px;">Impaired acuity<br/>Impaired contrast sensitivity<br/>Central field loss<br/>Peripheral field loss<br/>Oculomotor problems<br/>Perceptual impairment</p> <ul style="list-style-type: none"> <li>• Normal age related vision loss</li> <li>• Pathogenesis</li> <li>• Sighted guide instructional video</li> </ul> | 15        |
| 3  | <p>Optics &amp; Characteristics of Low vision aids</p> <p>3.1. Magnification</p> <p>3.2. Galilean telescope Vs Keplarian Telescopes</p> <p>3.3. Spectacle magnifiers</p> <p>3.4. Hand Magnifiers</p> <p>3.5. Stand Magnifiers</p> <p>3.6. CCTV</p> <p>3.7. Bioptic telescopes</p> <p>3.8. Accessory low vision aids</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5         |
| 4  | Selection of Low vision aids for distance, intermediate & Near                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 02        |
| 5  | Guidelines & training to use various aids                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 02        |
| 6  | <p>Choices of tests &amp; Aids in various pathological conditions</p> <p>6.1. Conditions causes overall blurring of the visual field</p> <p>6.2. Conditions causes central field defects</p> <p>6.3. Conditions causes peripheral field defects</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 05        |
| 7  | Light, glare & Contrast in Low vision care & Rehabilitation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 01        |
| 8  | Children with low vision                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 01        |
| 9  | Genetics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 01        |
| 10 | Rehabilitation of visually handicapped                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 01        |
| 11 | Definitions and eligibility for services in India                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 02        |
| 12 | Description of advanced low vision devices and their practice                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 03        |
|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>40</b> |

### LOW VISION AIDS - PRACTICAL

|   |                                                                                                                                                                                                                                                                                                                                                                                                      |    |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1 | Demonstration followed by evaluation of a low vision patient by students <ul style="list-style-type: none"> <li>▪ Low vision case history</li> <li>▪ Visual acuity measurement &amp; Documentation</li> <li>▪ Refraction</li> <li>▪ Needed diagnostic tests for each pathological condition</li> <li>▪ Selection, trial &amp; dispensing of visual aids</li> <li>▪ Rehabilitation methods</li> </ul> | 10 |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|

#### RECOMMENDED BOOKS

1. Low vision care- E.B.Mehr, Allen.N.Fried
2. Clinical Low vision- Eleanor.E.Fay

### GERIATRIC OPTOMETRY

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                     | HOURS        |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 1     | 1.1. Introduction<br>1.2. structural& physiological changes in the eye associated with ageing <ul style="list-style-type: none"> <li>✓ Structural changes to lid &amp; adnexa</li> <li>✓ Physiological changes to cornea, lens &amp; Uvea</li> <li>✓ Degenerative &amp; Physiological changes in vitreous, choroid &amp; retina</li> </ul> | 2            |
| 2     | 2.1. Optical& refractive changes <ul style="list-style-type: none"> <li>✓ Refractive changes in cornea, lens &amp; vitreous</li> <li>✓ Refractive changes due to diabetes</li> <li>✓ Refractive changes due to uveitis</li> </ul>                                                                                                          | 03           |
| 3     | <ul style="list-style-type: none"> <li>✓ Cataract</li> <li>✓ Glaucoma</li> <li>✓ Macular disorders</li> <li>✓ Vascular disorders</li> </ul>                                                                                                                                                                                                | 03           |
| 4     | Optical correction of refractive conditions                                                                                                                                                                                                                                                                                                | 02           |
| 5     | Dispensing in geriatric age groups <ul style="list-style-type: none"> <li>✓ Spectacle</li> <li>✓ Contact lenses</li> </ul>                                                                                                                                                                                                                 | 03           |
|       |                                                                                                                                                                                                                                                                                                                                            | <b>15Hrs</b> |

## RECOMMENDED BOOKS

- |                                                   |                                     |
|---------------------------------------------------|-------------------------------------|
| 1. vision of the ageing patient                   | Hirsch Wick                         |
| 2. Vision &Aeing – General & Clinical perspective | Alfred Rosenboom, Meredith.W.Morgan |
| 3.Clinical refraction                             | Borish                              |

## PEDIATRIC OPTOMETRY

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | HOURS  |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1     | Introduction<br>1.1. Review of ocular anatomy & Physiology<br>1.2. Visual development— visual system, visual acuity, refractive error, contrast sensitivity function, eye movements, accommodation, binocular vision, color vision                                                                                                                                                                                                                                                                                            | 03     |
| 2     | Pediatric case history<br>2.1. Genetic factors<br>2.2. Prenatal factors<br>2.3. Perinatal factors<br>2.4. Postnatal factors                                                                                                                                                                                                                                                                                                                                                                                                   | 04     |
| 3     | Normal Appearance, pathology and structural anomalies of <ul style="list-style-type: none"><li>✓ Orbit</li><li>✓ Eyelids</li><li>✓ Lacrimal system</li><li>✓ Conjunctiva</li><li>✓ Cornea</li><li>✓ Sclera</li><li>✓ Anterior chamber, Uveal tract, pupils</li><li>✓ Lens</li><li>✓ Vitreous, Fundus</li><li>✓ Oculomotor system</li></ul>                                                                                                                                                                                    | 03     |
| 4     | Ocular Examination<br>4.1. Measurement of visual acuity <ul style="list-style-type: none"><li>✓ Various visual acuity charts for different age groups</li><li>✓ Teller acuity chart &amp; VEP</li></ul> 4.2. Measurement of refractive status <ul style="list-style-type: none"><li>✓ Dry &amp; Cycloplegic refraction</li><li>✓ Interpretation of results</li></ul> 4.3. 4.3. Assessment of oculomotor function<br>4.4. Measurement of fusion and stereopsis, color vision<br>4.5. Assessment of accommodation & Convergence | 06     |
| 5     | Post examination processes<br>5.1. Compensatory treatment & remedial therapy for <ul style="list-style-type: none"><li>✓ Myopia</li><li>✓ Pseudomyopia</li><li>✓ Hyperopia</li><li>✓ Astigmatism</li><li>✓ Anisometropia</li><li>✓ Strabismus</li><li>✓ Nystagmus</li></ul>                                                                                                                                                                                                                                                   | 04     |
| 6     | Pediatric dispensing <ul style="list-style-type: none"><li>✓ Spectacles</li><li>✓ Contact Lenses</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                    | 04     |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 20 Hrs |

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### RECOMMENDED BOOKS

- |                                                                       |                                           |
|-----------------------------------------------------------------------|-------------------------------------------|
| 1. Principles & Practice of pediatric optometry                       | Alfred Rosenboom, M.W.Morgan              |
| 2. Pediatric Optometry                                                | Jerome Rosner                             |
| 3. Clinical pediatric optometry                                       | Leonard.J.Press – 1 <sup>st</sup> edition |
| 4. Visual Development, Diagnosis, Treatment of the Pediatric Patients | Robert H Duckman                          |

### BINOCULAR VISION & ADVANCES IN OPTOMETRY (THEORY)

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | HOURS |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | Binocular Vision and Space perception. <ul style="list-style-type: none"> <li>➤ Relative subjective visual direction.</li> <li>➤ Retino motor value</li> <li>➤ Grades of BSV</li> <li>➤ SMP and Cyclopean Eye</li> <li>➤ Correspondence,</li> <li>➤ Fusion, Diplopia, Retinal rivalry</li> <li>➤ Horopter</li> <li>➤ Physiological Diplopia and</li> <li>➤ Suppression</li> <li>➤ Stereopsis, Panum's area, BSV.</li> <li>➤ Stereopsis and monocular clues -significance.</li> <li>➤ Egocentric location, clinical applications.</li> <li>➤ Theories of Binocular vision.</li> </ul>                                                                                         |       |
| 2     | Anatomy of Extra Ocular Muscles. <ul style="list-style-type: none"> <li>➤ Rectii and Obliques, LPS.</li> <li>➤ Innervation &amp; Blood Supply.</li> </ul> Physiology of Ocular movements. <ul style="list-style-type: none"> <li>➤ Center of rotation, Axes of Fick.</li> <li>➤ Action of individual muscle.</li> </ul> Laws of ocular motility <ul style="list-style-type: none"> <li>➤ Donder's and Listing's law</li> <li>➤ Sherrington's law</li> <li>➤ Hering's law</li> </ul> Uniocular & Binocular movements - fixation, saccadic & pursuits. <ul style="list-style-type: none"> <li>➤ Version &amp; Vergence.</li> <li>➤ Fixation &amp; field of fixation</li> </ul> | 06    |
| 3     | Near Vision Complex<br>Accommodation <ul style="list-style-type: none"> <li>➤ Definition and mechanism (process).</li> <li>➤ Methods of measurement.</li> <li>➤ Stimulus and innervation.</li> <li>➤ Types of accommodation.</li> <li>➤ Anomalies of accommodation – aetiology and management.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                    | 04    |
| 4     | Convergence <ul style="list-style-type: none"> <li>➤ Definition and mechanism.</li> <li>➤ Methods of measurement.</li> <li>➤ Types and components of convergence - Tonic, accommodative, fusional, proximal.</li> <li>➤ Anomalies of Convergence – aetiology and management.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                      | 06    |

|    |                                                                                                                                                                                                                                                                                                                       |    |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 5  | Sensory adaptations Confusion                                                                                                                                                                                                                                                                                         | 02 |
| 6  | Suppression Investigations<br>Management Blind spot syndrome                                                                                                                                                                                                                                                          | 04 |
| 7  | Abnormal Retinal Correspondence<br>Investigation and management<br>Blind spot syndromeSurgical                                                                                                                                                                                                                        | 02 |
| 8  | Eccentric Fixation<br>Investigation and management                                                                                                                                                                                                                                                                    | 02 |
| 9  | Amblyopia Classification<br>Aetiology Investigation Management                                                                                                                                                                                                                                                        | 04 |
| 10 | Neuro-muscular anomalies<br>Classification and<br>etiological factors                                                                                                                                                                                                                                                 | 02 |
| 11 | History – recording and<br>significance.                                                                                                                                                                                                                                                                              | 02 |
| 12 | Convergent strabismus <ul style="list-style-type: none"> <li>➤ Accommodative convergent squint</li> <li>➤ Classification</li> <li>➤ Investigation and Management</li> <li>➤ Non accommodative Convergent squint</li> <li>➤ Classification</li> <li>➤ Investigation and Management</li> </ul>                          | 06 |
| 13 | Divergent Strabismus<br>Classification<br>A& V phenomenon<br>Investigation and Management                                                                                                                                                                                                                             | 04 |
| 14 | Vertical strabismus<br>Classification<br>Investigation and Management                                                                                                                                                                                                                                                 | 02 |
| 15 | Paralytic Strabismus<br>Acquired and Congenital<br>Clinical Characteristics<br>Distinction from comitant and restrictive Squint                                                                                                                                                                                       | 04 |
| 16 | Investigations <ul style="list-style-type: none"> <li>➤ History and symptoms</li> <li>➤ Head Posture</li> <li>➤ Diplopia Charting</li> <li>➤ Hess chart</li> <li>➤ PBCT</li> <li>➤ Nine directions</li> <li>➤ Binocular field of vision</li> </ul>                                                                    | 12 |
| 17 | Non-surgical Management of Squint                                                                                                                                                                                                                                                                                     | 02 |
| 18 | Restrictive Strabismus Features <ul style="list-style-type: none"> <li>➤ Musculofascial anomalies</li> <li>➤ Duane's Retraction syndrome</li> <li>➤ Clinical features and management</li> <li>➤ Brown's Superior oblique sheath syndrome</li> <li>➤ Strabismus fixus</li> <li>➤ Congenital muscle fibrosis</li> </ul> | 06 |
|    |                                                                                                                                                                                                                                                                                                                       |    |

## BINOCULAR VISION ADVANCES IN OPTOMETRY – PRACTICALS

| SL NO | TOPICS                                                                                                                                                                                      | HOURS  |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1     | Strabismus assessment<br>✓ Cover test, Krimsky, Synaptophore, Stereoacuity test, Diplopia charting Examination procedures of different types of strabismus and its non-surgical management. | 20     |
|       |                                                                                                                                                                                             | 20 Hrs |

### RECOMMENDED BOOKS

1. Binocular vision & Ocular motility
2. Clinical management of binocular vision
3. Binocular anomalies
4. Practical binocular vision assessment
5. Binocular vision & Orthoptics

Von Noorden – 6<sup>th</sup> edition  
M.Scheimann, Bruce Wick – 2<sup>nd</sup> edition  
John.R.Griffin, J.David Grisham – 4<sup>th</sup> edition  
Frank Eperjesi, Michelle.M.Rundstorm  
Bruce Evans, Sandip Doshi

## PRACTICE MANAGEMENT

1. Basics of book keeping
2. Data management
3. Record keeping
4. Clinic management
5. Staff management
6. Inventory control
7. Public relations.
  - Definitions.
  - ☐ PR- its disfunction from publicity, propaganda & advertising.
  - Internal and external aspects of PR
  - ☐ Phases of PR: analysis building, promotion of product or services, better employee, government and community relation.
8. Methods of public relations:
  - ☐ Press relations: Press release, Press conference, and Letter to editor.
  - Printed work: Style, colour & design.
9. Basic Accountancy and Public relations
  - ☐ Introduction.
  - Terms used in accounts, Principles of accountancy.
  - ☐ Journal & ledger
  - ☐ Trial Balance
  - ☐ Subsidiary books, petty cash book, sales register, purchase register, stock register
  - ☐ Bank reconciliation and Banking procedures.
  - ☐ Depreciation.
  - ☐ Balance sheet and profit & loss accounts.



- General ideas about Income tax and sales tax.
- □ Project report and financial inability.
- Costing in practice (Buying, stock-keeping, assesment of fees and costing of appliance).

## LAW AND OPTOMETRY

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | HOURS |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|       | <ol style="list-style-type: none"> <li>1. Legal environment and techniques- History – law and equity</li> <li>2. History and theory of licensure</li> <li>3. Licensure as a means of internal and external discipline- unprofessional conduct- incompetence- gross immorality</li> <li>4. International optometry- important foreign optometry law</li> <li>5. Optometrist in court</li> <li>6. Malpractice- theory of liability- damages –minimizing malpractice claims</li> <li>7. Insurance</li> <li>8. Negligence</li> <li>9. Ethics – professional ethics</li> <li>10. Laws governing practice of medical and paramedical profession in India</li> <li>11. Registered medical practitioner- laws against practice of medicine of those unregistered- medical council of India- dental council- nursing council</li> <li>12. Present rules and regulations – laws regarding optical product Manufacturers- dispensing in India</li> <li>13. Opticians- are they registered? Dispensing opticians- rules in UK</li> </ol> | 10    |

## OCCUPATIONAL OPTOMETRY

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | HOURS |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | <p>Public Health &amp; Community Optometry</p> <ol style="list-style-type: none"> <li>1. Public health &amp; Community optometry- concepts and implementation</li> <li>2. Global medicine and evolution of public health in India</li> <li>3. Health care delivery systems in India and determinants of health</li> <li>4. Quality assessment in health delivery programmes</li> <li>5. Natural history of disease, transmission of disease</li> <li>6. Levels of prevention – optometrist’s role in community</li> <li>7. Concepts of national health programme</li> <li>8. Screening in population (Screening for eye disease)</li> <li>9. Epidemiology of blindness- cataract, glaucoma, deficiency disorders</li> <li>10. Eye care in Primary Health care</li> <li>11. Community Eye Care Programs</li> <li>12. Community based Rehabilitation Program</li> <li>13. Vision 2020: The Right to Sight</li> <li>14. Scope of geriatric ophthalmology in preventive and rehabilitation care</li> <li>15. Basics in research methodology in populations</li> <li>16. Demography and vital statistics (This can be a part of Research Methadology )</li> <li>17. National and international agencies in health care</li> <li>18. Fundamentals of health economics, health plan</li> <li>19. Evaluation &amp; Assesment of Health Programmes</li> <li>20. Role of Optometrist in Public Health &amp; Community Optometry</li> <li>21. Role of Optometrist in school eye screening Program</li> <li>22. Community outreach-camps and school screening programmes</li> </ol> | 20    |

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|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 2  | 1.1. Introduction to occupational health, hygiene and safety<br>1.2. International bodies like ILO, WHO, national bodies like labour institutes, National institutes of occupational health, national safety council etc                                                                                                                                                                                                                                                                                                                                                                | 20     |
| 3  | Acts and rules,<br>2.1. Factories act and rules<br>2.2. Workmen's compensation act, ESI act etc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |
| 4  | 4.1 Light / Illumination<br>(Definition, Units, Sources, advantages, disadvantages)<br>4.2 Color<br>(Definition, Color defects, Color vision tests)<br>4.3 Introduction to Different Occupation<br>Occupation where Illumination and Color vision is Important                                                                                                                                                                                                                                                                                                                          |        |
| 5  | 5.1 Occupational Hazards<br>A. Physical Hazards<br>B. Biological Hazards<br>C. Ergonomic Hazards<br>D. Air-Borne Hazards<br>E. Chemical Hazards<br>Example of Occupation related to each Hazards<br>5.2 Radiation (Electromagnetic radiation, Ionizing & Non ionizing, Infrared, Ultraviolet, Microwave & laser)<br>5.3 Pesticides – General & Ocular defects<br><br>5.3 Occupational hygiene & ergonomics<br>A. Environmental monitoring<br>B. Recognition, evaluation and control of hazards                                                                                          |        |
| 6  | 6.1 Occupational diseases<br>A. Occupation related diseases caused by (Physical agents, Chemical agents Biological agents)<br>6.2 Common Systemic Disease Associated with Various Occupation<br>6.3 Common Ocular Disease in Various Occupation<br>6.4 Visual Problems in various Occupation<br><br>6.4 Occupational safety<br>A. Prevention & Protective Methods<br>B. Personal protective equipment<br>✓ Goggles, Face shields etc<br>Selection, use & Testing for standards<br>6.5 Occupational Accidents<br>5.1. Causes of accidents<br>5.2. Accident analysis, accident prevention |        |
| 7  | 7.1 Task Analysis of Occupation<br>7.2 Vision Standards for Occupation like Railways, Roadways, Airlines etc                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |
| 8  | Prevention of occupational diseases<br>✓ Medical examination / medical monitoring<br>✓ Pre-employment/pre- placement examinations                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |
| 9  | Visual Display Unit (Computer, Laptop, Digital Devices)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |
| 10 | Contact lens & work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |
| 11 | 11.1 Role of optometrist – promotion of general and visual health and safety of people at Work<br>11.2 Industrial visits & Industrial Vision Screening                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |
|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 50 Hrs |

## RECOMMENDED BOOKS

- |                                                             |                                                           |
|-------------------------------------------------------------|-----------------------------------------------------------|
| 1. Public health and community Optometry                    | Robert.D.Newcomb, Jerry.L.Jolly                           |
| 2. Industrial & Occupational ophthalmology                  | Samuel.L.Fox                                              |
| 3. Guide to occupational and other visual needs             | Holmes                                                    |
| 4. Work and the eye                                         | Raechel.V.North                                           |
| 5. Diagnosing and treating computer related vision problems | Sheedy, Shaw-McMinn                                       |
| 6. Principles of Ophthalmic lenses                          | M.O.Jalie – 2 <sup>nd</sup> edition                       |
| 7. System for ophthalmic dispensing                         | Clifford.W.Brooks, Irwin.M.Borish                         |
| 8. Clinical Optics                                          | Troy Fannin, Theodore Grosvenor – 2 <sup>nd</sup> edition |
| 9. Ophthalmic lenses & Dispensing                           | M.O.Jalie – 2 <sup>nd</sup> edition                       |
| 10. Practical aspects of ophthalmic optics                  | MargeretDowaliby – 4 <sup>th</sup> edition                |

## RESEARCH METHODOLOGY & STATISTICS

| SL NO | TOPICS                                                                                                                                                                                                                                                                                                                                 | HOURS |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | <b>Introduction I: Biostatistics</b> <ul style="list-style-type: none"> <li>✓ Definition</li> <li>✓ role of statistics in health science and health care delivery system</li> </ul>                                                                                                                                                    | 60    |
| 2     | <b>Introduction II: Research Methodology</b> <ul style="list-style-type: none"> <li>✓ Research process</li> <li>✓ Steps involved in research process</li> <li>✓ Research methods and methodology</li> </ul>                                                                                                                            |       |
| 3     | <b>Variables and scales of measurements</b> <ul style="list-style-type: none"> <li>✓ Definitions and examples of qualitative, quantitative, continuous discrete, dependent and independent variables.</li> <li>✓ Definitions, properties and examples of nominal, ordinal, interval and ratio scales of measurements.</li> </ul>       |       |
| 4     | <b>Sampling</b> <ul style="list-style-type: none"> <li>✓ Population, sample, sampling, reasons for sampling, probability and non-probability sampling.</li> <li>✓ Methods of probability sampling – simple random, stratified, systematic- procedure</li> <li>✓ Merits and demerits.</li> <li>✓ Use of random number table.</li> </ul> |       |
| 5     | <b>Organization of data</b> <ul style="list-style-type: none"> <li>✓ Frequency table, histogram, frequency polygon, frequency curve, bar diagram, pie chart</li> </ul>                                                                                                                                                                 |       |
| 6     | <b>Measures of location</b> <ul style="list-style-type: none"> <li>✓ Arithmetic mean, median, mode, quartiles and percentiles – definition</li> <li>✓ Computation (for raw data), merits, demerits and applications</li> </ul>                                                                                                         |       |
| 7     | <b>Measures of variation</b> <ul style="list-style-type: none"> <li>✓ Range, inter-quartile range, variance, standard deviation, coefficient of variation- definition</li> <li>✓ Computation (for raw data), merits, demerits and applications</li> </ul>                                                                              |       |
| 8     | <b>Normal distribution</b> <ul style="list-style-type: none"> <li>✓ Concept, graphical form, properties, examples</li> <li>✓ Concept of Skewnes and Kurtosis</li> </ul>                                                                                                                                                                |       |

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|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 9  | <b>Correlation</b> <ul style="list-style-type: none"> <li>✓ Scatter diagram</li> <li>✓ concept and properties of correlation coefficient, examples [No computation]</li> </ul>                                                                                                                                                                                                                                          |               |
| 10 | <b>Health Information System</b> <ul style="list-style-type: none"> <li>✓ Definition, requirement, component and uses of health information system.</li> <li>✓ Sources of health information system- Census, Registration of vital events, Sample registration system (SRS), Notification of diseases, Hospital records, Disease registries, Record linkage, Epidemiological surveillance, Population survey</li> </ul> |               |
| 11 | <b>Vital statistics and hospital statistics</b> <ul style="list-style-type: none"> <li>✓ Rate, ratio, proportion, Incidence, Prevalence. Common morbidity, mortality and Fertility statistics – Definition and computation.</li> </ul>                                                                                                                                                                                  |               |
| 12 | <b>Hypothesis</b> <ul style="list-style-type: none"> <li>✓ What is hypothesis</li> <li>✓ Formulation of hypothesis</li> <li>✓ Characteristics of good hypothesis.</li> </ul>                                                                                                                                                                                                                                            |               |
| 13 | <b>Epidemiology</b> <ul style="list-style-type: none"> <li>✓ Concept of health and disease</li> <li>✓ Definition and aims of Epidemiology,</li> <li>✓ Descriptive Epidemiology- methods and uses.</li> </ul>                                                                                                                                                                                                            |               |
| 14 | Concept of reliability & validity                                                                                                                                                                                                                                                                                                                                                                                       |               |
|    |                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>60 Hrs</b> |

#### RECOMMENDED BOOKS

1. Methods in Biostatistics for medical students & Research workers
2. Research methodology – Methods & techniques
3. Introduction to Biostatistics: A manual for students in health sciences
4. Text book of Preventive and social medicine

Mahajan B.K.- 6<sup>th</sup> edition  
 Kothari.C.R  
 Sundar Rao PSS, Richard.J  
 Park.E.Park

## CLINICS AND SPECIAL CLINICS

**No. of practical hrs. : 270**

1. Case sheet
2. History taking
3. Lensometry
4. Visual acuity
5. Tests for phorias and tropias
6. External examination
7. Slit lamp examination
8. Drugs and method of application
9. Do's and don'ts – Pupillary dilatation
10. Direct ophthalmoscopy
11. Indirect ophthalmoscopy
12. Instrumentation
13. Patients selection
14. Keratometry reading
15. Refraction
16. Fluorescein pattern
17. Overrefraction
18. Fitting of hard lenses
19. Rigid gas permeable lenses and soft lenses in refractive errors and in specialized condition

The students are made to observe the interneers initially, then gradually they are encouraged to work up a patient and perform various examination techniques.

# **FOURTH YEAR**

- **PROJECT WORK**
- **CLINICAL POSTING & SOCIALITY POSTING**

## **LEARNING AND TEACHING STRATEGY**

The curriculum of Optometry is designed in such a way that it ensures the development of professional skills as well as behaviors of an individual that helps them to deliver a comprehensive primary eye care to the needy.

The curriculum incorporates 4 Major phases

### **Phase - I (First year Optometry)**

The emphasis of learning is understanding & analysis of the basic sciences, philosophies, theories & skills required to develop professionally and academically. This theory oriented first year ensures a sound scientific foundation for the upcoming years.

### **Phase - II (Second year Optometry)**

The curriculum arranged in this part allows the students to apply the basic science knowledge procured from Phase-I in the Optometry topics. The introductory clinical posting in the ophthalmic outpatient department helps them to understand and learn the primary eye care procedures.

### **Phase – III (Third year Optometry)**

As the curriculum concentrates more on optometric patient evaluation and management, the focus is to refine the student's clinical and application skills to make him/her an Optometrist. The student will learn about the diagnostic approaches and management of various ocular disorders, binocular vision anomalies, assessment and dispensing of contact lenses and Low vision aids.

### **Phase – IV (Fourth year Optometry)**

This one year compulsory course work program is designed to facilitate the transition from student hood to a competent optometrist.

The learning and teaching process includes;

- Lectures
- Practical demonstration
- Projects & Assignments
- Seminars
- Case discussions
- Journal clubs
- Clinical teaching
- Industrial visits
- Community outreach

## ***CLINICAL POSTINGS***

**Aim:** To enable the students to learn the Optometric examination procedures, clinical assessment skills and management techniques which helps them to become a competent clinician.

**Description:** The students will be posted in different specialities of eye care on a rotatory basis under the supervision of experienced clinical supervisors.

### **Clinical Posting – II<sup>nd</sup> Year:**

At the end of second year clinical postings, the students will be performing History recording (Ocular and systemic – of relevance), Visual acuity assessment and documentation (Adults & Infants), Objective and subjective refraction, Spectacle prescription, Dispensing of various types of lenses and frames, Lensometry, Keratometry, demonstrating the slit lamp illumination techniques, color vision assessment, Do's and Don'ts of pupillary dilatation, Gross ophthalmic examination etc. under experienced clinical supervisors.

**TOTAL CLINICAL HOURS (IIND YEAR): 200 HOURS/YEAR**

### **Clinical Posting – III<sup>rd</sup> year:**

By the completion of III<sup>rd</sup> year clinical posting, the students will be able to perform the following under experienced clinical supervisors.

- Optometric workup to detect the ocular disorders (Ocular & relevant systemic history, Visual acuity assessment and refraction, Slit lamp examination, applanation Tonometry, fundus evaluation)
- Contact lens workup
- Low vision workup
- Orthoptic workup

**TOTAL CLINICAL HOURS (IIIRD YEAR): 575 HOURS/YEAR.**

### **Clinical Postings – IV<sup>th</sup> year:**

Successful completion of the course work program will facilitate the students to become competent independent Optometrist. The student will be proficient in

- Complete Optometric workup including diagnosis and management
- Contact lens workup including dispensing
- Low vision workup, dispensing of aids and counseling
- Orthoptic workup and non-surgical management
- Detection of ocular diseases and referral to specialists at the appropriate stage
- Managing an optical outlet/clinic of his/her own.
- Screening of Ocular disorders in community outreach programmes like Camps, School screening etc.
- Utilizing the latest technology in the diagnosis of ocular anomalies including visual field devices, Gonioscopy, imaging technology including ultrasound and retinal imaging techniques, corneal topography including ORBSCAN, Electrophysiology, etc

**SUPERVISED CLINICAL HOURS DURING COURSE WORK: 1800 HRS**

## **PROJECT:**

**No. of practical hrs: 144**

Each student is encouraged to take up a research project in the area of his/her liking. The project should be original and should have considerable clinical relevance. The concerned faculty members guide the student in his/her project. After completing the project, each student has to submit a complete report of their respective projects

### **PROJECT GUIDELINES**

All Bsc.optometry degree students enrolled in the Sri Siddhartha Academy of Higher Education should complete a scholarly project as partial fulfillment of requirements for the award of Bscoptometry (OPTOMETRY) degree.

#### **What is a project?**

A Project is a preliminary form of research. It is an independent investigation. It is very largely the students' own work and is to be pursued by them from the inception till completion. A master's project (non-thesis) will be completed during the third year and involves the student in a hands-on project led by a research supervisor/faculty advisor who will choose, develop and guide the project from its inception to completion.

#### **Purpose of a project work**

The purpose of the Project Work is to enable the student to gain practical experience. It enables the student to meet program objectives through development of an appreciation of the interrelations between theory research and practice. A project forms an introduction to scientific thinking and working.

##### **Project suggestions**

Prior to the practical work, students work out a concept with their supervisor that could include any of the following points:

- Scientific question
- Educational objectives (which methods have to be mastered and understood)
- Recent trends in the respective fields
- Case study
- Prospective studies
- Retrospective studies

This scholarly project provides the student with the opportunity to participate in a mentored research experience. The student will actively participate in a research project throughout all current applicable phases of the project such as the problem statement development, review of the literature, hypotheses formation, proposal writing, study design, data collection, data analysis, and result reporting. This may be done as a group project. A portfolio, paper, or poster is a presentation of those outcomes.

##### **Project supervision**

The supervisor schedules the project work together with the student and provides an introduction to all laboratory skills that are needed. She or he is then the contact person for all questions and problems during the project. If required, she or he may also ask for a progress report and preliminary results while the project is still ongoing.

The eligibility academic qualification and teaching experience required for recognition as research supervisor and faculty advisor by the SSAHE are:



- a. Eligibility to be a research supervisor and faculty advisor  
Shall be a full time teacher in the college or institution where he or she is working.
- b. Academic qualification and teaching/professional experience for each branch
  - Research supervisor (RS)- five years of teaching/ professional experience after the postgraduate qualification in a teaching institution or laboratory approved by SSAHE
  - Faculty advisor (FA)- three years of teaching/ professional experience after the postgraduate qualification in a teaching institution or laboratory approved by SSAHE
- c. Age:  
The age of the RS/ FA shall not exceed 65 years.

#### Assessment

Four copies of the project report should be submitted to the Principal along with a soft copy (CD), three months before the final examinations. Projects are assessed with a written report and a seminar. The written report and the presentation, as well as the practical work in the laboratory are to be included in the internal assessment. The Project report will carry 10 marks which would be assessed and awarded during the viva voce examination and added along with the viva voce marks.

#### **GUIDELINES FOR THE PREPARATION OF PROJECT REPORTS**

1. The project report should be typed in Times New Roman. The size of the titles should be 14 and Bold and the size of the subtitles should be 12 and bold.
2. The matter should have double spacing except for long quotations, footnotes and endnotes, which are single spaced. The left hand margin must be 1.5", other margins should be 1.0".
3. The project report should be hardbound.
4. The project report should be organized in the following subdivisions:
  - a. Title page
  - b. Certificate
  - c. Acknowledgement
  - d. List of abbreviations used
  - e. Table of contents
  - f. Introduction
  - g. Main project
  - h. Summary of the project work
  - i. List of references
  - j. Annexures

**a. Title page**

<-----Title----->  
<-----Subtitle----->  
by  
Name of the Candidate  
Project Report  
  
In partial fulfillment  
of the requirements for the degree of  
Degree Name  
in  
Subject Name  
Under the guidance of  
Name of the RS and FA  
Name of the Department  
Name of the College  
Place  
Year

**b. Certificate**

**CERTIFICATE BY THE RESEARCH SUPERVISOR**

This is to certify that the project report entitled "<-----Title----->" is a bonafide research work done by Name of the Candidate in partial fulfillment of the requirement for the degree of Degree Name.

Signature of the Research Supervisor  
Name  
Designation & Department

Date:

Place:

**ENDORSEMENT BY THE HOD, PRINCIPAL/HEAD OF THE INSTITUTION**

This is to certify that the project report entitled "<-----Title----->" is a bonafide research work done by Name of the Candidate under the guidance of Name & designation of the Guide.

Seal & Signature of the HOD

Seal & Signature of the Principal

Name

Name

Date:

Place:

**c. Acknowledgement**

The inclusion of a paper of Acknowledgment is a traditional practice in the write up of the Project Work. This permits the candidate to write a brief perface and acknowledge the help received from persons and organizations.

**d. List of abbreviations used**

**e. Table of Contents**

**f. Introduction**

This section includes a brief write up about the topic, its scope and importance as well as relation to any previous studies done in the particular topic. It should also mention any present developments.

**g. The main project**

The main project should be divided into various sections as per the demand of the topic.

**h. Summary of the project work**

**i. List of References (Vancouver Style)**

References should be numbered consecutively in the order in which they are first mentioned in the text; they should not be listed alphabetically by author or title or put in date order.

**j. Annexures**

**POINTS TO KEEP IN MIND**

- The project work should be an original document and in the candidates own language.
- The candidate should not copy or reproduce anyone else's published or unpublished project.
- Any arguments that are put forward in the project should be supported with appropriate data.
- Proper documentation of the information is very important.
- The methodology to be used should be very clearly stated in the beginning of the work.
- Plagiarism should be avoided.

**WHAT IS PLAGIARISM?**

Plagiarism means using another's work without giving

**CLINICAL POSTING:**

A student after having successfully completed the final year university examination is qualified to commence the Compulsory Rotatory Internship. The completion of Internship is mandatory to enable a student to obtain the bachelor degree in OPTOMETRY

**GUIDELINES**

- Interns should complete postings in all specialities as decided by the department
- The interns should conduct themselves in a manner befitting the profession.
- The intern should dress appropriately in the clinical areas
- It is mandatory for the intern to wear the white apron with nametag while attending clinics
- A total of 12 days' leaves can be availed for a period of one year. He/she is permitted to avail 1 day's casual leave in each posting/month or six days of casual leave at a stretch with prior permission from staff in-charge
- If the student takes more leaves than that can be availed, they have to extend the internship equal to the period of leaves taken

- Students are allowed to do externship only in institutions decided by the department and college on rotation basis. At least 3 months' compulsory internship has to be done in the parent institution
- Working hours in the parent institution is from 8.30am to 5.00pm. He/she should sign the attendance register before 8.30am
- Each intern should maintain a logbook wherever he/she is posted. The intern has to get signature from the supervising staff at the end of each posting
- Log book should be submitted to the Head of the department at the end of each posting of internship after the period of posting
- Accommodation for externship will be the sole responsibility of interns. Neither the department nor the college is responsible for providing accommodation
- Feedback of interns from the respective institutions during externship is mandatory
- Assignments/presentations given during the period of internship has to be duly undertaken and performed.
- Internship completion certificate will be issued from the College office only after obtaining satisfactory completion certificate from the Head of the Department
- The intern in the parent institute will get a monthly stipend. There is no stipend for off campus posting.
- The intern will be allowed to attend the National Conference, leave will be granted only for the days of conference and travel days. Any other leave declared by the University for the students will not apply to the interns

**REGULATIONS & CURRICULUM OF  
GRADUATE PARAMEDICAL COURSE  
  
BACHELOR OF SCIENCE IN  
  
MEDICAL IMAGING TECHNOLOGY  
  
2020**



**Sri Siddhartha  
Academy of Higher Education  
Deemed-to-be-University**

**Established under Section 3 of the UGC Act, 1956  
MHRD, GOI No. F.9-31/2006-U.3 (A) Dtd. 30th May 2008**

**Agalakote, B.H. Road, Tumkur – 572107, Karnataka, India**

# SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

(DEEMED TO BE UNIVERSITY)

Declared under Section 3 of the UGC Act, 1956, MHRD GOI No. F.9-31/2006-U.3 (A) Dated: 30/05/2008

Accredited 'A' Grade by NAAC

Agalakote, B.H.Road, Tumkur – 572 107. KARNATAKA, INDIA.

Ph. 0816- 2275516, Fax : 0816-2275510 website: sahetumkur.ac.in email: info@sahe.in



No. SSAHE/ACA-S&C(AHSP)/19/2022

Date: 01/09/2022

## NOTIFICATION

Sub: Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Medical Imaging Technology.

- Ref: 1). Proceedings of BOS Allied Health Sciences Programmes held on 06/04/2021  
2). Proceedings of the Academic Council meeting held on 19/08/2021  
3). Proceedings of the Board of Management held on 29/08/2022

In exercise of the powers vested under section 6 of 6.4 of MoA / Rules of SSAHE, the Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Medical Imaging Technology is notified herewith as per Annexure.

The above Regulations shall be applicable to the students admitted to the said course from the academic year 2020-21 onwards.

By Order,

REGISTRAR  
REGISTRAR

Sri Siddhartha Academy of Higher Education  
TUMKUR - 572 107, Karnataka.

To,  
Dean / Principal, Sri Siddhartha Medical College & Hospital,

Copy to

- 1) Office of the Chancellor, SSAHE, for kind information,
- 2) PA to Vice-Chancellor / PA to Registrar / Controller of Examinations / Finance Officer, SSAHE
- 3) The Director (AHSP), SSAHE
- 4) All Officers of the Academy Examination Branch / Academic Section
- 5) Guard File / Office copy.

## **REVISED ORDINANCE GOVERNING REGULATIONS & CURRICULUM OF B.Sc. MEDICAL IMAGING TECHNOLOGY - 2020**

### **1. Eligibility for admission:**

A candidate seeking admission to the BSc. Medical Imaging Technology shall have studied English as one of the principal subjects during the tenure of the course and shall have passed:

1. Two-year Pre-University examination or equivalent as recognized by Sri Siddhartha Academy of Higher Education with, Physics, Chemistry and Biology as subjects of study.

OR

2. Pre-Degree course from a recognized University considered as equivalent by SSAHE, (Two years after ten years of schooling) with Physics, Chemistry and Biology as subjects of study.

OR

3. Any equivalent examination recognized by the Sri Siddhartha Academy of Higher Education for the above purpose with Physics, Chemistry and Biology as subjects of study.

OR

4. The vocational higher secondary education course conducted by Vocational Higher Secondary Education, Government of Kerala with five subjects including Physics, Chemistry, Biology and English in addition to vocational subjects conducted is considered equivalent to plus TWO examinations of Government of Karnataka Pre University Course.

OR

5. Candidates with two years diploma from a recognized Government Board in Medical Imaging Technology shall have passed class 12 [10+2] with Physics, Chemistry and Biology, as subjects or candidates with 3 years diploma from a recognized Government Board in Medical Imaging Technology should have studied Physics, Biology and Chemistry as subjects during the tenure of the course.

6. Lateral entry to second year of B.Sc. Medical Imaging Technology for candidates who have passed diploma program from the Government Boards and recognized by SSAHE, fulfilling the conditions specified above under Sl. No. 5 and these students are eligible to take admission on lateral entry system only in the same subject studied at diploma level for the academic year .

### **7. Note:**

a. The candidate shall have passed individually in each of the subjects.

- b. Candidates who have completed diploma or vocational course through Correspondence shall not be eligible for any of the courses mentioned above.

## **2. Duration of the course:**

Duration shall be for a period of four years including one year of Internship.

## **3. Medium of instruction:**

The medium of instruction and examination shall be in English.

## **4. Scheme of examination:**

There shall be three examinations one each at the end of 1st, 2nd and 3rd year.

## **5. Attendance**

Every candidate should have attended at least 80% of the total number of classes conducted in an academic year from the date of commencement of the term to the last working day as notified by university in each of the subjects prescribed for that year separately in theory and practical. Only such candidates are eligible to appear for the university examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A candidate lacking in prescribed percentage of attendance in any subjects either in theory or practical in the first appearance will not be eligible to appear for the University Examination in that subject

### **Internal Assessment (IA):**

#### **1st Year B.Sc. MIT**

Theory - 20 marks

Practical's - 10 marks\*. [Lab work- 06 marks and Record-04 marks]

#### **2nd & 3rd year B.Sc. MIT**

Theory – 20 Marks

Practical's – 20 Marks

There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an academic year. The average marks of the two tests will be calculated and reduced to 20. The marks of IA shall be communicated to the University at least 15 days before the commencement of the University examination. The University shall have access to the records of such periodical tests. The marks of the internal assessment must be displayed on the notice board of the respective colleges within a fortnight from the date test is held. If a candidate is absent for any one of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

There shall be no University Practical Examination in First year.

## **6. Subject and hours of teaching for Theory and Practical's**

The number of hours of teaching theory and practical, subject wise in first year, second year and third year are shown in Table-I, Table-II and Table-III



Main and Subsidiary subjects are common in first year for all the courses in Allied Health Science.

The number of hours for teaching theory and practical for main subjects in first, Second and Third year are shown in Table-I, II and III.

## SCHEME OF CURRICULUM

**Table – I: Distribution of Teaching Hours in First Year**

### Main subjects

| Sl. No | Subjects                                                       | Theory No. of Hours | Practical No. of Hours | Total No. of Hours |
|--------|----------------------------------------------------------------|---------------------|------------------------|--------------------|
| 1      | Human Anatomy                                                  | 70                  | 20                     | 90                 |
| 2      | Physiology                                                     | 70                  | 20                     | 90                 |
| 3      | Biochemistry                                                   | 70                  | 20                     | 90                 |
| 4      | Pathology<br>(Clinical Pathology, Haematology & Blood Banking) | 70                  | 20                     | 90                 |
| 5      | Microbiology                                                   | 70                  | 20                     | 90                 |
|        | <b>Total</b>                                                   | <b>350</b>          | <b>100</b>             | <b>450</b>         |

The classes in main and subsidiary subjects are to be held from Monday to Thursday. On Fridays and Saturday's students shall work in hospitals in the respective specialty or department chosen by them.

### Subsidiary Subjects

English 25 Hours

Kannada 25 Hours

Healthcare 40 Hours

Clinical/Lab posting – 470 hours

(Friday 9am – 1pm and 2pm - 4-30 pm, Saturday 9am - 1pm)

**Table – II: Distribution of Teaching Hours in Second Year Subjects**

### Main subjects

| Sl. No | Subjects                                                                 | Theory No. of Hours | Practical No. of Hours | Total No. of Hours |
|--------|--------------------------------------------------------------------------|---------------------|------------------------|--------------------|
| 1      | Radiation Physics: Medical Physics & Radiation Safety in Radio Diagnosis | 100                 | -                      | 100                |
| 2      | Imaging Physics & Dark Room Techniques                                   | 80                  | -                      | 80                 |

|   |                                         |            |            |            |
|---|-----------------------------------------|------------|------------|------------|
| 3 | Radiographic Positioning and Techniques | 100        | 300        | 400        |
|   | <b>Total</b>                            | <b>280</b> | <b>300</b> | <b>580</b> |

#### **Subsidiary Subjects:**

Sociology - 20 Hours

Constitution of India – 10 Hours

Environmental Science & Health - 10 Hours

**Table - III Distribution of Teaching Hours in Third Year Subjects**

#### **Main subjects**

| <b>Sl. No</b> | <b>Subjects</b>                                  | <b>Theory No. of Hours</b> | <b>Practical No. of Hours</b> | <b>Total No. of Hours</b> |
|---------------|--------------------------------------------------|----------------------------|-------------------------------|---------------------------|
| 1             | Diagnostic Imaging Techniques & Modalities       | 200                        | 300                           | 500                       |
| 2             | Radiographic Special Procedures and Patient Care | 100                        | 300                           | 400                       |
|               | <b>Total</b>                                     | <b>300</b>                 | <b>600</b>                    | <b>900</b>                |

#### **Subsidiary Subjects:**

Ethics, Database Management – 50 Hours

Research & Biostatistics - 20 Hours

Computer application - 10 Hours

### **7. Schedule of Examination:**

The university shall conduct two examinations annually at an interval of not less than 4 to 6 months as notified by the university from time to time. A candidate who satisfies the requirement of attendance, progress and conduct as stipulated by the university shall be eligible to appear for the university examination. Certificate to that effect shall be produced from the Head of the institution along with the application for examination and the prescribed fee.

### **8. Scheme of Examination**

There shall be three examinations, one each at the end of I, II and III year. The examination for both main and subsidiary subjects for all courses in Allied Health Sciences shall be common in the first year. Distribution of Subjects and marks for First Year, second year & Third year University theory and practical Examinations are shown in the Table – IV, V & VI.

#### **First year examination:**

The University examination for 1st year shall consist of only theory examination and there shall be no University Practical Examination.

## Second- & Third-year examination:

The University examination for 2nd and 3rd year shall consist of Written Examination & Practical.

### Written Examinations consists of

05 papers in the 1st

year 03 papers in the

2nd Year

03 papers in the 3rd Year.

### Practical examination:

One practical examination at the end 2nd year and two practical examinations at the end of the 3rd year.

**TABLE-IV**

### Distribution of Subjects and marks for First Year University Theory Examination

| Sl. No. | Main Subjects*                      | Written Paper |       | I A Theory | Total |
|---------|-------------------------------------|---------------|-------|------------|-------|
|         |                                     | Duration      | Marks | Marks      | Marks |
| 1       | Basic Anatomy (Including Histology) | 3 Hours       | 80    | 20         | 100   |
| 2       | Physiology                          | 3 Hours       | 80    | 20         | 100   |
| 3       | Biochemistry                        | 3 Hours       | 80    | 20         | 100   |
| 4       | Pathology                           | 3 Hours       | 80    | 20         | 100   |
| 5       | Microbiology                        | 3 Hours       | 80    | 20         | 100   |
|         | <b>Subsidiary Subject**</b>         |               |       |            |       |
| 1       | English                             | 3 Hours       | 80    | 20         | 100   |
| 2       | Kannada                             | 3 Hours       | 80    | 20         | 100   |
| 3       | Health Care                         | 3 Hours       | 80    | 20         | 100   |

**Note:** I A = Internal Assessment

\*Main Subjects shall have University Examination.

There shall be no University Practical Examination.

\*\*Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

**TABLE – V**

### Distribution of Subjects and marks for Second Year Examination of B.Sc. MIT

| Sl. No. | Main Subjects* | Theory     |    |           |                 | Practical's |           | Grand Total |
|---------|----------------|------------|----|-----------|-----------------|-------------|-----------|-------------|
|         |                | Univ. Exam | IA | Sub Total | Univ. Practical | IA          | Sub Total |             |
|         | Subject        |            |    |           |                 |             |           |             |

|    |                                                                                   |    |    |     |               |    |     |     |
|----|-----------------------------------------------------------------------------------|----|----|-----|---------------|----|-----|-----|
| 1. | Radiation Physics:<br>Medical Physics &<br>Radiation Safety in Radio<br>Diagnosis | 80 | 20 | 100 | -----         | -- | --- | 100 |
| 2. | Imaging Physics & Dark<br>Room Techniques                                         | 80 | 20 | 100 | 80<br>(40+40) | 20 | 100 | 200 |
| 3. | Radiographic Positioning<br>and Techniques                                        | 80 | 20 | 100 | -----         | -- | --- | 100 |

**Distribution of Subsidiary Subjects and marks for Second Year Examination of B.Sc. MIT**

| Sl. No. | Subsidiary Subject             | Duration | Marks | I A Theory Marks | Total Marks |
|---------|--------------------------------|----------|-------|------------------|-------------|
| 1       | Sociology                      | 3 Hours  | 80    | 20               | 100         |
| 2       | Constitution of India          | 3 Hours  | 80    | 20               | 100         |
| 3       | Environmental Science & Health | 3 Hours  | 80    | 20               | 100         |

\*\*\*Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

**TABLE - VI**

**Distribution of Subjects and marks for Third Year Examination of B.Sc. MIT**

| Sl. No. | Subject                                          | Theory     |            |      |           | Practical's     |      |           | Grand Total |
|---------|--------------------------------------------------|------------|------------|------|-----------|-----------------|------|-----------|-------------|
|         |                                                  | Univ. exam | Viva Voice | IA   | Sub Total | Univ. Practical | IA   | Sub Total |             |
| 1.      | Diagnostic Imaging Techniques & Modalities       | 80         | --         | 20   | 100       | 80<br>(40+40)   | 20   | 100       | 200         |
| 2.      | Radiographic Special Procedures and Patient Care | 80         | --         | 20   | 100       | -----           | ---- | ----      | 100         |
| 3.      | Radiographic Positioning and Special Procedures  | -----      | -----      | ---- | -----     | 80<br>(40+40)   | 20   | 100       | 100         |

**Distribution of Subsidiary Subjects and marks for Third Year Examination of B.Sc. MIT**

| Sl. No. | Subsidiary Subject** | Duration | Marks | I A Theory Marks | Total Marks |
|---------|----------------------|----------|-------|------------------|-------------|
|---------|----------------------|----------|-------|------------------|-------------|

|   |                             |         |    |    |     |
|---|-----------------------------|---------|----|----|-----|
| 1 | Ethics, Database Management | 3 Hours | 80 | 20 | 100 |
| 2 | Research & Biostatistics    | 3 Hours | 80 | 20 | 100 |
| 3 | Computer Application        | 3 Hours | 80 | 20 | 100 |

\*\* Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

## **9. Pass criteria**

### **9.1. First year examination**

- a. Main Subjects: A candidate is declared to have passed in a subject, if he/she secures, 50% of marks in University Theory exam and internal assessment added together.
- b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

### **9.2. Second- and Third-year Examination**

- a. Main Subjects: A candidate is declared to have passed the examination in a subject if he/she secures 50% of the marks in Theory and 50% in practical separately. For a pass in theory, a candidate has to secure a minimum of 40% marks in the University conducted written examination, and 50% in aggregate in the University conducted written examination and internal assessment added together and for pass in Practical, a candidate has to secure a minimum of 40% marks in the university conducted Practical/Clinical examination and 50% in aggregate i.e. University conducted Practical/Clinical and Internal Assessment.
- b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

## **10. Carry over benefit**

### **10.1 First year examination:**

A candidate who fails in any two of the five main subjects of first year shall be permitted to carry over those subjects to second year. However, he/ she must pass the carry over subjects before appearing for second year examination.

### **10.2. Second year examination:**

A candidate is permitted to carry over any one main subject to the third year but shall pass this subject before appearing for the third-year examination.

## 11. Declaration of Class

- a. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with Distinction.
- b. A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 60% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in First Class.
- c. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than 60% of grand total marks prescribed will be declared to have passed the examination in Second Class.
- d. A candidate passing the university examination in more than one attempt shall be placed in Pass class irrespective of the percentage of marks secured by him/her in the examination.
- e. The marks obtained by a candidate in the subsidiary subjects shall not be considered for award of Class or Rank.

[Please note, fraction of marks should not be rounded off clauses (a), (b) and (c)]

## 14. Eligibility for the award of Degree:

A candidate shall have passed in all the subjects of first, second and third year to be eligible for a compulsory 12 months of rotational internship. On completion of 12 months of the internship with pass criteria in outgoing clinical assessment exams the candidate is then eligible for the award of degree

## 15. Distribution of Type of Questions and Marks

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>First year</b> ) |                  |                          |
|------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                          | No. of Questions | Marks for Each Questions |
| Long Essay                                                 | 1                | 10                       |
| Short Essay                                                | 5                | 5                        |
| Short Notes Type                                           | 5                | 3                        |
| Short Answer Type                                          | 10               | 2                        |
| MCQ's                                                      | 10               | 1                        |

- |                                                     |                  |
|-----------------------------------------------------|------------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks   |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks   |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks   |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks   |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks   |
|                                                     | <b>Total= 80</b> |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Second and Third Year</b> ) |                  |                          |
|-----------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                     | No. of Questions | Marks for Each Questions |
| Long Essay                                                            | 1                | 10                       |
| Short Essay                                                           | 5                | 5                        |
| Short Notes Type                                                      | 5                | 3                        |
| Short Answer Type                                                     | 10               | 2                        |
| MCQ's                                                                 | 10               | 1                        |

- |                                                     |                  |
|-----------------------------------------------------|------------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks   |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks   |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks   |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks   |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks   |
|                                                     | <b>Total= 80</b> |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Subsidiary subjects</b> ) |                  |                          |
|---------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                   | No. of Questions | Marks for Each Questions |
| Essay Type                                                          | 3 (2 x 10)       | 10                       |
| Short Essay Type                                                    | 8 (6 x 5)        | 05                       |
| Short Answer Type                                                   | 12 (10 x 3)      | 03                       |

# First Year B.Sc. Medical Imaging Technology

## ANATOMY

Theory: 70 hours

Practical's: 20 hours

### **Chapter 1: Introduction:**

#### **Theory:**

- *Definition of anatomy and its divisions*
- Terms of location, positions and planes
- Epithelium-definition, classification, describe with examples, function
- Glands- classification, describe serous, mucous & mixed glands with examples
- Basic tissues – classification with examples

#### **Practical:**

- Histology of types of epithelium
- Histology of serous, mucous & mixed salivary gland

### **Chapter 2: Connective tissue:**

#### **Theory:**

- Cartilage – types with example & histology theory
- Bone – Classification, names of bone cells, parts of long bone, microscopy of compact bone, names of all bones, vertebral column, intervertebral disc, fontanelles of fetal skull
- Joints – Classification of joints with examples, synovial joint (in detail for radiology)



- Muscular system: Classification of muscular tissue & histology
- Names of muscles of the body

### **Practical:**

- Histology of the 3 types of cartilage
- Histology of compact bone (TS & LS)
- Histology of skeletal (TS & LS) & cardiac muscle
- Demo of all bones showing parts, radiographs of normal bones & joints
- Demonstration of important muscles of the body

## **Chapter 3: Cardiovascular system:**

### **Theory:**

- Heart-size, location, chambers, exterior & interior, pericardium
- Blood supply of heart
- Systemic & pulmonary circulation
- Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery
- Inferior vena cava, portal vein, portosystemic anastomosis, Great saphenous vein, Dural venous sinuses
- Lymphatic system- cisterna chyli & thoracic duct, Histology of lymphatic tissues, Names of regional lymphatics, axillary and inguinal lymph nodes in brief

### **Practical:**

- Demonstration of heart and vessels in the body
- Histology of large artery & vein, medium sized artery & vein
- Histology of lymph node, spleen, tonsil & thymus
- Radiology: Normal chest radiograph showing heart shadows

## **Chapter 4: Gastro-intestinal system**

### **Theory:**

- Parts of GIT: Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring), Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas, spleen, peritoneum & reflections

### **Practical:**

- Demonstration of parts of GIT
- Radiographs of abdomen

## **Chapter 5: Respiratory system**

**Theory:**

- Parts of RS: nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments, diaphragm
- Histology of trachea, lung and pleura
- Names of paranasal air sinuses

**Practical:**

- Demonstration of parts of respiratory system.
- Normal radiographs of chest, X-ray paranasal sinuses
- Histology of lung and trachea

**Chapter 6: Urinary system:****Theory:**

- Kidney, ureter, urinary bladder, male and female urethra
- Histology of kidney, ureter and urinary bladder **Practical:**
- Demonstration of parts of urinary system
- Histology of kidney, ureter, urinary bladder
- Radiographs of abdomen-IVP, retrograde cystogram

**Chapter 7: Reproductive system:****Theory:**

- Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology)
- Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology) •
- Mammary gland – gross

**Practical:**

- Demonstration of section of male and female pelvis with organs in situ
- Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes, ovary
- Radiographs of pelvis – hysterosalpingogram

**Chapter 8: Endocrine glands:****Theory:**

- Names of all endocrine glands in detail on pituitary gland, thyroid gland & suprarenal gland – (gross & histology)

**Practical:**

- Demonstration of the glands
- Histology of pituitary, thyroid, parathyroid, suprarenal glands

## **Chapter 9: Nervous system:**

### **Theory:**

- Neuron & Classification of NS
- Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (gross & histology) Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei
- Blood supply of brain
- Cranial nerves
- Sympathetic trunk & names of parasympathetic ganglia

### **Practical:**

- Histology of peripheral nerve & optic nerve
- Demonstration of all plexuses and nerves in the body
- Demonstration of all part of brain
- Histology of cerebrum, cerebellum, spinal cord

## **Chapter 10: Sensory organs:**

### **Theory:**

- Skin: Skin-histology & Appendages of skin
- Eye: Parts of eye & lacrimal apparatus, Extra-ocular muscles & nerve supply
- Ear: parts of ear- external, middle and inner ear and contents

### **Practical:**

- Histology of thin and thick skin
- Demonstration and histology of eyeball
- Histology of cornea & retina

## **Chapter 11: Embryology:**

### **Theory:**

- Spermatogenesis & oogenesis
- Ovulation, fertilization
- Fetal circulation
- Placenta

## **INTERNAL ASSESSMENT:**

|                                             |    |
|---------------------------------------------|----|
| <b>Theory:</b> Average of 2 exams conducted | 20 |
| <b>Practical's:</b> Record and lab work*    | 10 |

\*There shall be no university practical examination and internal assessment marks secured in Practical's need not be sent to the university.

## **REFERENCE BOOKS:**

1. William Davis (P) understanding Human Anatomy and Physiology – McGraw Hill
2. Chaurasia- A Text Book of Anatomy
3. T. S. Ranganathan- A Text Book of Human Anatomy
4. Fattana, Human Anatomy (Description and applied) - Saunder's & C P Prism Publishers, Bangalore
5. ESTER. M. Grishcimer- Physiology & Anatomy with Practical Considerations, J. P. Lippin Cott. Philadelphia
6. Bhatnagar- Essentials of Human Embryology- Revised Edition. Orient Blackswan Pvt. Ltd.

# PHYSIOLOGY

Theory - 70 hours

Practical - 20hours

## 1. General Physiology

- Introduction to cell physiology, transport across cell membrane, Homeostasis.
- Body Fluid compartment & measurement.

## 2. Blood

- Introduction- composition and function of blood Plasma proteins, types and functions
- Red blood cells - erythropoiesis, stages of differentiation, factors affecting it, function, normal count, physiological variation.
- Hemoglobin- function, concentration, types & methods of Hb estimation, fate of hemoglobin  
Jaundice- types Anemia, - types
- ESR, PCV, osmotic fragility & blood indices
- WBC- morphology, production, functions, normal count, differential count, variation, variation  
Immunity (in brief)
- Platelets- origin, morphology, normal count, function-Platelet plug, bleeding disorder
- Haemostasis - definition, normal haemostasis, clotting factors, mechanism of clotting, anticoagulants  
disorders of clotting factors.
- Blood group-ABO & Rh system, Rh incompatibility blood typing, cross matching, hazards of  
mismatched blood transfusion
- RES, spleen and lymph.

## 3. Nerve-Muscle

- Neuron structure, types, neuroglia-types, nerve fiber classification, properties of nerve fibers,  
RMP, action potential, wallerian degeneration
- NMJ, blockers, Myasthenia gravis
- Classification of muscle, structure of skeletal muscle, sarcomere, contractile proteins, Excitation,  
contraction, coupling, mechanism of muscle contraction, types of contraction, Motor unit,  
fatigue, rigor mortis, Smooth muscle.

## 4. Respiratory system

- Physiological anatomy of respiratory system, muscles of respiration, respiratory & non  
respiratory functions of lungs, dead space
- Mechanics of breathing, intrapulmonary & pleural pressures Compliance, Surfactant, Hyaline  
membrane disease
- Lung volumes and capacities
- Respiratory membrane, transport of O<sub>2</sub> & CO<sub>2</sub>

- Chemical regulation of respiration Neural regulation of respiration Hypoxia, Acclimatization, Dysbarism. Artificial respiration
- Definition-Periodic breathing, dyspnoea, apnoea, asphyxia, cyanosis.

## **5. Cardiovascular system**

- Introduction to CVS & general principles of circulation Properties of Cardiac muscle Cardiac cycle, heart sounds, Pulse Cardiac output, factors and measurement Heart rate
- BP-factors, measurement, Short term regulation Intermediate and long-term regulation of BP
- ECG uses and significance, normal waveform, heart block Coronary circulation, Cutaneous circulation- Triple response Shock
- Effects of exercise on CVS and Respiratory system.

## **6. Renal system, Skin and body temperature**

- Kidneys- functions, structure of nephron, type, juxtaglomerular apparatus-structure and function, non- excretory functions of kidney.
- Glomerular filtration rate (GFR)- Definition, normal value, factors affecting GFR Tubular reabsorption - sites, substance reabsorbed, mechanisms of reabsorption Tubular secretion-sites, substance secreted, mechanisms of reabsorption.
- Counter current mechanism of concentration of urine Obligatory and Facultative reabsorption of water Micturition reflex, Diuretics.
- Artificial kidney, renal function tests-clearance tests
- Skin -structure and function, body temperature measurement, physiological variation.
- Regulation of body Temperature by physical chemical and nervous mechanisms-Role of Hypothalamus Hypothermia and fever.

## **7. Digestive system**

- Physiological anatomy, Enteric nervous system & functions of GIT Saliva- composition, regulation, disorder.
- Deglutition- stages & disorders
- Stomach-functions, composition and regulation of gastric juice Gastric motility, MMC, vomiting reflex. Pancreas- function, composition and regulation of pancreatic juice
- Liver & gall bladder-functions, bile- composition, secretion and regulation Small intestine-Succus entericus-composition, functions & movements Large intestine- functions, movements and defecation reflex
- Digestion & absorption of Carbohydrates, fats and proteins.

## **8. Endocrine system**

- Classification of Endocrine glands & their hormones & properties-chemistry and receptor, feedback mechanisms of hormone regulation.
- Anterior pituitary hormones- secretion, functions, disorders Posterior pituitary hormones-secretion, functions, disorders Thyroid hormones- secretion, functions, disorders
- Parathyroid hormones- secretion, functions, disorders Calcium homeostasis & disorders Pancreatic hormones, -Insulin and Glucagon secretion, functions, disorders
- Adrenal cortex- Glucocorticoids & Mineralocorticoids, Androgen - secretion, functions, disorders Adrenal medulla- secretion, functions, disorders Thymus & Pineal gland.

## 9. Reproductive system

- Introduction to reproductive system, sex differentiation & Puberty Male reproductive system, functions of testosterone & Spermatogenesis
- Female reproductive system, functions of Estrogen, Progesterone, Oogenesis Ovulation & Menstrual cycle Physiological changes during pregnancy, pregnancy tests, parturition & lactation Male & Female contraceptive methods.

## 10. Central nervous system

- Introduction to CNS, Sensory receptors classification, properties Synapse– classification, properties Sensory pathways: Anterior spin thalamic tract and Posterior column pathway
- Lateral spin thalamic tract, Types of pain, Referred pain, Thalamus; nuclei and function
- Classification of reflexes, Monosynaptic reflex- Stretch reflex, muscle spindle, inverse stretch reflex. Polysynaptic reflex-Withdrawal reflex
- Motor pathways: Pyramidal pathway and functions, UMNL, LMNL Cerebral cortex (Sensory and motor)- functions, Medulla and Pons-functions Cerebellum –functions, disorders
- Basal ganglia-functions, disorders Hypothalamus and Limbic system-functions CSF, lumbar puncture Sleep, EEG,
- Autonomic Nervous System - Sympathetic and parasympathetic distribution and functions.

## 11. Special senses

- Vision –Functional anatomy of eye, visual pathway, lesion Refractive errors, color vision
- Audition – Physiological anatomy of ear, Mechanism of hearing, auditory pathway, deafness Olfaction – modalities, receptor, function, abnormalities
- Gustation-modalities, receptor, function, taste pathway, abnormalities.

### Practical's

- Blood pressure recording auscultation for heart sounds.
- Artificial respiration determination of vital capacity.

### INTERNAL ASSESSMENT

**Theory** - Average of 2 exams conducted  
- 20

**Practical's:** Record and lab work\* - 10

### REFERENCE BOOKS:

1. Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism Publishers
2. Chatterjee (CC) Human Physiology Latest Ed. Vol. 1, Medical Allied Agency
3. Choudhari (Sujith K) Concise Medical Physiology Latest Ed. New Central Book
4. Ganong (William F) Review of Medical Physiology. Latest Ed. Appleton

# BIOCHEMISTRY

No. Theory classes: 70 hours

No. Practical classes: 20 hours

## 1. Carbohydrate Chemistry [3 hours]

- Classification (Definition/ examples for each class)
- Monosaccharides (classification depending upon number of carbon atoms and functional group with examples)
- Disaccharides (Sucrose/ lactose/ maltose and their composition) • Polysaccharides:
  - a) Homopolysaccharides (Structure of starch and glycogen)
  - b) Heteropolysaccharides (Functions).

## 2. Lipid Chemistry [3 hours]

- Definition of lipids
- Functions of lipids in the body
- Classification of lipids (subclasses with examples)
- Definition and Classification of fatty acids
- Essential fatty acids
- Phospholipids and their importance



### **3. Amino-acid and Protein Chemistry [3 hours]**

- General structure of D and L amino acids
- Amino acids; Definition and Classification of amino acids with examples.
- Peptides; definition & Biologically important peptides
- Classification of Proteins based on composition, functions and shape (with examples) • Functions of amino acids and Proteins.

### **4. Nucleotide and Nucleic acid Chemistry [ 3 hours]**

- Nucleosides & Nucleotides
- Nucleic acid Definition & types
- Composition & functions of DNA & RNA
- Structure of DNA (Watson and Crick model)
- Structure of tRNA, & functions of tRNA, rRNA, mRNA
- Difference between DNA and RNA.

### **5. Enzymes [5 hours]**

- Definition & Classification of Enzymes with example • Definitions of Active site, Cofactor (Coenzyme, Activator),
- Proenzyme; Definition and examples (Pepsin & trypsin).

### **6. Digestion and Absorption [ 3 Hours]**

- General characteristics of digestion and absorption,
- Digestion and absorption of carbohydrates, proteins and lipids.

### **7. Carbohydrate Metabolism [ 5 Hours]**

- Glycolysis; Aerobic, Anaerobic, Definition, Site and subcellular site, Steps with all the enzymes and coenzymes at each step, mention the regulatory enzymes, Energetics,
- Citric acid cycle; Pyruvate dehydrogenase complex (reaction and coenzymes), Site and subcellular site, Reactions with all the enzymes and coenzymes, Regulatory enzymes, Energetics
- Significance of HMP Shunt pathway.
- Hyperglycemic and hypoglycemic hormones
- Blood Glucose Regulation.
- Diabetes mellitus (definition, classification, signs and symptoms)
- Glycogen metabolism and gluconeogenesis.

### **8. Lipid Metabolism [ 4 Hours]**

- Introduction to lipid metabolism, Lipolysis
- Beta oxidation of fatty acids; Definition, Site and subcellular site, Activation of palmitic acid, Transport of activated palmitic acid into mitochondria, Reactions, Energetics.
- Name the different ketone bodies. Note on ketosis.

### **9. Amino acid and Protein Metabolism [ 3 Hours]**

- Introduction, transamination, deamination, Fate of ammonia, transport of ammonia, • Urea cycle.

## **10. Vitamins [5 Hours]**

- Definition and classification.
- RDA, sources, coenzyme forms, biochemical functions and disorders for the following watersoluble vitamins: Thiamine, Niacin, Pyridoxine, Cobalamine, Folic acid, Ascorbic acid
- RDA, sources, coenzyme forms, biochemical functions and deficiency disorders for the following fat-soluble vitamins; A and vitamin D.

## **11. Mineral Metabolism [3 Hours]**

- Name the macro/ microminerals
- Iron: Sources, RDA, Functions and Disorders of deficiency and excess
- Calcium and phosphorus: Sources, RDA, functions, normal serum levels and hormones regulating their levels.

## **12. Nutrition [6 hours]**

- Balanced diet (Definition)
- Caloric value; Definition, Caloric values of carbohydrates, proteins and fats
- Total daily caloric requirements of an adult male and female,
- RDA (Definition, standard values for nutrients)
- Basal metabolic rate (BMR); Definition, Magnitude of BMR in men and women, Factors affecting BMR
- Thermic effect/ SDA of food (Definition, values for major macronutrients) • Carbohydrates: Daily dietary requirement.
- Dietary fibers (Definition, functions, importance and their daily requirements)
- Proteins: Daily requirement, Biological value. a. Definition b. Protein used as a standard for this, Protein sources with high and low biological value, Mutual supplementation of proteins (Definition, examples).
- Fats: Daily requirement, Essential fatty acids (Definition, functions, daily requirement and deficiency manifestations), Saturated and unsaturated fatty acids (Definition, sources, examples).
- Malnutrition

## **13. Renal Function Tests [ 2 hours]**

- Name the different tests to assess the kidney functions
- Explain Creatinine clearance & Inulin clearance
- Urinary acidification test

## **14. Radioactive Isotopes [1 hour]**

- Definition, clinical applications
- Biological effects of radiations

## **15. Clinical Biochemistry [ 5 hours]**

- A. Definitions of acid, base, pH and pKa [1 hour]
- B. Buffers • Definition [2 hours]
  - Henderson Hasselbalch equation,
  - Principal buffer systems in the ECF ICF and urine
  - Bicarbonate and phosphate buffer systems (pKa value, normal ratio of base/acid in the plasma)
  - Acidosis & Alkalosis: Definition, classification, causes and biochemical findings, Normal serum levels and condition where they are altered [2 hour]
- Glucose, Protein, urea, uric acid, and creatinine

- Bilirubin, cholesterol
- Serum Electrolytes

## 16. Fundamental Chemistry (1 hour)

- Valency, Molecular weight & Equivalent weight of elements and compounds. Normality, Molarity, Molality.

## 17. Solutions: Definition, use, classification where appropriate, preparation and storage (5 hours)

- Stock and working solutions.
- Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H<sub>2</sub>SO<sub>4</sub>, H<sub>3</sub>PO<sub>4</sub>, CH<sub>3</sub>COOH etc.,)
- Preparation of percent solutions – w/w, v/v w/v (solids, liquids and acids), Conversion of a percent solution into a molar solution
- Saturated and supersaturated solutions
- Standard solutions. Technique for preparation of standard solutions and Storage. E.g: glucose, albumin etc.
- Dilutions- Diluting Normal, Molar and percent solutions. Preparing working standard from stock standard.

## ASSIGNMENT TOPICS

1. Units of measurement
2. Hazards - Physical, Chemical, Biological
3. Arterial blood gas analysis
4. Responsibilities of Health care personnel
5. Biomedical waste management

## PRACTICAL DEMONSTRATION [20 hours]

- Color Reactions of Carbohydrates & amino acids.
- Precipitation Reactions of proteins
- Colorimetry
- Estimation of Blood glucose Folin Wu and enzymatic method
- Estimation of Urea by DAM method

## INTERNAL ASSESSMENT

**Theory:** Average of 2 exams conducted - 20

**Practical's:** Record and lab work\* - 10

\*There shall be no university practical examination and internal assessment marks secured in practical's need not be sent to the university.

## Distribution of Marks for University Theory and Practical Exam

| Theory |           |    |           | Practical's |    |           | Grand Total |
|--------|-----------|----|-----------|-------------|----|-----------|-------------|
| Theory | Viva Voce | IA | Sub Total | Practical's | IA | Sub Total |             |
| 80     | --        | 20 | 100       | *           |    |           | 100         |

## Reference Books

- Biochemistry – 3<sup>rd</sup> revised edition by U Sathyanarayana & U Chakrapani • Textbook of Medical Biochemistry-6<sup>th</sup> Edition by MN Chatterjea & Rana Shinde • Textbook of Medical Laboratory technology 2<sup>nd</sup> edition by Godkar and Godkar.
- Biochemistry-3<sup>rd</sup> edition by Pankaja Naik
- Medical Laboratory technology 6<sup>th</sup> edition by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students-3<sup>rd</sup> edition by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> editions.

## PATHOLOGY

(Clinical Pathology, Hematology and Blood Banking)

Theory - 70 hours

Practical's - 20 hours

### I. Clinical Pathology- Theory

- Introduction to clinical pathology
- Collection, transport, preservation and processing of various clinical specimens
- Urine examination- collection and preservation, Physical, chemical and microscopic examination for abnormal constituents
- Examination of Body fluids
- Examination of Cerebrospinal fluid (CSF)
- Sputum examination
- Examination of feces

## II. **Hematology – Theory**

- Introduction to hematology
- Normal constituents of Blood, their structure and functions
- Collection of Blood samples
- Various anticoagulants used in Hematology
- Hemoglobin estimation, different methods and normal values
- Packed cell volume
- Erythrocyte sedimentation rate
- Normal Haemostasis
- Bleeding time. Clotting time, prothrombin time, Activated partial Thromboplastin time

## III. **Blood Bank- Theory**

- Introduction blood banking
- Blood group system
- Collection and processing of blood for transfusion
- Compatibility testing
- Blood transfusion reactions

## IV. **General Pathology:**

### 1. **Cell injury:**

- a. Definition, causes.
- b. Cellular adaptations – Hypertrophy, hyperplasia, atrophy and metaplasia.
- c. Types of cell injury – Reversible and irreversible; morphology of reversible injury.
- d. Necrosis – Definition and patterns of tissue necrosis.
- e. Intracellular accumulations – Lipids, cholesterol, proteins, glycogen and pigments; examples.
- f. Pathologic calcification – Types and examples.

### 2. **Inflammation:**

- a. Definition and signs of inflammation.
- b. Types – Acute and chronic inflammation.
- c. Acute inflammation – Causes, morphological patterns and outcome.
- d. Chronic inflammation – Causes, morphology and examples.
- e. Regeneration and repair – Mechanism of cutaneous wound healing.
- f. Factors affecting wound healing.

### 3. **Hemodynamic disorders:**

- a. Edema – Definition, pathogenesis and types: Renal, cardiac, pulmonary and cerebral.
- b. Difference between transudate and exudate.
- c. Shock – Definition, types of shock with examples: Hypovolemic, cardiogenic and septic shock, stages of shock: Nonprogressive, progressive and irreversible.
- d. Thrombosis – Definition, mechanism of thrombus formation (Virchow's triad) and fate of thrombus.
- e. Embolism – Definition and types: Thromboembolism, fat, air and amniotic fluid embolism. f. Infarction – Definition and examples.

### 4. **Immune system:**

- a. Autoimmune diseases – General features, enumerate systemic and organ specific autoimmune diseases.
- b. Systemic lupus erythematosus – Manifestations and diagnosis.

### 5. **Neoplasia:**

- a. Definition and nomenclature of tumors.

- b. Differences between benign and malignant neoplasms.
- c. Enumerate modes of carcinogenesis: Genes, physical, chemical and microbial agents of carcinogenesis.
- d. Modes of spread of tumors.
- e. Clinical aspects of neoplasia.
- f. Grading and staging of cancers.
- g. Laboratory diagnosis of cancer.

## **Practical's**

- 1. Urine analysis- Physical, Chemical, Microscopic
- 2. Blood grouping and Rh typing
- 3. Hb estimation, packed cell volume (PCV), Erythrocyte Sedimentation rate (ESR)
- 4. Bleeding time and Clotting time
- 5. Histopathology - section cutting and H&E staining.

## **INTERNAL ASSESSMENT**

**Theory** - Average of 2 exams conducted 20

**Practical's:** Record and lab work\* 10

\*There shall be no university practical examination and internal assessment marks secured in practical's need not be sent to the university.

### Distribution of Marks for University Theory and Practical Exam

| Theory |           |    |           | Practicals |    |           | Grand Total |
|--------|-----------|----|-----------|------------|----|-----------|-------------|
| Theory | Viva Voce | IA | Sub Total | Practicals | IA | Sub Total |             |
| 80     | --        | 20 | 100       | *          |    |           | 100         |

### REFERENCE BOOKS:

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss- Cytology
4. Winifred Diagnostic cytopathology
5. Orell Cytopathology
6. Todd and Sanford- clinical diagnosis by Laboratory Medicine
7. Dacie and Lewis- Practical Hematology
8. Ramnik SOOD. Lab technology, Methods and interpretation, 4 th edition JP Bros New Delhi, 1996
9. Sathish Guptha, Short textbook of Medical laboratory techniques for technicians
10. Sachdev K N. Clinical Pathology and Bacteriology, 8 th edi JP Bros, New Delhi, 1996.

## MICROBIOLOGY

Theory: 70 Hours

Practical's: 20 Hours

### 1. Introduction (6 hours)

- History of Microbiology - Louis Pasteur, Antony Van Leeuwenhoek, Robert Koch, Edward Jenner, Alexander Fleming.
- Use of microscope in the study of bacteria - Types of microscopes - compound microscope, phase contrast microscope, electron microscope, fluorescent microscope, dark ground microscope.
- Morphology of bacterial cell

### 2. Growth and Nutrition (6 hours)

- Nutrition, growth and multiplication of bacteria, bacterial growth curve, culture media, culture methods, anaerobic culture methods.

### **3. Sterilization and disinfection (8 hours)**

- Principles and use of equipment's of sterilization, chemicals used in disinfection, testing of disinfectants.

### **4. Biomedical waste management principle and practice 5. Immunology (5hours)**

- Immunity - mechanism of immunity, classification, types Vaccines
- Immunization schedule
- Definition of antigen, antibody, list of antigen antibody reaction (no need of detailed account of antigen antibody reactions)
- Definition of hypersensitivity and classification (no need of detailed account of types of hypersensitivity)

### **6. Infection (5 hours)**

- Definition, types and mode of transmission
- Hospital acquired infection - causative agents, mode of transmission and prophylaxis. Antimicrobial sensitivity testing

### **7. Systematic bacteriology (15 hours)**

- Disease caused and laboratory diagnosis of medically important bacteria (Staphylococcus, coagulase negative Staphylococcus, MRSA, Streptococcus pyogenes, Pneumococcus, gonococcus, E.coli, diarrhoeagenic E.coli, Salmonella, Vibrio cholerae, ElTor vibrios, Halophilic vibrios, Shigella, Mycobacterium tuberculosis, Mycobacterium leprae, Atypical Mycobacteria, Treponema pallidum, leptospira)
- (no need of classification, antigenic structure, virulence mechanism)

### **8. Parasitology (10 hours)**

- Introduction to Parasitology
- List of medically important parasites and diseases (E.histolytica, Plasmodium, W.bancrofti, Ascaris, Ancylostoma, B.coli, G.lamblia, T.solium, T.saginata)
- Laboratory diagnosis of parasitic infection (No need of including life cycles)

### **9. Virology (10 hours)**

- Introduction to virology
  - List of medically important viruses and diseases (AIDS, Hepatitis, Rabies, Polio, Arbo viruses)
- Cultivation of viruses and laboratory diagnosis of viral infections.

### **10. Mycology (5 hours)**

- Introduction to Mycology
- Classification of medically important fungi - (based on morphology, spore production, disease production, taxonomy)



- List of medically important fungi and diseases (Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis, Mucor Mycosis) • Laboratory diagnosis of fungal infections.

### Practical's (20 hours)

- Compound microscope (Demonstration) Demonstration of sterilization equipment's
- Demonstration of culture media and culture methods
- Demonstration of antibiotic sensitivity testing
- Demonstration of serological tests - Widal, VDRL, ASO, CRP, RA
- Demonstration of gram stain and ZN staining
- Demonstration of Helminthic ova Grams stain, Acid fast staining Stool exam for Helminthic ova

There shall be no university practical examination and Internal Assessment marks secured in practical's need not be sent to the university.

### INTERNAL ASSESSMENT

**Theory** - Average of 2 exams conducted      **20 Practical's:** Record and lab work\* 10

#### Distribution of Marks for University Theory and Practical Exam

| Theory |           |    |           | Practical's |    |           | Grand Total |
|--------|-----------|----|-----------|-------------|----|-----------|-------------|
| Theory | Viva Voce | IA | Sub Total | Practical's | IA | Sub Total |             |
| 80     | --        | 20 | 100       | *           |    |           | <b>100</b>  |

### Reference Books-

1. Ananthanarayana & Panikar Medical Microbiology- University Press
2. Robert Cruickshank- Medical Microbiology- The Practice of Medical Microbiology
3. Chatterjee- Parasitology- Interpretation to Clinical Medicine
4. Rippon- Medical Mycology
5. Emmons- Medical Mycology
6. Basic Laboratory methods in Parasitology, J P Bros, New Delhi
7. Basic Laboratory procedures in clinical bacteriology, J P Bros, New Delhi
8. Medical Parasitology- Ajit Damle 9. Introduction to medical microbiology- Ananthanarayana- Orient Longman Pvt. Ltd.

# SUBSIDIARY SUBJECTS

## ENGLISH

**COURSE DESCRIPTION:** This course is designed to help the student acquire a good command and comprehension of the English language through individual papers and conferences.

### BEHAVIOURAL OBJECTIVES:

The student at the end of training can

1. Read and comprehend English language
2. Speak and write grammatically correct English
3. Appreciates the value of English literature in personal and professional life.

### UNIT - I: INTRODUCTION:

- Study Techniques
- Organization of effective note taking and logical processes of analysis & synthesis
- Use of the dictionary
- Enlargement of vocabulary
- Effective diction

### UNIT - II: APPLIED GRAMMAR:

- Correct usage
- The structure of sentences
- The structure of paragraphs
- Enlargements of Vocabulary

### UNIT - III: WRITTEN COMPOSITION:

- Precise writing and summarizing
- Writing of bibliography
- Enlargement of Vocabulary

### UNIT - IV: READING AND COMPREHENSION:

- Review of selected materials and express oneself in one's words.
- Enlargement of Vocabulary.

### UNIT - V: THE STUDY OF THE VARIOUS FORMS OF COMPOSITION:

- Paragraph, Essay, Letter, Summary, Practice in writing

### UNIT - VI: VERBAL COMMUNICATION:

- Discussions and summarization, Debates, Oral reports, use in teaching

### **No Practical or Viva voce examination.**

This is a subsidiary subject, examination to be conducted by respective colleges.

Marks required for a pass is 35%.

### **REFERENCE**

- English Grammar Collins, Birmingham University, International Language Data Base, Rupa & Co. 1993
- Wren and Martin - Grammar and Composition, 1989, Chanda & Co, Delhi
- Letters for all Occasions. A S Myers. Pub - Harper Perennial
- Spoken English V. Shasikumar and P V Dhanija. Pub. By: Tata Mcgraw Hill, New Delhi
- Journalism Made Simple D Wainwright
- Writers Basic Bookself Series, Writers Digest series
- Interviewing by Joan Clayton Platkon
- Penguin Book of Interviews.

### **HEALTH CARE**

#### **Teaching Hours: 40**

- Introduction to Health
- Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept.
- National Health Policy
- National Health Programs (Briefly Objectives and scope) Population of India and Family welfare program in India Introduction to Nursing
- What is Nursing? Nursing principles. Inter-Personnel relationships. Bandaging: Basic turns; Bandaging extremities; Triangular Bandages and their application.
- Nursing Position, Bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's positions, comfort measures, Aids and rest and sleep.
- Lifting and Transporting Patients: Lifting patients up in the bed. Transferring from bed to wheelchair. Transferring from bed to stretcher.
- Bed Side Management: Giving and taking Bed pan, Urinal: Observation of stools, urine. Observation of sputum understand use and care of catheters, enema giving.
- Methods of Giving Nourishment: Feeding, Tube feeding, drips, transfusion Care of Rubber Goods
- Recording of body temperature, respiration and pulse, Simple aseptic technique, sterilization and disinfection. Surgical Dressing: Observation of dressing procedures First Aid:
- Syllabus as for Certificate Course of Red Cross Society of St. John's Ambulance Brigade.

#### **Reference Books:**

- Preventive and Social Medicine by J.Park Text Book of P & SM by Park and Park
- Counseling& Communicate skills for medical and health, Bayne- Orient Longman Pvt. Ltd.

**Total=80 marks**

**No Practical or Viva voce examination.**

This is a subsidiary subject, examination to be conducted by respective colleges.

Marks required for a pass is 35%.

# II Year B.Sc. Medical Imaging Technology

## COURSE TITLE

### Theory

- † Radiation Physics: Medical Physics & Radiation Safety in Radio Diagnosis
- † Imaging Physics & Dark Room Techniques
- † Radiographic Positioning and Techniques

### Practical

- † Imaging Physics & Dark Room Technique

## RADIATION PHYSICS: MEDICAL PHYSICS & RADIATION SAFETY IN RADIO DIAGNOSIS

No. of Theory Classes: 100 Hours

### SECTION-A

#### RADIATION PHYSICS

| Unit | Topics                                                                                                                                                                                                                                                                                                                                                                      | No. of Hours | Mode of Teaching                      |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------------------------|
| 1.   | <b>Atomic and Nuclear Physics Review of Ideas on Atomic and Nuclear Physics</b> <ul style="list-style-type: none"><li>• Review of ideas on atomic and nuclear physics</li><li>• Alpha decay, beta decay gamma emission</li><li>• Internal conversion and nuclear isomerism</li><li>• Nuclides and its classification</li><li>• Radio activity</li><li>• Half life</li></ul> | 3            | Lecture<br>Discussion<br>Presentation |
| 2.   | <b>Electromagnetic Radiation</b> <ul style="list-style-type: none"><li>• Electromagnetic spectrum</li><li>• Common properties of electromagnetic radiation</li><li>• Relationship between energy, frequency, wavelength and velocity e.g., x- ray and gamma rays</li></ul>                                                                                                  | 4            | Lecture<br>Discussion<br>Presentation |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |                                       |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------------|
| 3. | <b>Review of X-Rays</b> <ul style="list-style-type: none"> <li>• Properties of X-rays</li> <li>• Production of X-rays</li> <li>• Interaction of X-rays with the target</li> <li>• Spectra of X-rays</li> <li>• Quality and intensity of X-rays</li> <li>• The factors influencing quality and intensity</li> </ul>                                                                                                                                                                                                                           | 5 | Lecture<br>Discussion<br>Presentation |
| 4. | <b>Interactions of X-Rays, Gamma Rays and Beta Rays with Matter</b> <ul style="list-style-type: none"> <li>• Transmission through matter</li> <li>• Law of exponential attenuation</li> <li>• Half value layer</li> <li>• Linear attenuation coefficient</li> <li>• Interaction of radiation with matter</li> <li>• Classical scattering</li> <li>• Compton scattering</li> <li>• Photo electric absorption</li> <li>• Pair production</li> <li>• Practical aspects of radiation absorption and transmission through body tissue.</li> </ul> | 7 | Lecture<br>Discussion<br>Presentation |

## MEDICAL PHYSICS

| Unit | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                             | No. of Hours | Mode of Teaching                      |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------------------------|
| 1.   | <b>Main Power Supply</b> <ul style="list-style-type: none"> <li>• Generation of Electrical Energy</li> <li>• Distribution of Electrical Energy</li> <li>• Generators and transformers</li> <li>• AC and DC power supply with examples</li> <li>• Single phase and poly phase power supply • Switches, fuses, circuit breakers, earthing etc.</li> <li>• Main voltage drop: causes and remedy</li> <li>• Low- and high-tension Cables</li> </ul>    | 7            | Lecture<br>Discussion<br>Presentation |
| 2.   | <b>Rectification</b> <ul style="list-style-type: none"> <li>• Vacuum diode- variation of anode current with anode voltage and filament temperature</li> <li>• Gas filled diode and triode</li> <li>• Principles of rectification</li> <li>• Wave form of half wave and full wave current/voltage wave form</li> <li>• Rectifiers: valves, metal rectifiers, semiconductor rectifiers and relative merits and demerits</li> <li>• Diodes</li> </ul> | 6            | Lecture<br>Discussion<br>Presentation |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |                                       |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------------|
| 3. | <b>X- Ray Circuits</b> <ul style="list-style-type: none"> <li>• Principle of transformers, design efficiency of transformer, source of power loss</li> <li>• H.T generators for x-ray machines</li> <li>• High frequency circuits</li> <li>• Self-rectifier half wave rectifier, bridge rectifier and three phase rectifier circuits</li> <li>• Capacitance filter control and stabilizing equipment</li> <li>• Main voltage compensators and main resistance compensators</li> <li>• Compensation for frequency variation</li> <li>• Control of tube voltage, including kV compensator</li> <li>• High tension selector switch</li> <li>• Filament circuit</li> <li>• Control of tube current, space charge compensation</li> </ul> | 7 | Lecture<br>Discussion<br>Presentation |
| 4. | <b>X- Ray Tube</b> <ul style="list-style-type: none"> <li>• Gas filled x-ray tube: construction, working and limitations; thermionic emission</li> <li>• Stationary anode x-ray tube: construction, working, methods of cooling anode; rating chart and cooling chart</li> <li>• Rotating anode x-ray tube: construction, working &amp;</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                   | 7 | Lecture<br>Discussion<br>Presentation |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |                                       |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------------|
|    | rating chart, speed of anode rotation, angle of anode inclination <ul style="list-style-type: none"> <li>• Dual focus with consideration in choice of focus</li> <li>• Anode heel effect</li> <li>• Grid controlled x-ray tube</li> <li>• Effect of variation of anode voltage and filament temperature</li> <li>• Continuous and characteristic spectrum of x-rays</li> <li>• Inherent filter and added filter; their effect on quality of the spectrum</li> </ul> |   |                                       |
| 5. | <b>Modern x-ray tubes •</b><br>Types in detail                                                                                                                                                                                                                                                                                                                                                                                                                      | 4 | Lecture<br>Discussion<br>Presentation |
| 6. | <b>Filters</b> <ul style="list-style-type: none"> <li>• Definition of filtration</li> <li>• Types of filtration and their effect on quality of the spectrum</li> <li>• Effect of filtration on patient as well as exposure factor <ul style="list-style-type: none"> <li>• Types of filters</li> </ul> </li> </ul>                                                                                                                                                  | 5 | Lecture<br>Discussion<br>Presentation |
| 7. | <b>X- ray beam restrictors</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Functions of restrictors</li> <li>• Radiation protection considerations</li> </ul>                                                                                                                                                                                                                                                                                    | 5 | Lecture<br>Discussion<br>Presentation |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                  |   |                                       |
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| 8. | <b>Grids</b> <ul style="list-style-type: none"> <li>• Definition and types</li> <li>• Evaluation of grid performance</li> <li>• Grid cut-off</li> <li>• Air gap technique</li> </ul>                                                                                                                                                                                                                                             | 4 | Lecture<br>Discussion<br>Presentation |
| 9. | <b>Fluoroscopy</b><br><b>Image intensifier</b> <ul style="list-style-type: none"> <li>• Direct fluoroscopy</li> <li>• Principles of image intensification</li> <li>• Image quality: unsharpness, noise, resolution, distortion</li> <li>• Spectral emission; gas spots</li> <li>• Multi field image intensifiers</li> <li>• Lens system and image distribution</li> <li>• Viewing and recording of fluoroscopic image</li> </ul> | 6 | Lecture<br>Discussion<br>Presentation |

## RADIATION SAFETY IN RADIO DIAGNOSIS

| Unit No. | Topic                                                                                                                                                                                                                                                                                                                                                                                            | No. of Hours | Mode of teaching                      |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------------------------|
| 1.       | <b>Introduction to Radiation Protection</b> <ul style="list-style-type: none"> <li>• Need for protection</li> <li>• Aim of radiation protection</li> <li>• Basic radiation units and quantities</li> <li>• Exposure</li> <li>• Absorbed dose</li> <li>• Absorbed dose equivalent Quality factor • Tissue weighting factor.</li> </ul>                                                            | 5            | Lecture<br>Discussion<br>Presentation |
| 2.       | <b>Limits for Radiation exposure</b> <ul style="list-style-type: none"> <li>• Concept of ALARA (or ALARP)</li> <li>• ICRP regulation</li> <li>• Maximum permissible dose</li> <li>• Exposure in pregnancy, children</li> </ul>                                                                                                                                                                   | 4            | Lecture<br>Discussion<br>Presentation |
| 3.       | <b>Protection in Diagnostic Radiology</b> <ul style="list-style-type: none"> <li>• Protection for primary radiation</li> <li>• Work load</li> <li>• Use factor</li> <li>• Occupancy factor</li> <li>• Protection for scatter radiation and leakage radiation</li> <li>• X-Ray room design</li> <li>• Structural shielding</li> <li>• Protective devices</li> <li>• Radiation signages</li> </ul> | 5            | Lecture<br>Discussion<br>Presentation |



|    |                                                                                                                                                                                                                                                                                                                                                                                                                                  |   |                                       |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------------|
| 4. | <b>Technical Protective Consideration During Radiography</b> <ul style="list-style-type: none"> <li>• Evaluation of hazards</li> <li>• Effective communication</li> <li>• Immobilization</li> <li>• Beam limiting devices</li> <li>• Filtration</li> <li>• Exposure factors</li> <li>• Protection in</li> <li>• Fluoroscopy</li> <li>• Mammography,</li> <li>• Mobile radiography CT Scan</li> <li>• Angiography room</li> </ul> | 6 | Lecture<br>Discussion<br>Presentation |
| 5. | <b>Radiation measuring instruments</b> <ul style="list-style-type: none"> <li>• Area monitoring</li> <li>• Ionization chamber</li> <li>• G M counter</li> <li>• Scintillation detector</li> <li>• Photo film method</li> <li>• Pocket dosimeter</li> <li>• Personnel dosimeters</li> </ul>                                                                                                                                       | 5 | Lecture<br>Discussion<br>Presentation |
|    | <ul style="list-style-type: none"> <li>• Film badge</li> <li>• TLD</li> <li>• Solid state detectors</li> <li>• Chemical dosimeters</li> <li>• Exposure meters and rate meters</li> <li>• Measurement of half value layer</li> </ul>                                                                                                                                                                                              |   |                                       |
| 6. | <b>Biological aspects of Radiological protection</b> <ul style="list-style-type: none"> <li>• Direct &amp; Indirect actions of radiation</li> <li>• Concept of detriment – Deterministic &amp; stochastic effect of radiation – somatic and genetic effects.</li> </ul>                                                                                                                                                          | 5 | Lecture<br>Discussion<br>Presentation |

## Reference Books:

1. Christensen, Curry and Dowdey: An Introduction of The Physics of Diagnostic Radiology (Lea Febiger) 2nd Ed.
2. D.N. And M.O. Chesney, X-Ray Equipment for Student Radiographers (Cbs)
3. W.J. Meredith & J.B. Massey: Fundamental Physics of Radiology. (Varghese Publishing House). 4. Faiz M. Khan, Physics of Radiation Therapy (Williams & Wilkins)
4. S.S. Kapoor & Ramamoorthy; Nuclear Radiation Detectors.

## IMAGING PHYSICS AND DARKROOM TECHNIQUES

No. of Theory Classes: 80 Hours

| Unit No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                    | No. of Hours | Mode of teaching                      |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------------------------|
| 1.       | <b>Image Characteristics</b> <ul style="list-style-type: none"><li>• Definition</li><li>• Reflected, transmitted and emitted light image</li><li>• Noise (fog, quantum noise), SNR, contrast, optimum contrast, sharpness</li><li>• Resolution</li></ul>                                                                                                                                                  | 4            | Lecture<br>Discussion<br>Presentation |
| 2.       | <b>Radiographic Image Quality</b> <ul style="list-style-type: none"><li>• Density</li><li>• Noise</li><li>• Contrast</li><li>• Sharpness</li><li>• Resolution</li><li>• Magnification &amp; Distortion</li></ul> <b>Exposure Factors</b> <ul style="list-style-type: none"><li>• Milliampere seconds</li><li>• Kilovoltage</li><li>• Focus to film distance</li><li>• Secondary radiation Grids</li></ul> | 4            | Lecture<br>Discussion<br>Presentation |
| 3.       | <b>The invisible X-ray image</b> <ul style="list-style-type: none"><li>• Latent image</li><li>• Subject contrast</li><li>• Differential attenuation</li><li>• Effects of scatter and its control</li><li>• Geometric &amp; motion unsharpness</li></ul>                                                                                                                                                   | 4            | Lecture<br>Discussion<br>Presentation |

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| 4. | <b>Photographic principle</b> <ul style="list-style-type: none"> <li>• Photographic effect</li> <li>• Photosensitive chemicals: latent image formation</li> <li>• Manufacture of emulsion: light and x-ray sensitive emulsion</li> <li>• Describing photographic performance: density, log relative exposure</li> <li>• The characteristic curve</li> <li>• Sensitometry</li> </ul> | 4 | Lecture<br>Discussion<br>Presentation |
| 5. | <b>The recording system: film material</b> <ul style="list-style-type: none"> <li>• Film construction</li> <li>• Film base, subbing layer, emulsion, super coat, backing layers</li> <li>• Crossover effect; irradiation</li> <li>• Types of films</li> <li>• Screen &amp; Non-screen films</li> <li>• Single emulsion films</li> <li>• Duplitized films</li> </ul>                 | 4 | Lecture<br>Discussion<br>Presentation |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                       |   |                                       |
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|     | <ul style="list-style-type: none"> <li>• CRT films •</li> <li>Film storage</li> </ul>                                                                                                                                                                                                                                                                                                                                 |   |                                       |
| 6.  | <b>The recording system: intensifying screens</b> <ul style="list-style-type: none"> <li>• Luminescence</li> <li>• Screen unsharpness</li> <li>• Screen construction</li> <li>• Phosphors</li> <li>• Quantum detection &amp; conversion efficiency</li> <li>• Types of screen</li> <li>• Intensifying factor: quantum mottle</li> <li>• Factors affecting speed and unsharpness</li> <li>• Care of screens</li> </ul> | 4 | Lecture<br>Discussion<br>Presentation |
| 7.  | <b>The recording system: film cassettes</b> <ul style="list-style-type: none"> <li>• Cassette construction and ideal features</li> <li>• Types of cassettes</li> <li>• Care of cassettes; loading and unloading cassettes •</li> <li>Special cassettes</li> </ul>                                                                                                                                                     | 4 | Lecture<br>Discussion<br>Presentation |
| 8.  | <b>Factors effecting image quality</b> <ul style="list-style-type: none"> <li>• Radiographic image.</li> <li>• Geometry of the radiographic image</li> </ul>                                                                                                                                                                                                                                                          | 4 | Lecture<br>Discussion<br>Presentation |
| 9.  | <b>The processing area</b> <ul style="list-style-type: none"> <li>• Siting and function of the processing area</li> <li>• Darkroom design and construction</li> <li>• Darkroom illumination</li> <li>• Darkroom equipments: manual &amp; automatic processors</li> <li>• Health and safety in Dark room</li> <li>• COSHH regulations</li> </ul>                                                                       | 4 | Lecture<br>Discussion<br>Presentation |
| 10. | <b>Photographic processing: Principles -1 (Manual Processing)</b> <ul style="list-style-type: none"> <li>• Acidity, alkalinity and pH •      Development:</li> <li>• Developer solution &amp; activity</li> <li>• Fixing: fixing solution and activity</li> <li>• Washing &amp; Drying</li> </ul>                                                                                                                     | 6 | Lecture<br>Discussion<br>Presentation |

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|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------------|
| 11. | <b>Photographic processing: principles - 2 (Auto processors)</b> <ul style="list-style-type: none"> <li>Film transport, cycle time, capacity</li> <li>Feed section</li> <li>Developer section</li> <li>Fixer section</li> <li>Washing section</li> <li>Drying section</li> <li>Stand by mode</li> <li>Replenishment; auto mixers</li> <li>Auto processors for special films</li> <li>Care &amp; maintenance of the auto processors</li> </ul> | 6 | Lecture<br>Discussion<br>Presentation |
| 12. | <b>Silver recovery</b> <ul style="list-style-type: none"> <li>Justification for silver recovery</li> <li>Amounts of silver in fixer</li> <li>Electrolytic recovery; high current systems</li> <li>Recovering silver deposit; recycling fixer</li> <li>Monitoring efficiency; comparison of methods</li> <li>Silver recovery from scrap films</li> </ul>                                                                                       | 4 | Lecture<br>Discussion<br>Presentation |
| 13. | <b>Film artifacts</b> <ul style="list-style-type: none"> <li>Definition</li> <li>Causes</li> <li>Types</li> </ul>                                                                                                                                                                                                                                                                                                                             | 4 | Lecture<br>Discussion<br>Presentation |
| 14. | <b>Macro radiography</b> <ul style="list-style-type: none"> <li>Definition</li> <li>Principle</li> <li>Unsharpness</li> <li>Scattered radiation</li> <li>Cassette support</li> <li>Examples of macro radiography</li> </ul>                                                                                                                                                                                                                   | 4 | Lecture<br>Discussion<br>Presentation |

## Practical

There shall be a university practical examination in the subject of Imaging Physics and Darkroom Techniques for 100 marks.

The internal assessment is for 20 marks.

### Pattern for Practical Examination:

| Sl. No.      | Particulars        | Marks     |
|--------------|--------------------|-----------|
| 1            | Practical Exercise | 40        |
| 2            | Viva-Voce          | 40        |
| <b>Total</b> |                    | <b>80</b> |

## Reference books:

1. D.N. Chesney & M.O Chesney: radiographic imaging (CBS)
2. I.C.R.P.: Protection of the patient in medical radiography (Bergaman)
3. Derrick p. Roberts & Nigel I. Smith: radiographic imaging a practical approach (Churchill Uvingstone)
4. Stewart c. Buchong: radiological science (workbook and laboratory manual)
5. Kodak: fundamentals of radiographic photography books 1,2,3,4,5 (kodak ltd.)
6. Seeman & herman: physical and photography principles of medical radiography (Wiley)
7. Hford: Manual of photography Bouthworth & bently: elementary photogenic chemistry (pitmans)

## RADIOGRAPHIC POSITIONING AND TECHNIQUES

No. of Theory Classes: 100 Hours

No. of Practical Classes: 300 Hours

| Unit No. | Topics                                                                                                                                                          | No. of Hours | Mode of teaching                      |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------------------------|
| 1.       | <b>Introduction</b> <ul style="list-style-type: none"><li>• Anatomical Terminology</li><li>• Positioning Terminology</li><li>• Projection Terminology</li></ul> | 2            | Lecture<br>Discussion<br>Presentation |

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| 2. | <b>Shoulder girdle</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> </ul> <b>Basic and special projections</b><br><b>Shoulder non-trauma routine</b> <ul style="list-style-type: none"> <li>• AP (external rotation)</li> <li>• AP (internal rotation)</li> <li>• Superior-inferior (axial view)</li> <li>• Inferio-superior axial (Lawrence method)</li> <li>• Inferio-superior shoulder projection (west point method)</li> <li>• Posterior oblique – glenoid cavity (grashey method)</li> <li>• Intertubercular groove (fisk method)</li> </ul> <b>Shoulder (trauma routine)</b> <ul style="list-style-type: none"> <li>• AP neutral rotation</li> <li>• Transthoracic lateral (Lawrence method)</li> <li>• Tangential projection - supraspinatus outlet (neer method)</li> <li>• Apical oblique projections (garth method)</li> <li>• Clavicle</li> <li>• AP and AP axial</li> <li>• Acromioclavicular joints:</li> <li>• AP bilateral with and without weight</li> <li>• Sternoclavicular joints (PA, RAO, LAO)</li> <li>• Scapula</li> <li>• AP</li> <li>• Scapula Y view</li> <li>• Lateral recumbent</li> </ul> | 8 | Lecture<br>Discussion<br>Presentation |
| 3. | <b>Humerus</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• AP</li> <li>• LAT</li> <li>• Horizontal beam LAT</li> <li>• Proximal humerus views</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2 | Lecture<br>Discussion<br>Presentation |
| 4. | <b>Elbow</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• AP- fully extended, partially flexed</li> <li>• AP oblique- external and internal rotation</li> <li>• Lateral</li> <li>• Acute flexion (jones method)</li> <li>• Trauma axial lateral (coyle method)</li> <li>• Radial head lateral</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2 | Lecture<br>Discussion<br>Presentation |
| 5. | <b>Forearm</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• AP</li> <li>• LAT</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 8 | Lecture<br>Discussion<br>Presentation |

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| 6.  | <b>Wrist</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• PA, AP</li> <li>• PA oblique</li> <li>• Lateral</li> <li>• PA scapula views</li> <li>• Radial deviation, ulnar deviation</li> <li>• Carpal canal- inferiosuperior (gaynor-hart method) • Carpel bridge</li> </ul> | 4 | Lecture<br>Discussion<br>Presentation |
| 7.  | <b>Hand</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• PA</li> <li>• PA oblique</li> <li>• Lateral</li> <li>• Lateral- flexion and extension</li> <li>• AP bilateral oblique (norgaard method)</li> </ul>                                                                 | 2 | Lecture<br>Discussion<br>Presentation |
| 8.  | <b>Fingers</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• PA</li> <li>• Oblique</li> <li>• LAT</li> </ul>                                                                                                                                                                 | 2 | Lecture<br>Discussion<br>Presentation |
| 9.  | <b>Thumb</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• AP</li> <li>• PA oblique</li> <li>• Lateral</li> <li>• AP (Roberts method)</li> <li>• Skiers thumb (folio method)</li> </ul>                                                                                      | 2 | Lecture<br>Discussion<br>Presentation |
| 10. | <b>Femur</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• Mid and distal femur</li> <li>• AP</li> <li>• Lateral</li> <li>• Mid and proximal femur</li> <li>• AP</li> <li>• Lateral</li> </ul>                                                                               | 2 | Lecture<br>Discussion<br>Presentation |

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| 11. | <b>Knee</b> <ul style="list-style-type: none"> <li>• • Related radiological anatomy</li> <li>• • Knee</li> <li>• • AP</li> <li>• • Oblique- medial and lateral rotations</li> <li>• Lateral</li> <li>• Skyline view</li> <li>• AP (weight bearing)</li> <li>Knee- intercondylar fossa</li> <li>PA axial (camp coventry and holmblad method)</li> <li>AP axial</li> </ul> | 2 | Lecture<br>Discussion<br>Presentation |
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| 12. | <b>Leg</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• AP</li> <li>• LAT</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2 | Lecture<br>Discussion<br>Presentation |
| 13. | <b>Ankle</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• AP</li> <li>• AP mortise (15° oblique)</li> <li>• Lateral</li> <li>• AP stress</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2 | Lecture<br>Discussion<br>Presentation |
| 14. | <b>Foot</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• AP</li> <li>• Oblique</li> <li>• Lateral</li> <li>• AP and lateral weight bearing</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2 | Lecture<br>Discussion<br>Presentation |
| 15. | <b>Calcaneus</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• Planto-dorsal (axial)</li> <li>• Lateral</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2 | Lecture<br>Discussion<br>Presentation |
| 16. | <b>Pelvic girdle and proximal femur</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> </ul> <p><b>Basic &amp; special projections</b></p> <ul style="list-style-type: none"> <li>• Pelvic girdle</li> <li>• AP pelvis</li> <li>• Frog lateral (modified cleaves method)</li> <li>• AP axial for pelvic outlet (taylor method)</li> <li>• AP axial for pelvic inlet (modified linienfield method)</li> <li>• Posterior oblique- acetabulum (judet method)</li> <li>• Hip and proximal femur</li> <li>• AP unilateral hip</li> <li>• Axiolateral, inferosuperior (danelius – miller method)</li> <li>• Unilateral frog leg (modified cleaves method)</li> <li>• Modified axiolateral (clements-nakayama method)</li> <li>• Sacroiliac joints: AP, posterior obliques</li> </ul> | 6 | Lecture<br>Discussion<br>Presentation |
| 17. | <b>Chest</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> </ul> <p><b>Basic &amp; special projections</b></p> <ul style="list-style-type: none"> <li>• PA, LAT</li> </ul> <p><b>Special:</b></p> <ul style="list-style-type: none"> <li>• AP supine &amp; semierect</li> <li>• Lateral decubitus</li> <li>• AP lordotic</li> <li>• Anterior oblique</li> <li>• Posterior oblique</li> <li>• Upper airway: AP, LAT</li> </ul>                                                                                                                                                                                                                                                                                                                                                 | 6 | Lecture<br>Discussion<br>Presentation |



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| 18. | <b>Abdomen</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy • Basic &amp; special projection •</li> <li>Basic:</li> <li>• AP supine (KUB)</li> <li>Special:</li> <li>• PA prone</li> <li>• Lateral decubitus</li> <li>• Erect AP</li> <li>• Dorsal decubitus</li> <li>• Lateral</li> <li>• Acute abdomen: three-way series</li> </ul>                                                                                                                                                          | 6 | Lecture<br>Discussion<br>Presentation |
| 19. | <b>KUB</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• Positioning- AP/Lat</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                              | 3 | Lecture<br>Discussion<br>Presentation |
| 20. | <b>Cervical spine</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• Basic views</li> <li>• AP open mouth (C1 and C2)</li> <li>• AP axial</li> <li>• Oblique</li> <li>• Lateral</li> <li>• Erect</li> <li>• Trauma lateral (horizontal beam)</li> <li>• Cardiothoracic junction (swimmers view)</li> <li>• Special views</li> <li>• Lateral- hyperflexion and hyperextension</li> <li>• AP (fuchs method) or PA (judd method)</li> <li>• AP wagging jaw (ottonello method)</li> </ul> | 8 | Lecture<br>Discussion<br>Presentation |
|     | <ul style="list-style-type: none"> <li>• AP axial (pillars)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |   |                                       |
| 21. | <b>Thoracic spine</b> <ul style="list-style-type: none"> <li>• Related radiographic anatomy</li> <li>• AP</li> <li>• Lateral</li> <li>• Oblique</li> </ul>                                                                                                                                                                                                                                                                                                                                                              | 4 | Lecture<br>Discussion<br>Presentation |

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| 22. | <b>Lumbar spine, sacrum and coccyx</b> <ul style="list-style-type: none"> <li>• Related radiographic anatomy</li> <li>• Lumbar spine</li> <li>• AP</li> <li>• Oblique</li> <li>• Lateral</li> <li>• Lateral (L5 - S1)</li> <li>• AP axial (L5 - S1)</li> <li>• Scoliosis series</li> <li>• AP or PA</li> <li>• Erect lateral</li> <li>• AP (Ferguson method)</li> <li>• AP - R and L bending</li> <li>• Spinal fusion series</li> <li>• AP or PA - R and L bending</li> <li>• Lateral - hyperextension and hyperflexion</li> <li>• Sacrum and Coccyx</li> <li>• AP axial sacrum</li> <li>• AP axial coccyx</li> <li>• Lateral sacrum</li> <li>• Lateral coccyx</li> </ul> | 8 | Lecture<br>Discussion<br>Presentation |
| 23. | <b>Pediatric radiography</b> <ul style="list-style-type: none"> <li>• Positioning, care and radiation protection while handling babies</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2 | Lecture<br>Discussion<br>Presentation |
| 24. | <b>Skull and cranial bones and facial bones</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• Basic &amp; special projections</li> <li>• Cranium</li> <li>• Base of skull</li> <li>• Sella turcica</li> <li>• Mastoids</li> <li>• Optic foramina and Orbits</li> <li>• Nasal bone</li> <li>• TM joint</li> <li>• Facial bone</li> <li>• Zygomatic arches</li> <li>• Mandible</li> <li>• Para nasal sinuses</li> </ul>                                                                                                                                                                                                                  | 8 | Lecture<br>Discussion<br>Presentation |
| 25. | <b>Neck</b> <ul style="list-style-type: none"> <li>• Related radiological anatomy</li> <li>• Positioning- AP, LAT</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2 | Lecture<br>Discussion<br>Presentation |
| 26. | <b>Dental radiography</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Terminology</li> <li>• Dental formula</li> <li>• Intra – oral radiography</li> <li>• Bite wing</li> <li>• Periapical radiography</li> <li>• Occlusal radiography</li> <li>• Extra oral oblique lateral</li> <li>• Cephalometry</li> <li>• Orthopantomography</li> </ul>                                                                                                                                                                                                                                                                                                        | 3 | Lecture<br>Discussion<br>Presentation |

There shall be no University Practical Examination in Second year in the subject of Radiographic Positioning & Techniques.

There shall be a university practical examination in third year in the subject of Radiographic Positioning and Special Procedures for 100 marks.

# III Year BSc. Medical Imaging Technology

## COURSE TITLE

### Theory

- † Diagnostic Imaging Techniques & Modalities
- † Radiographic Special Procedures and Patient Care

### Practical

- † Diagnostic Imaging Techniques & Modalities
- † Radiographic Positioning and Special Procedure

# DIAGNOSTIC IMAGING TECHNIQUES & MODALITIES

No. of Theory Classes: 200 Hours

No. of Practical Classes: 300 Hours

| UNIT No.      | Topics                                                                                                                                                                                                                                                                                          | No. of Hours | Mode of teaching                      |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------------------------|
| <b>PART-A</b> | <b>COMPUTED TOMOGRAPHY</b>                                                                                                                                                                                                                                                                      |              |                                       |
| 1.            | <b>Introduction to CT</b> <ul style="list-style-type: none"> <li>History</li> <li>Advantage of CT</li> <li>Comparisons with other imaging modalities</li> </ul>                                                                                                                                 | 2            | Lecture<br>Discussion<br>Presentation |
| 2.            | <b>CT principle</b> <ul style="list-style-type: none"> <li>Basic principle</li> <li>CT number</li> </ul>                                                                                                                                                                                        | 2            | Lecture<br>Discussion<br>Presentation |
| 3.            | <b>CT generations</b> <ul style="list-style-type: none"> <li>First generation</li> <li>Second generation</li> <li>Third generation</li> <li>Fourth generation</li> <li>Slip ring technology</li> <li>Electron beam CT</li> <li>Multi slice technology</li> </ul>                                | 3            | Lecture<br>Discussion<br>Presentation |
| 4.            | <b>CT detector</b> <ul style="list-style-type: none"> <li>Types</li> <li>Construction</li> <li>Comparison</li> <li>Detector Cross talk</li> </ul>                                                                                                                                               | 2            | Lecture<br>Discussion<br>Presentation |
| 5.            | <b>Image reconstruction</b> <ul style="list-style-type: none"> <li>Basic principle</li> <li>Image reconstruction from projections</li> <li>Reconstruction algorithms</li> <li>Types of data</li> </ul>                                                                                          | 3            | Lecture<br>Discussion<br>Presentation |
| 6.            | <b>Instrumentation</b> <ul style="list-style-type: none"> <li>CT scanner</li> <li>Imaging system</li> <li>CT computer and image processing</li> <li>Image display, storage, recording and communications</li> <li>CT control console</li> <li>Options and accessories for CT systems</li> </ul> | 4            | Lecture<br>Discussion<br>Presentation |
| 7.            | <b>Data acquisition</b> <ul style="list-style-type: none"> <li>Basic scheme for data acquisition</li> <li>CT detector technology</li> <li>Detector electronics</li> <li>Data acquisition and sampling</li> </ul>                                                                                | 3            | Lecture<br>Discussion<br>Presentation |

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| 8.            | <b>Image display</b> <ul style="list-style-type: none"> <li>• Image formation and representation</li> <li>• Image processing</li> <li>• Pixel and voxel</li> <li>• CT number</li> <li>• Window level and window width</li> </ul>                         | 3 | Lecture<br>Discussion<br>Presentation |
| 9.            | <b>CT Artifacts</b> <ul style="list-style-type: none"> <li>• Classification</li> <li>• Types</li> <li>• Causes</li> <li>• Remedies</li> </ul>                                                                                                            | 3 | Lecture<br>Discussion<br>Presentation |
| 10.           | <b>Image quality</b> <ul style="list-style-type: none"> <li>• Qualities</li> <li>• Resolution</li> <li>• Contrast</li> <li>• Sharpness</li> <li>• Noise properties in CT</li> </ul>                                                                      | 2 | Lecture<br>Discussion<br>Presentation |
| 11.           | <b>Basic diagnostic aspects</b> <ul style="list-style-type: none"> <li>• Role of the CT technologist</li> <li>• Patient management</li> <li>• Indication</li> <li>• Patient preparation</li> <li>• Patient positioning and scanning protocols</li> </ul> | 2 | Lecture<br>Discussion<br>Presentation |
| 12.           | <b>CT contrast media</b> <ul style="list-style-type: none"> <li>• Types</li> <li>• Use and administration</li> <li>• Contraindications</li> </ul>                                                                                                        | 2 | Lecture<br>Discussion<br>Presentation |
| 13.           | <b>CT guided procedures</b> <ul style="list-style-type: none"> <li>• Protocols</li> <li>• Both invasive and non- invasive</li> </ul>                                                                                                                     | 2 | Lecture<br>Discussion<br>Presentation |
| 14.           | <b>Safety consideration •</b><br>Staff safety <ul style="list-style-type: none"> <li>• Patient safety</li> <li>• Universal precautions</li> <li>• Knowledge of communicable and non-communicable diseases</li> </ul>                                     | 2 | Lecture<br>Discussion<br>Presentation |
| 15.           | <b>Documentation</b> <ul style="list-style-type: none"> <li>• Role of CT Technologist</li> <li>• Documentation of information about patient care, the procedure and the final outcome</li> </ul>                                                         | 1 | Lecture<br>Discussion<br>Presentation |
| <b>PART-B</b> | <b>ULTRASONOGRAPHY</b>                                                                                                                                                                                                                                   |   |                                       |

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| 1. | <b>Introduction to Ultrasound Imaging</b> <ul style="list-style-type: none"> <li>• Ultrasound imaging</li> <li>• Doppler imaging</li> <li>• Basic principle</li> <li>• Advantages and disadvantages</li> </ul><br><b>Ultrasound</b> <ul style="list-style-type: none"> <li>• Sound</li> <li>• Ultrasound</li> <li>• Attenuation</li> <li>• Echoes</li> </ul> | 3 | Lecture<br>Discussion<br>Presentation |
| 2. | <b>Instrumentation</b> <ul style="list-style-type: none"> <li>• Knowledge of console and keys</li> <li>• CRT</li> <li>• USG probes</li> <li>• Coupling agent</li> <li>• Contrast agents used</li> </ul>                                                                                                                                                      | 4 | Lecture<br>Discussion<br>Presentation |
| 3. | <b>Piezoelectric effect</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types of elements</li> <li>• Properties</li> <li>• Use</li> </ul>                                                                                                                                                                                                 | 3 | Lecture<br>Discussion<br>Presentation |
| 4. | <b>Transducers</b> <ul style="list-style-type: none"> <li>• Construction and operation</li> <li>• Types</li> <li>• Beams and focusing</li> <li>• Resolution</li> </ul>                                                                                                                                                                                       |   | Lecture<br>Discussion<br>Presentation |
| 5. | <b>USG display</b> <ul style="list-style-type: none"> <li>• A mode</li> <li>• B mode</li> <li>• M mode</li> <li>• TM mode</li> <li>• Gray scale imaging</li> <li>• Time gain compensator</li> </ul>                                                                                                                                                          | 3 | Lecture<br>Discussion<br>Presentation |
| 6. | <b>Doppler</b> <ul style="list-style-type: none"> <li>• Principle</li> <li>• Doppler effect</li> <li>• Flow</li> </ul>                                                                                                                                                                                                                                       | 4 | Lecture<br>Discussion<br>Presentation |
| 7. | <b>Instrumentation</b> <ul style="list-style-type: none"> <li>• Color Doppler</li> <li>• Continuous wave Doppler</li> <li>• Pulsed wave Doppler</li> </ul>                                                                                                                                                                                                   | 3 | Lecture<br>Discussion<br>Presentation |

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| 8. | <b>Artifacts</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Causes</li> <li>• Remedies</li> </ul> | 3 | Lecture<br>Discussion<br>Presentation |
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| 10.           | <b>Performance and safety</b> <ul style="list-style-type: none"> <li>• Performance measurement</li> <li>• Bioeffects</li> <li>• Safety</li> </ul>                                                                                                                                                                          | 3  | Lecture<br>Discussion<br>Presentation |
| 11.           | <b>Practical aspect</b> <ul style="list-style-type: none"> <li>• Scanning protocols</li> <li>• Indications</li> <li>• Patient preparation</li> <li>• Positioning</li> <li>• Knowledge of all USG guided procedures</li> </ul>                                                                                              | 4  | Lecture<br>Discussion<br>Presentation |
| <b>PART-C</b> | <b>NUCLEAR MEDICINE IMAGING</b>                                                                                                                                                                                                                                                                                            |    |                                       |
| 1.            | <b>Introduction &amp; History</b>                                                                                                                                                                                                                                                                                          | 1  | Lecture<br>Discussion<br>Presentation |
| 2.            | <b>Basic atomic &amp; nuclear physics</b> <ul style="list-style-type: none"> <li>• Quantities and Units</li> <li>• Atom composition and structure</li> <li>• Nucleus composition</li> <li>• Radioactivity</li> <li>• Exponential decay</li> <li>• Parent / Daughter decay</li> <li>• Modes of Radioactive decay</li> </ul> | 10 | Lecture<br>Discussion<br>Presentation |
| 3.            | <b>Introduction to radiopharmaceuticals</b> <ul style="list-style-type: none"> <li>• Ideal features of Radiopharmaceutical</li> <li>• General principle of tracer technique</li> </ul>                                                                                                                                     | 6  | Lecture<br>Discussion<br>Presentation |
| 4.            | <b>Radiation safety in Nuclear medicine</b> <ul style="list-style-type: none"> <li>• Safe handling of Radioactive</li> <li>• Storage of radioactive materials</li> <li>• Procedures for handling spills</li> <li>• Disposal of Radioactive waste</li> </ul>                                                                | 6  | Lecture<br>Discussion<br>Presentation |
| 5.            | <b>Gamma Camera</b>                                                                                                                                                                                                                                                                                                        | 2  | Lecture<br>Discussion<br>Presentation |
| 6.            | <b>PET</b>                                                                                                                                                                                                                                                                                                                 | 2  | Lecture<br>Discussion<br>Presentation |
| 7.            | <b>SPECT</b>                                                                                                                                                                                                                                                                                                               | 2  | Lecture<br>Discussion<br>Presentation |



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| 8.            | <b>Radiation monitoring</b> <ul style="list-style-type: none"> <li>• Survey meters</li> <li>• Personnel dosimeters</li> <li>• Wipe testing</li> <li>• Contamination monitor</li> <li>• Isotope calibrator</li> <li>• Area monitor</li> <li>• Inventory of isotopes</li> </ul>                                                                                                           | 6 | Lecture<br>Discussion<br>Presentation |
| 9.            | <b>Construction and layout of nuclear medicine department</b>                                                                                                                                                                                                                                                                                                                           | 3 | Lecture<br>Discussion<br>Presentation |
| 10.           | <b>In vivo technique</b> <ul style="list-style-type: none"> <li>• Static and dynamic studies</li> <li>• Thyroid imaging</li> <li>• Imaging of bone</li> <li>• Respiratory system</li> <li>• Urinary system</li> <li>• G.I. system</li> <li>• Cardiovascular system</li> <li>• Iodine131 uptake studies</li> <li>• Iodine 131 therapy for thyrotoxicosis and thyroid ablation</li> </ul> | 9 | Lecture<br>Discussion<br>Presentation |
| <b>PART D</b> |                                                                                                                                                                                                                                                                                                                                                                                         |   |                                       |
| 1.            | <b>Computed Radiography</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Components</li> <li>• Cassettes and Imaging plates</li> <li>• Digitizer</li> <li>• Image formation</li> <li>• Advantages and disadvantages</li> </ul>                                                                                                                                      | 4 | Lecture<br>Discussion<br>Presentation |
| 2.            | <b>Digital Radiography</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Work flow</li> <li>• System components</li> <li>• Image formation</li> <li>• Advantages and disadvantages</li> </ul>                                                                                                                                                                        | 4 | Lecture<br>Discussion<br>Presentation |
| 3.            | <b>PACS</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Work flow</li> <li>• Components</li> <li>• Types</li> <li>• Storage Advantages and disadvantages</li> </ul>                                                                                                                                                                                                | 3 | Lecture<br>Discussion<br>Presentation |
| 4.            | <b>DSA</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Room layout and design</li> <li>• Equipment</li> <li>• Image recording system</li> </ul>                                                                                                                                                                                                                    | 6 | Lecture<br>Discussion<br>Presentation |

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|                | <ul style="list-style-type: none"> <li>• Automatic injection devices</li> <li>• Contrast media</li> <li>• Catheters and accessories</li> <li>• Subtraction techniques</li> </ul>                                                                                                                                                                                                                                                       |   |                                       |
| 5.             | <b>Mammography</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Physics involved in it</li> <li>• Patient preparation</li> <li>• Different techniques</li> </ul>                                                                                                                                                                                                                                                   | 4 | Lecture<br>Discussion<br>Presentation |
| <b>PART- E</b> | <b>MAGNETIC RESONANCE IMAGING</b>                                                                                                                                                                                                                                                                                                                                                                                                      |   |                                       |
| 1.             | <b>Basic principle</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Atomic structure</li> <li>• Motion within the atom</li> <li>• The hydrogen nucleus, alignment</li> <li>• Precession</li> <li>• Larmor equation</li> <li>• Resonance</li> <li>• MR signal</li> <li>• Free induction decay signal</li> <li>• Relaxation</li> <li>• T1 recovery</li> <li>• T2 decay</li> <li>• Pulse timing parameters</li> </ul> | 4 | Lecture<br>Discussion<br>Presentation |
| 2.             | <b>Encoding and image formation</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Gradients</li> <li>• Slice selection</li> <li>• Frequency encoding</li> <li>• Phase encoding</li> <li>• Sampling</li> </ul>                                                                                                                                                                                                       | 3 | Lecture<br>Discussion<br>Presentation |
| 3.             | <b>Data collection and image formation</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• K space</li> <li>• Fast fourier transformation</li> <li>• Matrix</li> <li>• Scan timing</li> <li>• K space filling</li> <li>• Partial or fractional echo imaging &amp; averaging</li> <li>• Pre- scan</li> <li>• Types of acquisition</li> </ul>                                                                           | 3 | Lecture<br>Discussion<br>Presentation |
| 4.             | <b>Parameters and trade- offs</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Signal to Noise Ratio (SNR) &amp; How to increase SNR</li> <li>• Contrast to Noise Ratio (CNR)</li> <li>• Spatial resolution &amp; how to increase the spatial resolution</li> </ul>                                                                                                                                                | 4 | Lecture<br>Discussion<br>Presentation |

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|     | <ul style="list-style-type: none"> <li>• Scan time &amp; how to reduce time</li> <li>• Trade-offs</li> <li>• Decision making</li> <li>• Volume imaging</li> </ul>                                                                                                                                                                                                                                                                                             |   |                                       |
| 5.  | <b>Pulse sequences •</b><br>Introduction                                                                                                                                                                                                                                                                                                                                                                                                                      | 3 | Lecture<br>Discussion<br>Presentation |
| 6.  | <b>Spin echo sequences</b> <ul style="list-style-type: none"> <li>• Conventional spin echo</li> <li>• Fast spin echo</li> <li>• Inversion recovery</li> <li>• STIR</li> <li>• FLAIR</li> </ul>                                                                                                                                                                                                                                                                | 4 | Lecture<br>Discussion<br>Presentation |
| 7.  | <b>Gradient echo pulse sequences</b> <ul style="list-style-type: none"> <li>• Conventional gradient echo</li> <li>• The steady state</li> <li>• Coherent gradient echo</li> <li>• Incoherent gradient echo</li> <li>• Balance gradient echo</li> <li>• SSFP</li> <li>• Ultra- fast sequences</li> <li>• EPI</li> </ul>                                                                                                                                        | 5 | Lecture<br>Discussion<br>Presentation |
| 8.  | <b>Flow phenomena</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• The mechanisms of flow</li> <li>• Time of flight phenomenon</li> <li>• Entry slice phenomenon</li> <li>• Intra- voxel dephasing</li> </ul>                                                                                                                                                                                                                             | 3 | Lecture<br>Discussion<br>Presentation |
| 9.  | <b>Flow phenomena compensation</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Gradient moment rephrasing</li> <li>• Pre-saturation</li> <li>• Even echo rephrasing</li> </ul>                                                                                                                                                                                                                                                           | 3 | Lecture<br>Discussion<br>Presentation |
| 10. | <b>Artifacts and their compensation</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Phase mis-mapping</li> <li>• Aliasing or wrap around</li> <li>• Chemical shift artifact</li> <li>• Chemical misregistration</li> <li>• Truncation artifact</li> <li>• Magnetic susceptibility artifact</li> <li>• Zipper artifact</li> <li>• Shading artifact</li> <li>• Motion of the patient</li> <li>• Cross excitation and cross talk</li> </ul> | 4 | Lecture<br>Discussion<br>Presentation |

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| 11. | <b>Instrumentation and Equipment's</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Magnetism</li> <li>• Permanent magnets</li> <li>• Electromagnets</li> <li>• Super conducting magnets</li> <li>• Fringe fields</li> <li>• Shim coils</li> <li>• Gradient coils</li> <li>• Radio-frequency coils</li> <li>• The pulse control units</li> <li>• Patient transportation system</li> <li>• Operator interface</li> </ul>                                                                                                                                     | 6 | Lecture<br>Discussion<br>Presentation |
| 12. | <b>Vascular and cardiac imaging</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Conventional vascular imaging techniques</li> <li>• MRA</li> <li>• Perfusion and diffusion imaging</li> <li>• Cardiac imaging</li> <li>• Peripheral gating</li> <li>• Pseudo-gating</li> <li>• Multi-phase cardiac imaging</li> <li>• Cine</li> <li>• SPAMM</li> </ul>                                                                                                                                                                                                     | 5 | Lecture<br>Discussion<br>Presentation |
| 13. | <b>MR safety</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• MRI Environment</li> <li>• Safety from main magnetic field</li> <li>• Safety from varying magnetic field (gradient)</li> <li>• Safety from Radio frequency field</li> <li>• Projectiles</li> <li>• Medical emergencies</li> <li>• Implants and prostheses</li> <li>• Claustrophobia</li> <li>• Quenching</li> <li>• Safety education</li> <li>• Patient monitoring</li> <li>• Monitors and devices in MRI</li> <li>• MRI personnel</li> <li>• Safety tips</li> <li>• Site planning</li> </ul> | 5 | Lecture<br>Discussion<br>Presentation |
| 14. | <b>Contrast agents in MRI</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses and methodology</li> <li>• Review of weighting</li> <li>• Mechanism of action</li> <li>• Dipole-dipole interactions</li> <li>• Magnetic susceptibility</li> <li>• Relaxivity</li> </ul>                                                                                                                                                                                                                                                                                     | 3 | Lecture<br>Discussion<br>Presentation |
|     | <ul style="list-style-type: none"> <li>• Gadolinium safety</li> <li>• Feridex safety</li> <li>• Current applications of contrast agents</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                              |   |                                       |

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| 15. | <b>Advanced imaging techniques</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• High speed gradient system</li> <li>• Developments in fast spin echo</li> <li>• Developments in gradient echo</li> <li>• Applications of echo planar imaging</li> <li>• Spectroscopy</li> <li>• Diffusion imaging</li> <li>• Perfusion imaging</li> <li>• Functional imaging</li> <li>• Interventional MRI</li> </ul> | 4 | Lecture<br>Discussion<br>Presentation |
| 16. | <b>MRI Imaging protocol</b> <ul style="list-style-type: none"> <li>• Brain</li> <li>• Neck</li> <li>• Heart</li> <li>• Abdomen</li> <li>• Pelvis</li> <li>• Extremities</li> <li>• Spine</li> </ul>                                                                                                                                                                                                                       | 4 | Lecture<br>Discussion<br>Presentation |

## Reference Books:

1. R.F. Fatr& P.J. Ahisy: Physics for Medical Imaging (Saunders)
2. D.N. Chesney & M.O. Chesney: X-Ray Equipment for Student Radiographers (CBS)
3. Christensen, Curry &Dowdey: An Introduction of Physics to Diagnostic Radiography (Lea &Febiger)
4. Cullinan: Illustrated Guide Techniques (Blackwell)
5. Jamdrell, Thompson & Ashworth: X-Ray Physics and Equipment (Blackwell)
6. Adrian K.Dixon : Body C.T. - A Handbook (Churchill Livingstone)
7. John M. Stevens, Alan R. Valentine & Brian E. Kendall: Computed Cranial & Spinal Imaging (Williams & Wilkins)
8. John R. Haaga, Charles F. Lanzion, David J. Sartoris & Elias A.Aerhouni . Computerised 9. Tomography and Magnetic Resonance Imaging of The Whole Body (Vol.1 & Ii) (Saunders).
10. Philip T. English & Christine Moore: Mri For Radiographers (Springer)
11. Pablo R.Ros& W. Dean Bidgood : Abdominal Magnetic Resonance Imaging (Mosby)
12. Roger C. Sounders: Clinical Sonography: A Practical Guide (Little Brown & Company)
13. Pes Palmer: Manual of Diagnostic Ultrasound (WHO)
14. Sandra L Hagen Ansert: Text Book of Diagnostic Ultrasonography (Bi Publications).

# DIAGNOSTIC IMAGING TECHNIQUES & MODALITIES

Practical/Clinical: 300 Hours

## General Guidelines

**When performing the imaging procedures, the candidate must demonstrate appropriate:**

- Evaluation of requisition and/or medical record
- Preparation of examination room
- Identification of patient
- Patient assessment and education concerning the procedure
- Documentation of patient history including allergies
- Patient positioning
- Protocol selection
- Parameter selection
- Image display, filming, and archiving
- Documentation of procedure, treatment and patient data in appropriate record
- Patient discharge with post-procedure instructions
- Universal precautions
- Radiation protection
- Preparation and/or administration of contrast media
- And evaluate the resulting images for: Image quality (e.g., motion, artifacts, noise)
- Optimal demonstration of anatomic region (e.g., delayed imaging, reconstruction spacing, Algorithm, slice thickness)
- Exam completeness

| Unit No.                             | Topics                                                                                                                                                                                                                               | Mode of Teaching |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <b>COMPUTED TOMOGRAPHY PROTOCOLS</b> |                                                                                                                                                                                                                                      |                  |
| 1.                                   | <b>Head</b> <ul style="list-style-type: none"><li>• Routine head</li><li>• Sinuses</li><li>• Facial / orbit</li><li>• Temporal bones</li><li>• Trauma head</li><li>• Vascular head (CTA)</li><li>• Cross sectional anatomy</li></ul> |                  |
| 2.                                   | <b>Neck</b> <ul style="list-style-type: none"><li>? Soft tissue neck</li><li>? Larynx and vocal cords</li><li>? Vascular neck (CTA)</li><li>Cross sectional anatomy</li></ul>                                                        |                  |

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| 3. | <b>Spine and Musculoskeletal</b> <ul style="list-style-type: none"> <li>• Lumbar</li> <li>• Cervical</li> <li>• Thoracic</li> <li>• Spinal trauma</li> <li>• Upper extremity</li> <li>• Lower extremity</li> <li>• Pelvic girdle; hips</li> <li>• Musculoskeletal trauma</li> <li>• Cross sectional anatomy</li> </ul> | Clinics |
| 4. | <b>Chest</b> <ul style="list-style-type: none"> <li>• Routine chest</li> <li>• HRCT</li> <li>• Vascular chest (e.g., PE)</li> <li>• Chest trauma</li> <li>• Airway (trachea, bronchus)</li> <li>• Heart (e.g., cardiac scoring, Angiography)</li> <li>• Cross sectional anatomy</li> </ul>                             |         |
| 5. | <b>Abdomen</b> <ul style="list-style-type: none"> <li>• Routine abdomen</li> <li>• Liver (multi-phase)</li> <li>• Kidneys (with contrast)</li> <li>• Pancreas</li> <li>• Adrenals</li> <li>• GI tract</li> <li>• Abdominal trauma</li> <li>• Vascular abdomen (CTA)</li> <li>• Cross sectional anatomy</li> </ul>      |         |
| 6. | <b>Pelvis</b> <ul style="list-style-type: none"> <li>• Routine pelvis</li> <li>• Bladder</li> <li>• Pelvic trauma</li> <li>• Vascular pelvis (CTA)</li> <li>• Colorectal studies</li> <li>• Cross sectional anatomy</li> </ul>                                                                                         |         |
| 7. | <b>Special Procedures</b> <ul style="list-style-type: none"> <li>• Biopsies</li> <li>• Drainage / aspirations</li> </ul>                                                                                                                                                                                               |         |
| 8. | <b>Image Display and Post Processing</b> <ul style="list-style-type: none"> <li>• Geometric measurements (e.g., stent graft, distance)</li> <li>• ROI</li> <li>• Retrospective reconstruction</li> </ul>                                                                                                               |         |



| ULTRASONOGRAPHY PROTOCOL       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 1.                             | <b>Head &amp; Neck</b> <ul style="list-style-type: none"><li>• Soft tissue neck</li><li>• Larynx and vocal cords</li><li>• Arteries and veins</li><li>• Cross sectional anatomy</li></ul>                                                                                                                                                                                                                                                                                       | Clinics |
| 2.                             | <b>Abdomen</b> <ul style="list-style-type: none"><li>• Routine abdomen</li><li>• Liver</li><li>• Kidneys</li><li>• Pancreas</li><li>• Adrenals</li><li>• GI tract</li><li>• Abdominal trauma</li><li>• Arteries &amp; Veins</li><li>• Cross sectional anatomy</li></ul>                                                                                                                                                                                                         |         |
| 3.                             | <b>Pelvis</b> <ul style="list-style-type: none"><li>• Routine pelvis</li><li>• Bladder</li><li>• Pelvic trauma</li><li>• Colorectal studies</li><li>• Cross sectional anatomy</li></ul>                                                                                                                                                                                                                                                                                         |         |
| 4.                             | <b>Upper limb &amp; Lower limb</b> <ul style="list-style-type: none"><li>• All related arteries and veins</li></ul>                                                                                                                                                                                                                                                                                                                                                             |         |
| 5.                             | <b>Special Procedures</b> <ul style="list-style-type: none"><li>• Biopsies</li><li>• Drainage / aspirations</li></ul>                                                                                                                                                                                                                                                                                                                                                           |         |
| DIGITAL RADIOGRAPHY TECHNIQUES |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |
|                                | <p>The student should be aware of the advanced in radiology equipments, performing procedures, handling the computerized and digital equipment and quality control and quality check of the equipment in:</p> <ul style="list-style-type: none"><li>• Computed radiography</li><li>• Digital radiography</li><li>• PACS</li><li>• DSA</li><li>• Mammography</li><li>• Dental radiography</li><li>• Macro radiography</li><li>• Digital x ray techniques of whole body</li></ul> | Clinics |
| MAGNETIC RESONANCE IMAGING     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |

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|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 1. | <b>Head and Neck</b> <ul style="list-style-type: none"> <li>• Routine brain</li> <li>• Internal auditory canal</li> <li>• Orbit</li> <li>• Pituitary</li> <li>• Vascular head</li> <li>• Cranial nerves</li> <li>• Posterior fossa</li> <li>• Head trauma</li> <li>• Sinuses</li> <li>• Soft tissue neck</li> <li>• Vascular neck</li> </ul> | Clinics |
| 2. | <b>Spine</b> <ul style="list-style-type: none"> <li>• Thoracic</li> <li>• Lumbar</li> <li>• Cervical</li> <li>• Sacrum / coccyx</li> <li>• Spinal trauma</li> <li>• Bony pelvis</li> </ul>                                                                                                                                                   |         |
| 3. | <b>Thorax</b> <ul style="list-style-type: none"> <li>• Brachial plexus</li> <li>• Mediastinum</li> <li>• Cardiovascular</li> <li>• Breast</li> <li>• Aorta</li> <li>• Heart and great vessels</li> </ul>                                                                                                                                     |         |
| 4. | <b>Abdomen and Pelvis</b> <ul style="list-style-type: none"> <li>• Liver / spleen / pancreas*</li> <li>• Kidneys</li> <li>• Adrenals</li> <li>• MRCP</li> <li>• Vascular</li> <li>• Male pelvis</li> <li>• Female pelvis</li> </ul>                                                                                                          |         |
| 5. | <b>Musculoskeletal System</b> <ul style="list-style-type: none"> <li>• Upper limb</li> <li>• Lower limb</li> </ul>                                                                                                                                                                                                                           |         |

## Scheme of Examination

### Practical:

There shall be a university practical examination in the subject of Diagnostic Imaging Techniques & Modalities for 100 marks.

The internal assessment is for 20 marks.

### Pattern for Practical Examination

| Sl. No. | Particulars        | Marks |
|---------|--------------------|-------|
| 1       | Practical Exercise | 40    |
| 2       | Viva-Voce          | 40    |
| Total   |                    | 80    |

## RADIOGRAPHIC SPECIAL PROCEDURES AND PATIENT CARE

No. of Theory Classes: 100 Hours

No. of Practical Classes: 300 Hours

| Unit No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                      | No. of Hours | Mode of teaching                      |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------------------------|
| 1.       | <b>Introduction to the subject</b> <ul style="list-style-type: none"><li>• Diagnostic procedures</li><li>• Therapeutic procedures</li></ul>                                                                                                                                                                                                                                                                 | 1            | Lecture<br>Discussion<br>Presentation |
| 2.       | <b>Contrast media</b> <ul style="list-style-type: none"><li>• Definition</li><li>• Classification</li><li>• Chemistry</li><li>• Physiology</li><li>• Toxicity</li><li>• Treatment- emergency drugs</li><li>• C M used in USG</li></ul>                                                                                                                                                                      | 5            | Lecture<br>Discussion<br>Presentation |
| 3.       | <b>Intravenous Urogram (IVU/IVP)</b> <ul style="list-style-type: none"><li>• Anatomy of urinary system</li><li>• Indications Contraindications &amp; Risk factors</li><li>• Contrast media, Preparation, procedure</li><li>• Filming technique</li><li>• IVU in children</li><li>• Special views &amp; modifications of Urogram</li><li>• Nephrotomogram</li><li>• Complications &amp; after care</li></ul> | 2            | Lecture<br>Discussion<br>Presentation |
| 4.       | <b>Retrograde pyeloureterography</b> <ul style="list-style-type: none"><li>• Indications &amp; contraindications</li><li>• Procedure &amp; filming</li><li>• Complications &amp; aftercare</li></ul>                                                                                                                                                                                                        | 1            | Lecture<br>Discussion<br>Presentation |
| 5.       | <b>Micturating Cystourethrogram (MCU)</b> <ul style="list-style-type: none"><li>• Anatomy of lower urinary tract</li><li>• Indications &amp; contraindications</li><li>• Preparation, Procedure &amp; filming</li><li>• Complications</li><li>• Other techniques</li></ul>                                                                                                                                  | 1            | Lecture<br>Discussion<br>Presentation |

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| 6.  | <b>Ascending Cystourethrogram (ASU)</b> <ul style="list-style-type: none"> <li>• Indications &amp; contraindications</li> <li>• Preparation, technique, procedure</li> <li>• Filming</li> <li>• Complications &amp; after care</li> </ul>                                                                                                                                                                                     | 1 | Lecture<br>Discussion<br>Presentation |
| 7.  | <b>Myelogram</b> <ul style="list-style-type: none"> <li>• Anatomy of spinal cord</li> <li>• Definition, indication &amp; contraindication</li> <li>• Preparation requirements &amp; contrast media</li> <li>• Lumbar, cisternal &amp; lateral cervical puncture</li> <li>• CT myelogram</li> </ul>                                                                                                                            | 3 | Lecture<br>Discussion<br>Presentation |
| 8.  | <b>Contrast media in GIT</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Properties of an ideal barium preparation</li> <li>• Advantages of barium sulphate preparation</li> <li>• Manufacture</li> <li>• Characteristics influencing coating</li> <li>• Adverse effects</li> <li>• Other contrast media used</li> <li>• Contrast media used for CT in GIT</li> </ul>                                    | 3 | Lecture<br>Discussion<br>Presentation |
| 9.  | <b>Barium swallow</b> <ul style="list-style-type: none"> <li>• Anatomy of upper GI tract</li> <li>• Indications &amp; contraindications</li> <li>• Contrast</li> <li>• Procedure and techniques</li> <li>• Specific conditions</li> <li>• Complications</li> </ul>                                                                                                                                                            | 3 | Lecture<br>Discussion<br>Presentation |
| 10. | <b>Barium meal</b> <ul style="list-style-type: none"> <li>• Anatomy of stomach</li> <li>• Indications &amp; contraindications</li> <li>• Preparation</li> <li>• Contrast media</li> <li>• Standard views</li> <li>• Conventional single contrast study</li> <li>• Double contrast barium study</li> <li>• Biphasic study of upper GIT</li> <li>• Hypotonic duodenography</li> <li>• After care &amp; complications</li> </ul> | 3 | Lecture<br>Discussion<br>Presentation |
| 11. | <b>BMFT</b> <ul style="list-style-type: none"> <li>• Anatomy of GI tract</li> <li>• Indications &amp; contraindication</li> <li>• Contrast medium</li> <li>• Patient preparation</li> <li>• Small bowel follow through</li> <li>• Dedicated small bowel follow through</li> <li>• Peroral pneumocolon</li> <li>• Retrograde small bowel examination</li> <li>• Advantages, disadvantages &amp; complications</li> </ul>       | 3 | Lecture<br>Discussion<br>Presentation |

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| 12. | <b>Enteroclysis</b> <ul style="list-style-type: none"> <li>Anatomy of small bowel</li> <li>Indication contraindication</li> <li>Equipment, contrast medium</li> <li>Preparation</li> <li>Techniques</li> <li>Single contrast study</li> <li>Double contrast study</li> <li>Air D C enteroclysis</li> <li>Comparison</li> <li>Advantages, disadvantages &amp; after care</li> </ul> | 3 | Lecture<br>Discussion<br>Presentation |
| 13. | <b>Barium enema</b> <ul style="list-style-type: none"> <li>Anatomy of large bowel</li> <li>•• Definition, indication, contraindication</li> <li>•• Contrast</li> <li>•• Preparation and positioning</li> <li>•• DCBE, SCBE</li> <li>• Special barium enema studies</li> <li>Aftercare &amp; complications</li> </ul>                                                               | 3 | Lecture<br>Discussion<br>Presentation |
| 14. | <b>HSG</b> <ul style="list-style-type: none"> <li>•• Anatomy of female reproductive system</li> <li>•• Definition, indication and contraindication</li> <li>• Equipments, procedures &amp; techniques</li> <li>After care &amp; complications</li> <li>Sonosalphingigraphy</li> </ul>                                                                                              | 2 | Lecture<br>Discussion<br>Presentation |
| 15. | <b>FTR</b> <ul style="list-style-type: none"> <li>•• Definition, indication and contraindication</li> <li>•• Instrumentation</li> <li>• Timing of the study, patient preparation</li> <li>• Technique and filming</li> <li>• Other methods</li> <li>Post procedure follow up and complications</li> </ul>                                                                          | 2 | Lecture<br>Discussion<br>Presentation |
| 16. | <b>Sialography</b> <ul style="list-style-type: none"> <li>Anatomy of salivary glands</li> <li>Definition, indication &amp; contraindication</li> <li>Equipments</li> <li>Preparation of the patient</li> <li>Procedure &amp; filming</li> </ul>                                                                                                                                    | 2 | Lecture<br>Discussion<br>Presentation |
| 17. | <b>Dacrocystography</b> <ul style="list-style-type: none"> <li>Anatomy of nasolacrimal duct</li> <li>Definition, indications &amp; contraindication</li> <li>Materials and techniques</li> <li>Complications &amp; after care</li> <li>Other techniques</li> </ul>                                                                                                                 | 2 | Lecture<br>Discussion<br>Presentation |

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| 18. | <b>Catheters</b> <ul style="list-style-type: none"> <li>• Classification</li> <li>• Catheters used for different studies</li> <li>• Sterilization of catheters</li> <li>• Balloon angioplasty catheters</li> </ul>                                                                                                                                                                      | 3 | Lecture<br>Discussion<br>Presentation |
| 19. | <b>Angiography (cerebral, visceral, peripheral)</b> <ul style="list-style-type: none"> <li>• Anatomy of blood vessels</li> <li>• Definition indication &amp; contraindication</li> <li>• Patient preparation and precautions</li> <li>• Local anaesthesia</li> <li>• Direct needle puncture</li> <li>• Catheter angiography</li> <li>• Percutaneous transluminal angioplasty</li> </ul> | 4 | Lecture<br>Discussion<br>Presentation |
| 20. | <b>T-tube / PTC / direct portal Venography overview</b>                                                                                                                                                                                                                                                                                                                                 | 3 | Lecture<br>Discussion<br>Presentation |
| 21. | <b>Biliary system procedures (PTBD/ERCP/PTC)</b>                                                                                                                                                                                                                                                                                                                                        | 2 | Lecture<br>Discussion<br>Presentation |
| 22. | <b>Bronchography and phlebography overview</b>                                                                                                                                                                                                                                                                                                                                          | 2 | Lecture<br>Discussion<br>Presentation |
| 23. | <b>Introduction to Patient Care</b> <ul style="list-style-type: none"> <li>• Responsibilities of the Healthcare facility</li> <li>• Responsibilities of the Imaging Technologist</li> </ul>                                                                                                                                                                                             | 2 | Lecture<br>Discussion<br>Presentation |
| 24. | <b>Nursing Procedure in Radiology</b> <ul style="list-style-type: none"> <li>• General abdominal preparation</li> <li>• Clothing of the patient</li> <li>• Giving an enema Handling the emergencies in Radiology</li> <li>First aid in the X-Ray department.</li> </ul>                                                                                                                 | 2 | Lecture<br>Discussion<br>Presentation |
| 25. | <b>Patient care during Investigation</b> <ul style="list-style-type: none"> <li>• G.I. Tract</li> <li>• Biliary tract</li> <li>• Respiratory tract</li> <li>• Gynecology</li> <li>• Cardiovascular</li> <li>• Lymphatic system</li> <li>• C.N.S etc</li> </ul>                                                                                                                          | 2 | Lecture<br>Discussion<br>Presentation |
| 26. | <b>Infection Control</b> <ul style="list-style-type: none"> <li>• Isolation technique</li> <li>• Infection sources</li> <li>• Transmission modes</li> <li>• Procedures</li> <li>• Psychological considerations</li> <li>• Sterilization &amp; sterile techniques.</li> </ul>                                                                                                            | 2 | Lecture<br>Discussion<br>Presentation |

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| 27. | <b>Patient Education</b> <ul style="list-style-type: none"> <li>• Communication</li> <li>• Patient communication problems</li> <li>• Explanation of examinations</li> <li>• Radiation Safety / Protection</li> <li>• Interacting with terminally ill patient</li> <li>• Informed Consent</li> </ul> | 2 | Lecture<br>Discussion<br>Presentation |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------------|

### Reference Books:

1. Bhushan and Lakkhar Radiological procedures
2. Chapman A guide to radiological procedures
3. Care of Patients in Diagnostic Radiology- Gunn
4. Patient care in radiography- Mosby Elsevier publication

## RADIOGRAPHIC POSITIONING AND SPECIAL PROCEDURES

Clinical/ Practical - 600Hours

**Mode of Teaching: Clinics**

### General anatomy, terminology, and positioning principles

- General, systemic and skeletal anatomy
- Positioning terminology
- Positioning principle

The student should be made familiar with radiographic appearance both normal subject and of common abnormal conditions where elementary knowledge of the pathology involved will

ensure the application of the appropriate radiographic technique, which may be necessary for various disabilities or types of subject.

**For each area studied, the topics will be presented under the following headings:**

- a. Anatomy (review)
- b. Clinical indications.
- c. Preparation of patient
- d. Accessory equipment
- e. Routine views
- f. Supplementary views: modifications in cases of trauma
- g. Radiation protection
- h. Care of patient

**For each view studied will be presented as follows.**

- a. Positioning of patient.
- b. Immobilization
- c. Identification
- d. Centering point
- e. Direction of central X-ray relative to the film
- f. Parts demonstrated
- g. Exposure factor - kVp, mAs, FFD grid/ non-grid screen
- h. Cassette size

**Technical skill and patient care may be emphasized to the following categories:**

- b. Children and neonates
- c. Seriously ill or injured patients
- d. Elder patients
- e. Deaf and blind patients
- f. Language difficulties.
- g. Unconscious patients or Anaesthetized patients.

**Objectives:**

**At the end of the course, the student should be able to understand the following:**

1. Knowledge about the radiographic positioning and related anatomy.
2. Technical factors used while taking X-rays.
3. Patient care given during the positioning.
4. Patient care for pediatrics, geriatrics, and during bedside radiography.

**General anatomy, terminology, and positioning principles**

- General, systemic and skeletal anatomy
- Positioning terminology
- Positioning principle



| Unit | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Mode of Teaching |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| 1.   | <p><b>RADIOGRAPHIC POSITIONING:</b><br/> <b>Routine and Special projections including the radiological anatomy and Imaging characteristics for the following:</b></p> <ol style="list-style-type: none"> <li>1. Chest</li> <li>2. Shoulder</li> <li>3. Humerus</li> <li>4. Elbow</li> <li>5. Forearm</li> <li>6. Wrist</li> <li>7. Hand</li> <li>8. Fingers</li> <li>9. Femur</li> <li>10. Knee</li> <li>11. Leg</li> <li>12. Ankle</li> <li>13. Foot</li> <li>14. Pelvis</li> <li>15. Neck</li> <li>16. Chest</li> <li>17. Abdomen</li> <li>18. KUB</li> <li>19. Pelvis</li> <li>20. Hip</li> <li>21. Spine</li> </ol> <p><b>RADIOLOGICAL SPECIAL PROCEDURES</b></p> <ol style="list-style-type: none"> <li>a. All radiographic procedures including:</li> <li>b. IVU</li> <li>c. MCU</li> <li>d. Retrograde pyelourethrogram</li> <li>e. Myelogram</li> <li>f. Ba studies</li> <li>g. HSG/ FTR</li> <li>h. Sialography</li> <li>i. T- tube cholangiography</li> <li>j. Percutaneous transhepatic cholangiography</li> <li>k. Bronchography</li> <li>l. Angiography</li> <li>m. Phlebography</li> <li>n. Dacrocystography</li> </ol> | Clinics          |

### **Scheme of Examination:**

#### **Practical**

There shall be a university practical examination in the subject of Radiographic Positioning and Special Procedures for 100 marks.

The internal assessment is for 20 marks.

**Pattern for Practical Examination:**

| Sl. No.      | Particulars        | Marks     |
|--------------|--------------------|-----------|
| 1            | Practical Exercise | 40        |
| 2            | Viva-Voce          | 40        |
| <b>Total</b> |                    | <b>80</b> |

**Reference Books:**

1. Bhushan and Lakkhar Radiological procedures
2. Chapman A guide to radiological procedures
3. Care of Patients in Diagnostic Radiology- Gunn
4. Patient care in radiography- Mosby Elsevier publication
5. Philip W. Ballinger: Atlas of Radiographic Positioning and Radiological Procedures (Mosby)
6. Ra Swallow, E Naylor: Clarks Positioning in Radiography
7. Ross and Gailway: A Handbook of Radiography (Lewis)
8. Glenda J.Bryan: Diagnostic Radiography (Mosby)
9. Meril's Atlas of radiographic positioning and Radiological procedure

# IV Year BSc. Medical Imaging Technology

## INTERNSHIP

A student after having successfully completed the final year university examination is qualified to commence the Compulsory Rotatory Internship. The completion of Internship is mandatory to enable a student to obtain the degree of Bachelor of Medical Imaging Technology.

### ***Aims:***

The internship program is designed to facilitate the transition from student hood to becoming a competent professional. It is meant to instill in the students clinical practice skills, which would encompass the following qualities:

- Sense of timing.
- Work behaviors, roles and routines
- Communication and interaction skills with patients, colleagues, supervisors & other professionals of multidisciplinary team.
- Ability to take certain independent decisions exercising their clinical judgment.
- Ability to deal with a critical situation using analytical skills.
- Successful completion of the internship program will facilitate the students to become competent independent Medical Imaging Technologists.

### ***Procedure:***

- After the 3<sup>rd</sup> year BSc. MIT University Examination results are declared, the candidate has to obtain no-dues clearance from various departments and sections as prescribed by the University.
- On submission of the no dues clearance to the college office, a **No Dues** slip will be issued to the student.
- The student should submit the no due slip to the Head of Medical Imaging Technology. • Faculty in charge will give the Clinical posting schedule & Guidelines for internship program.

### ***Duration and Description:***

The internship program is of **one-year** duration.

A student doing internship has to practice under supervision of experienced staff in all the modalities of radio diagnosis and imaging.

All the postings are **compulsory**.

### ***Ordinances:***

- The intern will be eligible for 2 days casual leave in each month and he/she can carry over the leave to next months, but he/she cannot avail the next month leave in advance.
- The interns should conduct themselves in a manner befitting the profession.

- The intern should dress appropriately in the clinical areas (Men in trousers and shirt, women in salwar suits).
- It is mandatory for the intern to wear the white apron with nametag when in the clinical area.
- The intern will get a monthly stipend.
- The intern will be allowed to attend the National Conference, leave will be granted only for the days of conference and travel days. • Any other leave declared by the University for the students will not apply to the interns.

## SUGGESTED BOOKS

| SI. No                   | NAME OF THE BOOK                                    | AUTHOR                                                  |
|--------------------------|-----------------------------------------------------|---------------------------------------------------------|
| <b>ANATOMY</b>           |                                                     |                                                         |
| 1                        | Manipal Manual of Anatomy                           | Dr. Sampath Madhyastha                                  |
| 2                        | Human Anatomy                                       | B. D. Chaurasia                                         |
| <b>PHYSIOLOGY</b>        |                                                     |                                                         |
| 1                        | Manipal Manual of Physiology                        | C.N.Chandrasheka                                        |
| 2                        | Text Book of Physiology                             | Prof. A. K. JAIN                                        |
| 3                        | Basics of Medical Physiology- Third edition         | D.Venkatesh & H.H. Sudhakar                             |
| <b>BIOCHEMISTRY</b>      |                                                     |                                                         |
| 1                        | Text Book of Biochemistry                           | V. Sathyanarayanan                                      |
| 2                        | Text book of Biochemistry with Clinical Correlation | Thomas M Devlin                                         |
| <b>PATHOLOGY</b>         |                                                     |                                                         |
| 1                        | Harsh MohansText Book of Pathology                  | Harsh Mohan                                             |
| 2                        | Robbins & Cortran Pathologic Basis of Diseases      | Mitchell, Kumar, Abbas, Fausto                          |
| 3                        | General & Systemic Pathology                        | J. C. E. Underwood                                      |
| <b>MICROBIOLOGY</b>      |                                                     |                                                         |
| 1                        | Text Book of Microbiology                           | Ananthanarayan & R. Jayaram                             |
| 2                        | General Microbiology                                | Roger Y Stanier, John L Ingrahan                        |
| <b>RADIATION PHYSICS</b> |                                                     |                                                         |
| 1                        | Christensen's Physics of Diagnostic Radiology       | Thomas Curry, James E Dowdey, Robert C Murry            |
| 2                        | Essential Physics of Medical Imaging                | Jerrold T Bushberg, J Antony Seibert, Edwin M Leidholdt |
| 3                        | Fundamental of X-Ray and Radiation Physics          | Joseph Selman                                           |

| <b>RADIATION PROTECTION</b>                             |                                                                    |                                                            |
|---------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------|
| 1.                                                      | Radiologic Science for Technologists                               | Stewart C. Bhushong                                        |
| 2.                                                      | Radiation Protection in Medical Radiography                        | E. Russel Ritenour                                         |
| 3.                                                      | ICRP Manual                                                        | -                                                          |
| <b>IMAGING PHYSICS &amp; DARKROOM TECHNIQUES</b>        |                                                                    |                                                            |
| 1                                                       | Chesney"s Radiographic Imaging                                     | John Ball & Tony Price                                     |
| 2                                                       | Fundamental of X- Ray and Radiation Physics                        | Joseph Selmen                                              |
| 3.                                                      | Christensen"s Physics of Diagnostic Radiology                      | Thomascurry, James E Dowdey, Robert C Murry                |
| <b>COMPUTED TOMOGRAPHY</b>                              |                                                                    |                                                            |
| 1.                                                      | CT Seeram                                                          | Dr Seeram Eudid                                            |
| <b>ULTRASOUND</b>                                       |                                                                    |                                                            |
| 1.                                                      | Diagnostic U S Principle And Instruments                           | Dr. Frederick w kremkau                                    |
| <b>RADIOGRAPHIC POSITIONING AND TECHNIQUES</b>          |                                                                    |                                                            |
| 1                                                       | Merrills Atlas of Radiographic Positioning &Radiological Procedure | Philip W Ballinger & Ergene D Frank                        |
| 2                                                       | Text Book of Radiographic Positioning & Related Anatomy            | Kenneth L Bontrager                                        |
| 3                                                       | Clarks Positioning in Radiography                                  | R. A. Swallow, E Naylor                                    |
| <b>RADIOGRAPHIC SPECIAL PROCEDURES AND PATIENT CARE</b> |                                                                    |                                                            |
| 1                                                       | Radiological Procedures                                            | Dr. Bhushan N                                              |
| 2                                                       | Patient Care in Radiography                                        | Ruth Ann Ehrlich<br>Ellen Double McCloskey<br>Joan A. Daly |
| <b>MAGNETIC RESONANCE IMAGING</b>                       |                                                                    |                                                            |
| 1                                                       | MRI In Practice                                                    | Catherine Wesstbrook& CaralynKaut                          |
| 2                                                       | Hand Book of MRI Techniques                                        | Catherine Westbrook                                        |
| <b>DIGITAL RADIOLOGY</b>                                |                                                                    |                                                            |
| 1                                                       | PACS Basic Principles & Applications                               | H. K. Huang                                                |
| 2                                                       | Diagnostic U.S Principles And Instruments                          | Frederick W Kremkau                                        |
| <b>NUCLEAR MEDICINE</b>                                 |                                                                    |                                                            |
| 1                                                       | Physics in Nuclear medicine                                        | Soroenson                                                  |
| 2                                                       | Physics of Nuclear medicine                                        | Powsner                                                    |
| <b>COMMUNICATION SKILLS</b>                             |                                                                    |                                                            |
| 1                                                       | Crystal clear                                                      | Kris Cole/EW                                               |
| 2                                                       | English conversation Practice                                      | Grant Taylor/TMH                                           |
| 3                                                       | The most common mistakes in English                                | Thomas Elliot Berry/TMH                                    |

**REGULATIONS & CURRICULUM OF  
GRADUATE PARAMEDICAL COURSE  
  
BACHELOR OF SCIENCE IN  
  
RADIOTHERAPY TECHNOLOGY  
  
2020**



**Sri Siddhartha  
Academy of Higher Education  
Deemed-to-be-University**

**Established under Section 3 of the UGC Act, 1956  
MHRD, GOI No. F.9-31/2006-U.3 (A) Dtd. 30th May 2008**

**Agalakote, B.H. Road, Tumkur – 572107, Karnataka, India**

# SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

(DEEMED TO BE UNIVERSITY)

Declared under Section 3 of the UGC Act, 1956, MHRD GOI No. F.9-31/2006-U.3 (A) Dated: 30/05/2008

Accredited 'A' Grade by NAAC

Agalakote, B.H.Road, Tumkur - 572 107, KARNATAKA, INDIA.

Ph. 0816- 2275516, Fax : 0816-2275510 website: sahetumkur.ac.in email: info@sahe.in



No. SSAHE/ACA-S&C(AHSP)/20/2022

Date: 01/09/2022

## NOTIFICATION

Sub: Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Radiotherapy Technology.

- Ref: 1). Proceedings of BOS Allied Health Sciences Programmes held on 06/04/2021  
2). Proceedings of the Academic Council meeting held on 19/08/2021  
3). Proceedings of the Board of Management held on 29/08/2022

In exercise of the powers vested under section 6 of 6.4 of MoA / Rules of SSAHE, the Ordinance pertaining to Regulations and Curriculum of Bachelor of Science in Radiotherapy Technology is notified herewith as per Annexure.

The above Regulations shall be applicable to the students admitted to the said course from the academic year 2020-21 onwards.

By Order,

REGISTRAR

REGISTRAR

Sri Siddhartha Academy of Higher Education  
TUMKUR - 572 107, Karnataka.

To,  
Dean / Principal, Sri Siddhartha Medical College & Hospital,

Copy to

- 1) Office of the Chancellor, SSAHE, for kind information,
- 2) PA to Vice-Chancellor / PA to Registrar / Controller of Examinations / Finance Officer, SSAHE
- 3) The Director (AHSP), SSAHE
- 4) All Officers of the Academy Examination Branch / Academic Section
- 5) Guard File / Office copy.

5. Guard File / Office copy.



## **REVISED ORDINANCE GOVERNING REGULATIONS & CURRICULUM OF BACHELOR OF RADIOTHERAPY TECHNOLOGY - 2020**

### **1. Eligibility for admission:**

A candidate seeking admission to the BSc. RT shall have studied English as one of the principal subject during the tenure of the course and shall have passed:

1. Two year Pre-University examination or equivalent as recognized by Sri Siddhartha Academy of Higher Education with, Physics, Chemistry and Biology as subjects of study.

OR

2. Pre-Degree course from a recognized University considered as equivalent by SSAHE, (Two years after ten years of schooling) with Physics, Chemistry and Biology as subjects of study.

OR

3. Any equivalent examination recognized by the Sri Siddhartha Academy of Higher Education, Tumkur for the above purpose with Physics, Chemistry and Biology as subjects of study.

OR

4. The vocational higher secondary education course conducted by Vocational Higher Secondary Education, Government of Kerala with five subjects including Physics, Chemistry, Biology and English in addition to vocational subjects conducted is considered equivalent to plus TWO examinations of Government of Karnataka Pre University Course.

OR

5. Candidates with two years diploma from a recognized Government Board in RT shall have passed class 12 [10+2] with Physics, Chemistry and Biology, as subjects or candidates with 3 years diploma from a recognized Government Board in RT should have studied Physics, Biology and Chemistry as subjects during the tenure of the course.

Lateral entry to second year of B.Sc. RT for candidates who have passed diploma program from the Government Boards and recognized by SSAHE, fulfilling the conditions specified above under Sl. No. 5 and these students are eligible to take admission on lateral entry system only in the same subject studied at diploma level for the academic year

**Note:**

- a. The candidate shall have passed individually in each of the subjects.
- b. Candidates who have completed diploma or vocational course through Correspondence shall not be eligible for any of the courses mentioned above.

**2. Duration of the course:**

Duration shall be for a period of four years including one year of Internship.

**3. Medium of instruction:**

The medium of instruction and examination shall be in English.

**4. Scheme of examination:**

There shall be three examinations one each at the end of 1st, 2nd and 3rd year.

**5. Attendance:**

Every candidate should have attended at least 80% of the total number of classes conducted in an academic year from the date of commencement of the term to the last working day as notified by university in each of the subjects prescribed for that year separately in theory and practical. Only such candidates are eligible to appear for the university examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A candidate lacking in prescribed percentage of attendance in any subjects either in theory or practical in the first appearance will not be eligible to appear for the University Examination in that subject

**6. Internal Assessment(IA):**

1st Year B.Sc. RT

Theory - 20marks

Practicals - 10 marks\*. [Lab work- 06 marks and Record-04 marks]

## 2nd & 3rd year B.Sc. RT

Theory – 20 Marks

Practicals – 20 Marks

There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an academic year. The average marks of the two tests will be calculated and reduced to 20. The marks of IA shall be communicated to the University at least 15 days before the commencement of the University examination. The University shall have access to the records of such periodical tests. The marks of the internal assessment must be displayed on the notice board of the respective colleges within a fortnight from the date test is held. If a candidate is absent for any one of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

\* There shall be no University Practical Examination in First year.

## 7. Subject and hours of teaching for Theory and Practicals

The number of hours of teaching theory and practical, subject wise in first year, second year and third year are shown in Table-I, Table-II and Table-III

Main and Subsidiary subjects are common in first year for all the courses in Allied Health Science.

The number of hours for teaching theory and practical for main subjects in first, Second and Third year are shown in Table-I, II and III.

Table - I Distribution of Teaching Hours in First Year Subjects Main subjects

| Sl. no | Subject                                                       | Theory No. Of Hours | Practical No. Of Hours | Total No. Of Hours |
|--------|---------------------------------------------------------------|---------------------|------------------------|--------------------|
| 1      | Human Anatomy                                                 | 70                  | 20                     | 90                 |
| 2      | Physiology                                                    | 70                  | 20                     | 90                 |
| 3      | Biochemistry I                                                | 70                  | 20                     | 90                 |
| 4      | Pathology I (Clinical Pathology, Haematology & Blood Banking) | 70                  | 20                     | 90                 |
| 5      | Microbiology                                                  | 70                  | 20                     | 90                 |
|        | Total                                                         | 350                 | 100                    | 450                |

The classes in main and subsidiary subjects are to be held from Monday to Thursday. On Fridays and Saturday's students shall work in hospitals in the respective speciality or department chosen by them

#### Subsidiary Subjects

English 25Hours  
Kannada 25Hours  
Health-Care 40Hours

Clinical/Lab posting – 470 hours (Friday 9am – 1pm and 2pm - 4-30 pm Saturday 9am - 1pm)

**Table – II: Distribution of Teaching Hours in Second Year Subjects**

#### Main subjects

| Sl. No | Subjects                                       | Theory No. of Hours | Practical No. of Hours | Total No. of Hours |
|--------|------------------------------------------------|---------------------|------------------------|--------------------|
| 1      | RADIOTHERAPY- PART-I A<br>Fundamental physics: | 100                 | -                      | 100                |
| 2      | RADIOTHERAPY-<br>PART- I B                     | 100                 | -                      | 100                |
| 3      | PRACTICE OF<br>RADIATION THERAPY<br>TECHNIQUES |                     | 300                    | 300                |
|        | <b>Total</b>                                   | <b>200</b>          | <b>300</b>             | <b>500</b>         |

#### Subsidiary Subjects:

Sociology - 20 Hours  
Constitution of India – 10 Hours  
Environmental Science &  
Health- 10 Hours

**Table - III Distribution of Teaching Hours in Third Year Subjects**

**Main subjects**

| Sl. No | Subjects                                        | Theory No. of Hours | Practical No. of Hours | Total No. of Hours |
|--------|-------------------------------------------------|---------------------|------------------------|--------------------|
| 1      | RADIOTHERAPY-<br>PART-II A<br>Radiation physics | 150                 | -                      | 150                |
| 2      | RADIOTHERAPY-<br>PART-II B                      | 150                 |                        | 150                |
| 3.     | RADIOTHERAPY-II                                 |                     | 300                    | 300                |
|        | <b>Total</b>                                    | <b>300</b>          | <b>300</b>             | <b>600</b>         |

**Subsidiary Subjects:**

Ethics, Database Management – 50 Hours

Research & Biostatistics - 20 Hours

Computer application - 10 Hours

**9. Schedule of Examination:**

The university shall conduct two examinations annually at an interval of not less than 4 to 6 months as notified by the university from time to time. A candidate who satisfies the requirement of attendance, progress and conduct as stipulated by the university shall be eligible to appear for the university examination. Certificate to that effect shall be produced from the Head of the institution along with the application for examination and the prescribed fee.

**10. Scheme of Examination:**

There shall be three examinations, one each at the end of I, II and III year. The examination for both main and subsidiary subjects for all courses in Allied Health Sciences shall be common in the first year. Distribution of Subjects and marks for First Year, second year & Third year University theory and practical Examinations are shown in the Table – IV, V & VI.

### First year Examination:

The University examination for 1st year shall consist of only theory examination and there shall be no University Practical Examination.

### Second- & Third-year examination:

The University examination for 2nd and 3rd year shall consist of Written Examination & Practical.

Written Examinations consists of

- 05 papers in the 1<sup>ST</sup> year
- 03 papers in the 2ndYear
- 03 papers in the 3rdYear

### Practical examination:

- There shall be no practical examination in the first year.
- There shall be one practical examination, at the end 2ndYear.
- There shall be one practical examination at the end of the 3rdyear.

**TABLE-III**

#### **Distribution of Subjects and marks for First Year University Theory Examination**

| A | Main Subjects*                      | Written Paper |       | I A Theory | Total |
|---|-------------------------------------|---------------|-------|------------|-------|
|   |                                     | Duration      | Marks | Marks      | Marks |
| 1 | Basic Anatomy (Including Histology) | 3 Hours       | 80    | 20         | 100   |
| 2 | Physiology                          | 3 Hours       | 80    | 20         | 100   |
| 3 | Biochemistry                        | 3 Hours       | 80    | 20         | 100   |
| 4 | Pathology                           | 3 Hours       | 80    | 20         | 100   |
| 5 | Microbiology                        | 3 Hours       | 80    | 20         | 100   |
|   | Subsidiary Subject**                |               |       |            |       |
| 1 | English                             | 3 Hours       | 80    | 20         | 100   |
| 2 | Kannada                             | 3 Hours       | 80    | 20         | 100   |
| 3 | Health Care                         | 3 Hours       | 80    | 20         | 100   |

Note: I A = Internal Assessment

\*Main Subjects shall have University Examination. There shall be no University Practical Examination.

\*\*Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

**Distribution of Subjects and marks for 2<sup>ND</sup> Year University Theory Examination**

| A | Main Subjects*                      | Written Paper |       |                  | Practical  |           |                     | Total |
|---|-------------------------------------|---------------|-------|------------------|------------|-----------|---------------------|-------|
|   |                                     | Duration      | Marks | I A Theory Marks | Practicals | Viva Voce | I A practical Marks | Marks |
| 1 | Radiotherapy- part- 1 A             | 3 Hours       | 80    | 20               | -          | -         | -                   | 100   |
| 2 | Radiotherapy-part- I B              | 3 Hours       | 80    | 20               | -          | -         | -                   | 100   |
| 3 | Radiation therapy practical part -1 |               |       |                  | 40         | 40        | 20                  | 100   |
|   | Subsidiary Subject**                |               |       |                  |            |           |                     |       |
| 1 | Sociology                           | 3 Hours       | 80    |                  |            |           | 20                  | 100   |
| 2 | Constitution of India               | 3 Hours       | 80    |                  |            |           | 20                  | 100   |
| 3 | Environmental Science &Health       | 3 Hours       | 80    |                  |            |           | 20                  | 100   |

Note: I A = Internal Assessment

\*Main Subjects shall have University Examination. There will be University Practical Examination.

\*\*Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

### Distribution of Subjects and marks for 3<sup>RD</sup> Year University Theory Examination

| A | Main Subjects*                     | Written Paper |       |                  | Practical  |           |                     | Total |
|---|------------------------------------|---------------|-------|------------------|------------|-----------|---------------------|-------|
|   |                                    | Duration      | Marks | I A Theory Marks | Practicals | Viva Voce | I A practical Marks | Marks |
| 1 | Radiotherapy- part- 2 A            | 3 Hours       | 80    | 20               | -          | -         | -                   | 100   |
| 2 | Radiotherapy-part- 2 B             | 3 Hours       | 80    | 20               | -          | -         | -                   | 100   |
| 3 | Radiation therapy practical part 2 |               |       |                  | 140        | 40        | 20                  | 200   |
|   | Subsidiary Subject**               |               |       |                  |            |           |                     |       |
| 1 | Ethics, Database Management        | 3 Hours       | 80    |                  |            |           | 20                  | 100   |
| 2 | Research & Biostatistics           | 3 Hours       | 80    |                  |            |           | 20                  | 100   |
| 3 | Computer application               | 3 Hours       | 80    |                  |            |           | 20                  | 100   |

Note: I A = Internal Assessment

\*Main Subjects shall have University Examination. There will be University Practical Examination.

\*\*Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

## 11. Pass criteria

### 11.1. First year examination

a. Main Subjects: A candidate is declared to have passed in a subject, if he/she secures, 50% of marks in University Theory exam and internal assessment added together.

b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the Commencement of the University examination.



### **11.2. Second- and Third-year Examination**

a. Main Subjects: A candidate is declared to have passed the examination in a subject if he/she secures 50% of the marks in Theory and 50% in practical separately. For a pass in theory, a candidate has to secure a minimum of 40% marks in the University conducted written examination, and 50% in aggregate in the University conducted written examination and internal assessment added together and for pass in Practical, a candidate has to secure a minimum of 40% marks in the university conducted Practical/Clinical examination and 50% in aggregate i.e. University conducted Practical/Clinical and Internal Assessment.

b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

## **12. Carry over benefit**

### **12.1 First year examination:**

A candidate who fails in any two of the five main subjects of first year shall be permitted to carry over those subjects to second year. However, he/ she must pass the carry over subjects before appearing for second year examination.

### **12.2. Second year examination:**

A candidate is permitted to carry over any one main subject to the third year but shall pass this subject before appearing for the third-year examination.

## **13. Declaration of Class**

a. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with Distinction.

b. A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 60% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in First Class.

c. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than 60% of grand total marks prescribed will be declared to have passed the examination in Second Class.

d. A candidate passing the university examination in more than one attempt shall be placed in Pass class irrespective of the percentage of marks secured by

him/her in the Examination.

The marks obtained by a candidate in the subsidiary subjects shall not be considered for award of Class or Rank. [Please note, fraction of marks should not be rounded off clauses (a), (b) and(c)]

#### 14. Eligibility for the award of Degree:

A candidate shall have passed in all the subjects of first, second and third year to be eligible for a compulsory 12 months of rotational internship. On completion of 12 months of the internship with pass criteria in outgoing clinical assessment exams the candidate is then eligible for the award of degree

#### 15. Distribution of Type of Questions and Marks

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>First year</b> ) |                  |                          |
|------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                          | No. of Questions | Marks for Each Questions |
| Long Essay                                                 | 1                | 10                       |
| Short Essay                                                | 5                | 5                        |
| Short Notes Type                                           | 5                | 3                        |
| Short Answer Type                                          | 10               | 2                        |
| MCQ's                                                      | 10               | 1                        |

|                                                     |                |
|-----------------------------------------------------|----------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks |
| <b>Total= 80</b>                                    |                |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Second and Third Year</b> ) |                  |                          |
|-----------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                     | No. of Questions | Marks for Each Questions |
| Long Essay                                                            | 1                | 10                       |
| Short Essay                                                           | 5                | 5                        |
| Short Notes Type                                                      | 5                | 3                        |
| Short Answer Type                                                     | 10               | 2                        |
| MCQ's                                                                 | 10               | 1                        |

- |                                                     |                  |
|-----------------------------------------------------|------------------|
| 1. Long essay- 1 Questions (answer any one)         | 1x10= 10 marks   |
| 2. Short essay- 7 Questions (answer any five)       | 05x5= 25 marks   |
| 3. Short Notes Type – 8 Questions (answer any five) | 05x3= 15 marks   |
| 4. Short answer- 12 Questions (answer any ten)      | 10x2= 20 marks   |
| 5. MCQ's – 10 Questions                             | 10x1= 10 marks   |
|                                                     | <b>Total= 80</b> |

| SUBJECTS HAVING MAXIMUM MARKS= 80 (for <b>Subsidiary subjects</b> ) |                  |                          |
|---------------------------------------------------------------------|------------------|--------------------------|
| Type of Questions                                                   | No. of Questions | Marks for Each Questions |
| Essay Type                                                          | 3 (2 x 10)       | 10                       |
| Short Essay Type                                                    | 8 (6 x 5)        | 05                       |
| Short Answer Type                                                   | 12 (10 x 3)      | 03                       |

# I YEAR B.Sc. RT

## ANATOMY

Theory: 70hrs

Practicals: 20hrs

### **Chapter 1: Introduction:**

#### **Theory:**

- ★ Definition of anatomy and its divisions
- ★ Terms of location, positions and planes
- ★ Epithelium-definition, classification, describe with examples, function
- ★ Glands- classification, describe serous, mucous & mixed glands with examples
- ★ Basic tissues – classification with examples

#### ★ **Practical:**

- ★ Histology of types of epithelium
- ★ Histology of serous, mucous & mixed salivary gland

### **Chapter 2: Connective tissue:**

#### **Theory:**

- ★ Cartilage – types with example & histology theory
- ★ Bone – Classification, names of bone cells, parts of long bone, microscopy of compact
- ★ bone, names of all bones, vertebral column, intervertebral disc, fontanelles of fetal skull
- ★ Joints – Classification of joints with examples, synovial joint (in detail for radiology)
- ★ Muscular system: Classification of muscular tissue & histology
- ★ Names of muscles of the body

#### **Practical:**

- ★ Histology of the 3 types of cartilage
- ★ Histology of compact bone (TS & LS)
- ★ Histology of skeletal (TS & LS) & cardiac muscle
- ★ Demo of all bones showing parts, radiographs of normal bones & joints
- ★ Demonstration of important muscles of the body

## **Chapter 3: Cardiovascular system:**

### **Theory:**

- Heart-size, location, chambers, exterior & interior, pericardium
- Blood supply of heart
- Systemic & pulmonary circulation
- Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery
- Inferior vena cava, portal vein, portosystemic anastomosis, Great saphenous vein, Dural venous sinuses
- Lymphatic system- cisterna chyli & thoracic duct, Histology of lymphatic tissues, Names of regional lymphatics, axillary and inguinal lymph nodes in brief

### **Practical:**

- Demonstration of heart and vessels in the body
- Histology of large artery & vein, medium sized artery & vein
- Histology of lymph node, spleen, tonsil & thymus
- Radiology: Normal chest radiograph showing heart shadows

## **Chapter 4: Gastro-intestinal system**

### **Theory:**

- Parts of GIT: Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring), Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas, spleen, peritoneum & reflections

### **Practical:**

- Demonstration of parts of GIT
- Radiographs of abdomen

## **Chapter 5: Respiratory system**

- Parts of RS: nose, nasal cavity, larynx, trachea, lungs, broncho pulmonary segments, diaphragm
- Histology of trachea, lung and pleura
- Names of paranasal air sinuses

### **Practical:**

- Demonstration of parts of respiratory system.
- Normal radiographs of chest, X-ray paranasal sinuses
- Histology of lung and trachea

## **Chapter 6: Urinary system**

### **Theory:**

- Kidney, ureter, urinary bladder, male and female urethra
- Histology of kidney, ureter and urinary bladder

### **Practical:**

- Demonstration of parts of urinary system
- Histology of kidney, ureter, urinary bladder
- Radiographs of abdomen-IVP, retrogradecystogram

## **Chapter 7: Reproductive system**

### **Theory:**

- Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology)
- Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology)
- Mammary gland –gross

### **Practical:**

- Demonstration of section of male and female pelvis with organs insitu
- Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes, ovary
- Radiographs of pelvis –hysterosalpingogram

## **Chapter 8: Endocrine glands**

### **Theory:**

- Names of all endocrine glands in detail on pituitary gland, thyroid gland & suprarenal gland –(gross & histology)

### **Practical:**

- Demonstration of the glands
- Histology of pituitary, thyroid, parathyroid, suprarenal glands

## **Chapter 9: Nervous system Theory:**

- Neuron & Classification of CNS
- Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (gross & histology) Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei
- Blood supply of brain
- Cranial nerves
- Sympathetic trunk & names of parasympathetic ganglia

### **Practical:**

- Histology of peripheral nerve & optic nerve
- Demonstration of all plexuses and nerves in the body
- Demonstration of all part of brain
- Histology of cerebrum, cerebellum, spinal cord

## **Chapter 10: Sensory organs**

### **Theory:**

- Skin: Skin-histology & Appendages of skin
- Eye: Parts of eye & lacrimal apparatus, Extra-ocular muscles & nerve supply
- Ear: parts of ear- external, middle and inner ear and contents

### **Practical:**

- Histology of thin and thick skin
- Demonstration and histology of eye ball
- Histology of cornea & retina

## **Chapter 11: Embryology:**

### **Theory:**

- Spermatogenesis & oogenesis
- Ovulation, fertilization
- Fetal circulation
- Placenta

**INTERNAL ASSESSMENT**

|                                     |    |
|-------------------------------------|----|
| Theory-average of 2 exams conducted | 20 |
| Practicals: record and lab work*    | 10 |

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

**Distribution of Marks for University Theory and Practical Exam**

| <b>Theory</b> |              |    |           | <b>Practicals</b> |    |              | <b>Grand<br/>Total</b> |
|---------------|--------------|----|-----------|-------------------|----|--------------|------------------------|
| Theory        | Viva<br>Voce | IA | Sub Total | Practicals        | IA | Sub<br>Total |                        |
| 80            | --           | 20 | 100       | *                 |    |              | 100                    |



## REFERENCE BOOKS:

1. William Davis (P) understanding Human Anatomy and Physiology – McGraw Hill
2. Chaurasia- A Text Book of Anatomy
3. T. S. Ranganathan- A Text Book of Human Anatomy
4. Fattana, Human Anatomy (Description and applied)- Saunder's & C P Prism Publishers, Bangalore
5. ESTER. M. Grishcimer- Physiology & Anatomy with Practical Considerations, J. P. Lippincott. Philadelphia
6. Bhatnagar- Essentials of Human Embryology- Revised Edition. Orient Blackswan Pvt.Ltd.

## PHYSIOLOGY

Theory 70 hours

Practical 20 hours

### 1. General Physiology

*Introduction to cell physiology, transport across cell membrane Homeostasis, Body Fluid compartment & measurement.*

### 2. Blood

Introduction- composition and function of blood Plasma. proteins, types and functions

Red blood cells - erythropoiesis, stages of differentiation, factors affecting it, function, normal count, physiological variation.

Hemoglobin- function, concentration, types & methods of Hb estimation, fate of hemoglobin Jaundice-types Anaemia,-types

ESR, PCV, osmotic fragility & blood indices

WBC- morphology, production, functions, normal count, differential count, variation, variation Immunity (in brief)

Platelets- origin, morphology, normal count, function-Platelet plug, bleeding disorder

Haemostasis - definition, normal haemostasis, clotting factors, mechanism of clotting, anticoagulants disorders of clotting factors.  
Blood group-ABO & Rh system, Rh incompatibility blood typing ,cross matching, hazards of mismatched blood transfusion  
RES, spleen and lymph.

### **3. Nerve-Muscle**

Neuron structure, types, neuroglia-types, nerve fibre classification, properties of nerve fibres, RMP, action potential, wallerian degeneration  
NMJ, blockers, Myasthenia gravis  
Classification of muscle, structure of skeletal muscle, sarcomere, contractile proteins Excitation contraction coupling, mechanism of muscle contraction, types of contraction Motor unit, fatigue, rigor mortis Smooth muscle.

### **4. Respiratory system**

Physiological anatomy of respiratory system, muscles of respiration, respiratory & non respiratory functions of lungs, dead space  
Mechanics of breathing, intrapulmonary & pleural pressures Compliance, Surfactant, Hyaline membrane disease  
Lung volumes and capacities  
Respiratory membrane, transport of O<sub>2</sub> & CO<sub>2</sub>  
Chemical regulation of respiration, Neural regulation of respiration Hypoxia, Acclimatization, Dysbarism. Artificial respiration  
Definition-Periodic breathing, dyspnoea, apnoea, asphyxia,, cyanosis.

### **5. Cardiovascular system**

Introduction to CVS & general principles of circulation Properties of Cardiac muscle  
Cardiac cycle, heart sounds, Pulse Cardiac output, factors and measurement Heart rate  
BP-factors, measurement, Short term regulation Intermediate and long term regulation of BP  
ECG uses and significance, .normal waveform, heart block Coronary circulation, Cutaneous circulation-Triple response Shock  
Effects of exercise on CVS and Respiratory system.

### **6. Renal system, Skin and body temperature**

Kidneys- functions, structure of nephron, type, juxtaglomerular apparatus-structure And function, non- excretory functions of kidney  
Glomerular filtration rate (GFR)- Definition ,normal value, factors affecting GFR  
Tubular reabsorption - sites, substance reabsorbed, mechanisms of reabsorption  
Tubular secretion- sites, substance secreted, mechanisms of reabsorption  
Counter current mechanism of concentration of urine Obligatory and Facultative reabsorption of water Micturition reflex, Diuretics

Artificial kidney, renal function tests-clearance tests  
Skin -structure and function, body temperature measurement, physiological variation,  
Regulation of body Temperature by physical chemical and nervous mechanisms-  
Role of Hypothalamus Hypothermia and fever.

## **7. Digestive system**

Physiological anatomy, Enteric nervous system & functions of GIT Saliva-composition, regulation, disorder.  
Deglutition- stages & disorders  
Stomach-functions, composition and regulation of gastric juice Gastric motility, MMC, vomiting reflex.  
Pancreas- function, composition and regulation of pancreatic juice  
Liver & gall bladder-functions, bile- composition, secretion and regulation Small intestine- Succus entericus-composition, functions & movements Large intestine-functions, movements and defecation reflex  
Digestion & absorption of Carbohydrates, fats and proteins.

## **8. Endocrine system**

Classification of Endocrine glands & their hormones & properties-chemistry and receptor, feedback mechanisms of hormone regulation.  
Anterior pituitary hormones- secretion, functions , disorders Posterior pituitary hormones- secretion , functions , disorders Thyroid hormones- secretion, functions, disorders  
Parathyroid hormones- secretion, functions, disorders Calcium homeostasis & disorders  
Pancreatic hormones, -Insulin and Glucagon- . secretion, functions, disorders  
Adrenal cortex- Glucocorticoids & Mineralocorticoids, Androgen - secretion, functions, disorders Adrenal medulla- secretion, functions, disorders Thymus & Pineal gland.

## **9. Reproductive system**

Introduction to reproductive system, sex differentiation & Puberty Male reproductive system, functions of testosterone & Spermatogenesis  
Female reproductive system, functions of Estrogen, Progesterone, Oogenesis  
Ovulation & Menstrual cycle  
Physiological changes during pregnancy, pregnancy tests, parturition & lactation  
Male & Female contraceptive methods.

## **10. Central nervous system**

Introduction to CNS, Sensory receptors classification, properties Synapse-classification, properties  
Sensory pathways: Anterior spino thalamic tract and Posterior column pathway  
Lateral spino thalamic tract, Types of pain, Referred pain, Thalamus; nuclei and function  
Classification of reflexes, Monosynaptic reflex- Stretch reflex , muscle spindle , inverse stretch reflex. Polysynaptic reflex-Withdrawal reflex

Motor pathways : Pyramidal pathway and functions, UMNL, LMNL Cerebral cortex (Sensory and motor)-functions, Medulla and Pons-functions Cerebellum –functions, disorders

Basal ganglia-functions, disorders Hypothalamus and Limbic system-functions CSF, lumbar puncture

Sleep, EEG,

Autonomic Nervous System - Sympathetic and parasympathetic distribution and functions.

## **11. Special senses**

Vision –Functional anatomy of eye, visual pathway, lesion Refractive errors, color vision

Audition – Physiological anatomy of ear, Mechanism of hearing, auditory pathway, deafness Olfaction –modalities, receptor, function, abnormalities

Gustation-modalities, receptor, function, taste pathway, abnormalities.

## **Practicals**

Blood pressure Recording

Auscultation for Heart Sounds

Artificial Respiration

Determination of vital capacity

## **INTERNAL ASSESSMENT**

|                                     |    |
|-------------------------------------|----|
| Theory-average of 2 exams conducted | 20 |
| Practicals: record and lab work*    | 10 |

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

**Distribution of Marks for University Theory and Practical Exam**

| Theory |           |    |           | Practicals |    |           | Grand Total |
|--------|-----------|----|-----------|------------|----|-----------|-------------|
| Theory | Viva Voce | IA | Sub Total | Practicals | IA | Sub Total |             |
| 80     | --        | 20 | 100       | *          |    |           | 100         |

**REFERENCE BOOKS:**

1. Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism Publishers
2. Chatterjee (CC) Human Physiology Latest Ed. Vol. 1, Medical Allied Agency
3. Choudhari (Sujith K) Concise Medical Physiology Latest Ed. New Central Book
4. Ganong (William F) Review of Medical Physiology. Latest Ed. Appleton

**BIOCHEMISTRY I**

No. Theory classes: 70 hours

No. Practical classes: 20 hours

**1. Carbohydrate Chemistry [3hours]**

- Classification (Definition/ examples for each class)
- Monosaccharides (classification depending upon number of carbon atoms and functional group with examples)
- Disaccharides (Sucrose/ lactose/ maltose and their composition)
- Polysaccharides:
  - a) Homopolysaccharides (Structure of starch and glycogen)
  - b) Heteropolysaccharides (Functions).

2. Lipid Chemistry [3hours]
  - Definition of lipids
  - Functions of lipids in the body
  - Classification of lipids (subclasses with examples)
  - Definition and Classification of fatty acids
  - Essential fatty acids
  - Phospholipids and their importance
3. Amino-acid and Protein Chemistry [3hours]
  - General structure of D and L amino acids
  - Amino acids; Definition and Classification of amino acids with examples.
  - Peptides; definition & Biologically important peptides
  - Classification of Proteins based on composition, functions and shape(with examples)
  - Functions of amino acids and Proteins.
4. Nucleotide and Nucleic acid Chemistry [ 3hours]
  - Nucleosides & Nucleotides
  - Nucleic acid Definition &types
  - Composition & functions of DNA &RNA
  - Structure of DNA (Watson and Crickmodel)
  - Structure of tRNA, & functions of tRNA, rRNA,mRNA
  - Difference between DNA andRNA.
5. Enzymes [5hours]
  - Definition & Classification of Enzymes with example
  - Definitions of Active site, Cofactor (Coenzyme,Activator),
  - Proenzyme; Definition and examples (Pepsin &trypsin).
6. Digestion and Absorption [ 3Hours]
  - General characteristics of digestion and absorption,
  - Digestion and absorption of carbohydrates, proteins and lipids.
7. Carbohydrate Metabolism [ 5Hours]
  - Glycolysis ; Aerobic, Anaerobic, Definition , Site and subcellular site , Steps with all the enzymes and coenzymes at each step , mention the regulatory enzymes ,Energetics,
  - Citric acid cycle; Pyruvate dehydrogenase complex (reaction and coenzymes) , Site and subcellular site , Reactions with all the enzymes and coenzymes ,Regulatory enzymes ,Energetics
  - Significance of HMP Shunt pathway.
  - Hyperglycemic and hypoglycemic hormones
  - Blood Glucose Regulation.
  - Diabetes mellitus (definition, classification, signs and symptoms)
  - Glycogen metabolism and gluconeogenesis.

## 8. Lipid Metabolism [ 4Hours]

- Introduction to lipid metabolism ,Lipolysis
- Beta oxidation of fatty acids; Definition,Site and subcellular site, Activation of palmitic acid Transport of activated palmitic acid into mitochondria , Reactions, Energetics.
- Name the different ketone bodies. Note on ketosis.

## 9. Amino acid and Protein Metabolism [ 3Hours]

- Introduction, transamination, deamination, Fate of ammonia, transport of ammonia,
- Urea cycle.

## 10. Vitamins [5Hours]

- Definition and classification.
- RDA, sources, coenzyme forms, biochemical functions and disorders for the following water soluble vitamins: Thiamine, Niacin, Pyridoxine, Cobalamine ,Folic acid, Ascorbic acid
- RDA, sources, coenzyme forms, biochemical functions and deficiency Disorders for the following fat soluble vitamins; A and vitaminD.

## 11. Mineral Metabolism [3Hours]

- Name the macro/microminerals
- Iron: Sources,RDA, Functions and Disorders of deficiency and excess
- Calcium and phosphorus: Sources,RDA, functions, normal serum levels and hormones regulating their levels.

## 12. Nutrition [6hours]

- Balanced diet(Definition)
- Caloric value ; Definition , Caloric values of carbohydrates, proteins and fats
- Total daily caloric requirements of an adult male and female,
- RDA (Definition, standard values for nutrients)
- Basal metabolic rate(BMR) ; Definition , Magnitude of BMR in men and women, Factors affecting BMR
- Thermic effect/ SDA of food (Definition, values for major macronutrients)
- Carbohydrates;. Daily dietary requirement. 2. Dietary fibers (Definition, functions, importance and their daily requirements)
- Proteins;. Daily requirement, Biological value. a. Definition b. Protein used as a standard for this, Protein sources with high and low biological value, Mutual supplementation of proteins(Definition, examples).
- Fats ; Daily requirement , Essential fatty acids (Definition, functions, daily requirement and deficiency manifestations) , Saturated and unsaturated Fatty acids(Definition, sources, examples).
- Malnutrition

**13. Renal Function Tests [ 2hours]**

- Name the different tests to assess the kidney functions
- Explain Creatinine clearance & Inulin clearance
- Urinary acidification test

**14. Radioactive Isotopes [1hour]**

- Definition, clinical applications
- Biological effects of radiations

**15. Clinical Biochemistry [ 5 hours]**

A. Definitions of acid, base, pH and pKa [1hour]

B. Buffers • Definition [2hours]

- Henderson Hasselbalch equation,
- Principal buffer systems in the ECF ICF and urine
- Bicarbonate and phosphate buffer systems (pKa value, normal ratio of base/acid in the plasma)
- Acidosis & Alkalosis (Definition, classification, causes and biochemical findings)

C. Normal serum levels and condition where they are altered [2hour]

- Glucose, Protein, urea, uric acid, and creatinine
- Bilirubin, cholesterol
- Serum Electrolytes

**16. Fundamental Chemistry (1hour)**

- Valency, Molecular weight & Equivalent weight of elements and compounds. Normality, Molarity, Molality.

**17. Solutions: Definition, use, classification where appropriate, preparation and storage (5hours)**

- Stock and working solutions.
- Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H<sub>2</sub>SO<sub>4</sub>, H<sub>3</sub>PO<sub>4</sub>, CH<sub>3</sub>COOH etc.,)
- Preparation of percent solutions – w/w, v/v w/v (solids, liquids and acids), Conversion of a percent solution into a molar solution
- Saturated and super saturated solutions
- Standard solutions. Technique for preparation of standard solutions and Storage. E.g: glucose, albumin etc.
- Dilutions- Diluting Normal, Molar and percent solutions. Preparing working Standard from stock standard.
- Part dilutions: Specimen dilutions. Serial dilutions. Reagent dilution. Dilution factors.



## **ASSIGNMENT TOPICS**

1. Units of measurement
2. Hazards - Physical, Chemical, Biological
3. Arterial blood gas analysis
4. Responsibilities of Health care personnel
5. Biomedical waste management

## **PRACTICAL DEMONSTRATION [20 hours]**

- Color Reactions of Carbohydrates & amino acids.
- Precipitation Reactions of proteins
- Colorimetry
- Estimation of Blood glucose Folin Wu and enzymatic method
- Estimation of Urea by DAM method

## **INTERNAL ASSESSMENT**

|                                     |    |
|-------------------------------------|----|
| Theory-average of 2 exams conducted | 20 |
| Practicals: record and lab work*    | 10 |

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

## Distribution of Marks for University Theory and Practical Exam

| Theory |           |    |           | Practicals |    |           | Grand Total |
|--------|-----------|----|-----------|------------|----|-----------|-------------|
| Theory | Viva Voce | IA | Sub Total | Practicals | IA | Sub Total |             |
| 80     | --        | 20 | 100       | *          |    |           | 100         |

### Text Book References

- Biochemistry – 3<sup>rd</sup> revised edition by U Sathyanarayana & U Chakrapani
- Textbook of Medical Biochemistry-6<sup>th</sup> Edition by MN Chatterjee & Rana Shinde
- Textbook of Medical Laboratory technology 2<sup>nd</sup> edition by Godkar and Godkar.
- Biochemistry-3<sup>rd</sup> edition by Pankaja Naik
- Medical Laboratory technology 6<sup>th</sup> edition by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students-3<sup>rd</sup> edition by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> editions.

## PATHOLOGY I

(Clinical Pathology, Hematology and Blood Banking)

Theory-70 hours

Practicals-20 hours

### I. Clinical Pathology-Theory

- Introduction to clinical pathology
- Collection, transport, preservation and processing of various clinical specimens
- Urine examination- collection and preservation, Physical, chemical and microscopic examination for abnormal constituents
- Examination of Body fluids
- Examination of Cerebrospinal fluid (CSF)
- Sputum examination
- Examination of feces

### II. Hematology -Theory

- Introduction to hematology
- Normal constituents of Blood, their structure and functions
- Collection of Blood samples

- Various anticoagulants used in Hematology
- Hemoglobin estimation, different methods and normal values
- Packed cell volume
- Erythrocyte sedimentation rate
- Normal Haemostasis
- Bleeding time. Clotting time, prothrombin time, Activated partial Thromboplastin time

### III. **Blood Bank-Theory**

- Introduction blood banking
- Blood group system
- Collection and processing of blood for transfusion
- Compatibility testing
- Blood transfusion reactions

## IV **General Pathology:**

### 1. **Cell injury:**

- a. Definition, causes.
- b. Cellular adaptations – Hypertrophy, hyperplasia, atrophy and metaplasia.
- c. Types of cell injury – Reversible and irreversible; morphology of reversible injury.
- d. Necrosis – Definition and patterns of tissue necrosis.
- e. Intracellular accumulations – Lipids, cholesterol, proteins, glycogen and pigments; examples.
- f. Pathologic calcification – Types and examples.

### 2. **Inflammation:**

- a. Definition and signs of inflammation.
- b. Types – Acute and chronic inflammation.
- c. Acute inflammation – Causes, morphological patterns and outcome.
- d. Chronic inflammation – Causes, morphology and examples.
- e. Regeneration and repair – Mechanism of cutaneous wound healing.
- f. Factors affecting wound healing.

### 3. **Hemodynamic disorders:**

- a. Edema – Definition, pathogenesis and types: Renal, cardiac, pulmonary and cerebral.
- b. Difference between transudate and exudate.
- c. Shock – Definition, types of shock with examples: Hypovolemic, cardiogenic and septic shock, stages of shock: Nonprogressive, progressive and irreversible.
- d. Thrombosis – Definition, mechanism of thrombus formation(Virchow's triad) and fate of thrombus.

- e. Embolism – Definition and types: Thromboembolism, fat, air and amniotic fluid embolism.
- f. Infarction – Definition and examples.

#### **4. Immune system:**

- a. Autoimmune diseases – General features, enumerate systemic and organ specific autoimmune diseases.
- b. Systemic lupus erythematosus – Manifestations and diagnosis.

#### **5. Neoplasia:**

- a. Definition and nomenclature of tumors.
- b. Differences between benign and malignant neoplasms.
- c. Enumerate modes of carcinogenesis: Genes, physical, chemical and microbial agents of carcinogenesis.
- d. Modes of spread of tumors.
- e. Clinical aspects of neoplasia.
- f. Grading and staging of cancers.
- g. Laboratory diagnosis of cancer.

#### **Practicals**

- 1. Urine analysis- Physical, Chemical, Microscopic
- 2. Blood grouping and Rh typing
- 3. Hb estimation , packed cell volume (PCV), Erythrocyte Sedimentation rate (ESR)
- 4. Bleeding time and Clotting time
- 5. Histopathology - section cutting and H& E staining.

#### **INTERNAL ASSESSMENT**

|                                     |    |
|-------------------------------------|----|
| Theory-average of 2 exams conducted | 20 |
| Practicals: record and lab work*    | 10 |

\*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

### Distribution of Marks for University Theory and Practical Exam

| Theory |           |    |           | Practicals |    |           | Grand Total |
|--------|-----------|----|-----------|------------|----|-----------|-------------|
| Theory | Viva Voce | IA | Sub Total | Practicals | IA | Sub Total |             |
| 80     | --        | 20 | 100       | *          |    |           | 100         |

### REFERENCE BOOKS:

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss-Cytology
4. Winifred Diagnostic cytopathology
5. Orell Cyto pathology
6. Todd and Sanford- clinical diagnosis by Laboratory Medicine
7. Dacie and Lewis- Practical Hematology
8. Ramnik SOOD. Lab technology, Methods and interpretation, 4 th editionJP BrosNewDelhi, 1996
9. Sathish Guptha , Short text book of Medical laboratory techniquesfor technicians
10. Sachdev K N. Clinical Pathology and Bacteriology, 8 thedi JP Bros,New Delhi,1996.

# Microbiology I

Theory: 70Hours

Practicals: 20Hours

## 1. Introduction (6hrs)

History of Microbiology - Louis Pasteur, Antony Van Leeuwenhoek, Robert Koch, Edward Jenner, Alexander Fleming.

Use of microscope in the study of bacteria - Types of microscopes - compound microscope, phase contrast microscope, electron microscope, fluorescent microscope, dark ground microscope.

Morphology of bacterial cell

## 2. Growth and Nutrition (6hrs.)

Nutrition, growth and multiplication of bacteria, bacterial growth curve, culture media, culture methods, anaerobic culture methods.

## 3. Sterilization and disinfection (8hrs.)

Principles and use of equipments of sterilization, chemicals used in disinfection, testing of disinfectants.

## 4. Biomedical waste management principle and practice

## 5. Immunology (5hrs.)

Immunity - mechanism of immunity, classification, types

Vaccines

Immunization schedule

Definition of antigen, antibody, list of antigen antibody reaction (no need of detailed account of antigen antibody reactions)

Definition of hypersensitivity and classification (no need of detailed account of types of hypersensitivity)

## 6. Infection (5hrs.)

Definition, types and mode of transmission

Hospital acquired infection - causative agents, mode of transmission and prophylaxis.

Antimicrobial sensitivity testing

## 7. Systematic bacteriology (15hrs.)

Disease caused and laboratory diagnosis of medically important bacteria (Staphylococcus, coagulase negative Staphylococcus, MRSA, Streptococcus pyogenes, Pneumococcus, gonococcus, E.coli, diarrhoeagenic E.coli, Salmonella, Vibrio cholerae, ElTorvibrios, Halophilic vibrios, Shigella, Mycobacterium

tuberculosis, Mycobacterium leprae, Atypical Mycobacteria, Treponema pallidum, leptospira)  
(no need of classification, antigenic structure, virulence mechanism)

]

### **8. Parasitology (10hrs.)**

Introduction to Parasitology

List of medically important parasites and diseases (E.histolytica, Plasmodium, W.bancrofti, Ascaris, Ancylostoma, B.coli, G.lamblia, T.solium, T.saginata)

Laboratory diagnosis of parasitic infection (No need of including life cycles)

### **9. Virology (10hrs.)**

Introduction to virology

List of medically important viruses and diseases (AIDS, Hepatitis, Rabies, Polio, Arbo viruses)

Cultivation of viruses and laboratory diagnosis of viral infections

### **10. Mycology (5hrs.)**

Introduction to Mycology

Classification of medically important fungi - (based on morphology, spore production, disease production, taxonomy)

List of medically important fungi and diseases (Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis, Mucor Mycosis)

Laboratory diagnosis of fungal infections.

### **Practicals (20 hrs.)**

Compound microscope (Demonstration)

Demonstration of sterilization equipments

Demonstration of culture media and culture methods

Demonstration of antibiotic sensitivity testing

Demonstration of serological tests - Widal, VDRL, ASO, CRP, RA

Demonstration of gram stain and ZN staining

Demonstration of Helminthic ova

Grams stain, Acid fast staining

Stool exam for Helminthic ova

There shall be no university practical examination and Internal Assessment marks secured in practicals need not be sent to the university.

### **INTERNAL ASSESSMENT**

|                                     |    |
|-------------------------------------|----|
| Theory-average of 2 exams conducted | 20 |
| Practicals: record and lab work*    | 10 |

### Distribution of Marks for University Theory and Practical Exam

| Theory |           |    |           | Practicals |    |           | Grand Total |
|--------|-----------|----|-----------|------------|----|-----------|-------------|
| Theory | Viva Voce | IA | Sub Total | Practicals | IA | Sub Total |             |
| 80     | --        | 20 | 100       | *          |    |           | 100         |

### Reference Books-

1. Ananthanarayana & Panikar Medical Microbiology- University Press
2. Robert Cruickshank- Medical Microbiology- The Practice of Medical Microbiology
3. Chatterjee- Parasitology- Interpretation to Clinical Medicine
4. Rippon- Medical Mycology
5. Emmons- Medical Mycology
6. Basic Laboratory methods in Parasitology, J P Bros, New Delhi
7. Basic Laboratory procedures in clinical bacteriology, J P Bros, New Delhi
8. Medical Parasitology- Ajit Damle
9. Introduction to medical microbiology- Ananthanarayana- Orient Longman Pvt. Ltd.



## **SUBSIDIARY SUBJECTS**

### **ENGLISH**

#### **COURSE OUTLINE**

**COURSE DESCRIPTION:** This course is designed to help the student acquire a good command and comprehension of the English language through individual papers and conferences.

#### **BEHAVIOURAL OBJECTIVES:**

The student at the end of training is able to

1. Read and comprehend English language
2. Speak and write grammatically correct English
3. Appreciates the value of English literature in personal and professional life.

#### **UNIT - I: INTRODUCTION:**

Study Techniques

Organisation of effective note taking and logical processes of analysis and synthesis Use of the dictionary

Enlargement of vocabulary Effective diction

#### **UNIT - II: APPLIED GRAMMAR:**

Correct usage

The structure of sentences The structure of paragraphs Enlargements of Vocabulary

#### **UNIT - III: WRITTEN COMPOSITION:**

Precise writing and summarizing Writing of bibliography Enlargement of Vocabulary

#### **UNIT - IV: READING AND COMPREHENSION:**

Review of selected materials and express oneself in one's words. Enlargement of Vocabulary.

#### **UNIT - V: THE STUDY OF THE VARIOUS FORMS OF COMPOSITION:**

Paragraph, Essay, Letter, Summary, Practice in writing

## UNIT - VI: VERBAL COMMUNICATION:

Discussions and summarization, Debates, Oral reports, use in teaching

### REFERENCE

1. English Grammar Collins, Birmingham University, International Language Data Base, Rupa & Co. 1993
2. Wren and Martin - Grammar and Composition, 1989, Chanda & Co, Delhi
3. Letters for all Occasions. A S Myers. Pub - Harper Perennial
4. Spoken English V. Shasikumar and P V Dhanija. Pub. By: Tata McGraw Hill, New Delhi
5. Journalism Made Simple Dwainwright
6. Writers Basic Bookself Series, Writers Digest series
7. Interviewing by Joan Clayton Platkon
8. Penguin Book of Interviews.

## HEALTH CARE

**Teaching Hours: 40**

### Introduction to Health

Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept.

National Health Policy

National Health Programmes ( Briefly Objectives and scope) Population of India and Family welfare programme in India

## **Introduction to Nursing**

What is Nursing ? Nursing principles. Inter-Personnel relationships. Bandaging : Basic turns; Bandaging extremities; Triangular Bandages and their application. Nursing Position, Bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's positions, comfort measures, Aids and rest and sleep.

Lifting And Transporting Patients: Lifting patients up in the bed. Transferring from bed to wheel chair. Transferring from bed to stretcher.

Bed Side Management: Giving and taking Bed pan, Urinal : Observation of stools, urine. Observation of sputum, Understand use and care of catheters, enema giving. Methods of Giving Nourishment: Feeding, Tube feeding, drips, transfusion Care of Rubber Goods

Recording of body temperature, respiration and pulse, Simple aseptic technique, sterilization and disinfection. Surgical Dressing: Observation of dressing procedures

### **First Aid :**

Syllabus as for Certificate Course of Red Cross Society of St. John's Ambulance Brigade.

## **Reference Books:**

1. Preventive and Social Medicine by J. Park
2. Text Book of P & SM by Park and Park
3. Counseling & Communicate skills for medical and health, Bayne-Orient Longman Pvt. Ltd.

## 2nd Year - RADIOTHERAPY- PART-IA

### FUNDAMENTAL PHYSICS:

#### Applied Mathematics:

- Elementary use of algebraic symbols and signs, Fractions & Decimals.
- Indices: Power of 10 simple equations, Logarithms.
- Fundamentals of Trigonometry
- Fundamentals of Geometry, Application of similar triangles in finding focalspot.
- Divergence from a point source.
- Graphical representation of a data - linear & semi log plot,
- Measurement of angles. Geometry of triangles,
- Proportion, Inverse square law, Elementary explanation of exponential law.

#### Electromagnetic Radiation, Atomic Structure and Radioactivity:

- Electromagnetic waves and their properties, Inverse square law
- The quantum theory of Radiation (Planck's concept of quanta, Photon and its characteristic properties),
- The electromagnetic spectrum, Fluorescence and Phosphorescence, Photoelectric emission, Photocell, Intensity and quality of electromagnetic radiation.
- The structure of the Atom :Nucleus ,Atomicnumber(Z), Massnumber(A) ,Ionization & Excitation , Isotopes, And the Periodic Table.
- Radioactivity, Properties of alpha, beta, gamma radiation, Radioactive transformation process (Radioactive displacement law), Radioactive decay (Radioactive disintegration law), decay constant half-life, Units of Radioactivity
- Radioactive nuclides in medicine
- Radioactive disintegration process and radiation emission and daughter products.
- Properties of radium and its daughter elements.

- Radioactive equilibrium.
- Production of artificial radioactive isotopes.
- The principles of the nuclear reactor.
- The Curie and specific gamma ray emission.
- Fundamental of Electricity (Basic of Electronics):
- Electric charges and units of electric charge, Coulombs law, Electric induction, electric potential & potential difference, Capacitance and Capacitors, Resistance.
- Conductors, Insulators and Semiconductors, Electric current, Ohm's law & Kirchoff's law, Circuit laws (Combination of Potential difference in series and parallel, meters, Electrical energy & Power, heating effect of a current.
- The magnetic effects of an electric current (Electromagnetism), electro magnetic induction, Mutual induction and Self-induction.
- Alternating current, The A.C. transformer theory and construction, Types of transformers is practical aspects, Transformer losses and regulation and rating, Types of transformers used in X-ray equipment.
- Thermionic emission. The vacuum diode, Variation of anode current with anode voltage and filament temperature in the vacuum diode, the effect of gas in the diode, the thermionic gas diode. Meaning of rectification (full wave & half wave rectification).
- Principles of semiconductors, p-n junction diode, High voltage rectifier circuits (self-rectifying circuit, Half-wave pulsating voltage circuit, Full-wave pulsating voltage circuits, shock proofing). Advantages of semiconductor devices over thermionic devices

#### **X-rays (Basics of Radiation Physics):**

- Conductivity of electricity through gases at low pressure, Cathode rays-production and properties. Sources of electrons (Discharge through gases, Thermionic emission and photoelectric emission), Discovery of an electron, Concept of electron volt.
- Discovery of X-rays, Production & properties of X-rays. Bremsstrahlung, Factors influencing the intensity and quality of X-rays, Construction and working of Modern X-ray tube (fixed anode and rotator anode tubes), The physics of X-spectra i.e. the spectrum of radiation from an X-ray tube (Continuous spectrum and line or characteristic

spectrum) ,Factors upon which the X-ray emission depends, Soft and Hard X-rays, Distribution of X-rays in space, The diagnostic X-ray tubes (inserts and shields), filament design , anode design (fixed and rotatory), methods of cooling, Basic X-ray Circuit .Linear accelerator-Transmission Type Target.

- Fine focus and large focus .Importance of Focal spot. Line focus principle and shape of the anode surface, Anode heel effect.
- Basic interactions between X-rays and matter: Coherent scattering, Photoelectric effect, Compton scattering, Pair production and Photodisintegration, Attenuation and absorption, Reduction in intensity due to absorption and attenuation and the inverse square law(Exponential formula), Filtration, Attenuation coefficients and half value layer. Energy absorbed from X-rays, Factors affecting transmission of a homogenous beam through an object(geometry, thickness, wavelength of beam, composition of an object) Transmission of a heterogeneous X-ray beam,
- Transmission of X-rays through body tissues :Relative amount of scattered radiation in an X-ray beam during its passage through a patient. The practical aspects of X-ray absorption and transmission in body tissues. The physics of the radiograph. The basic of the X-ray measurements,
- The units of Exposure(Roentgen) and Absorbed dose(gray) and their simple principles of dosimeters. The fluorescent effect of X-rays. The photographic film as a dosimeter, X-ray quality specification and measurement, Kilo voltage peak ,half value thickness. Routine methods of checking quality. Definition of KERMA.
- Dosimetric quantities (mean energy imparted ,the specific energy, exposure and exposure rate, absorbed dose and absorbed dose rate, concept of karm,
- Protection quantities (dose equivalent and effective dose equivalent) and Definition of Rem & Sievert.
- Linear Energy Transfer (LET) - Low & High LET Radiation.

# 2nd Year - RADIOTHERAPY-PART- I B

## SECTION-A

### A. RADIATION BIOLOGY

- The Physics and Chemistry of Radiation Absorption
- DNA strand breaks and chromosomal aberrations
- Cell Survival curves
- Dose response relationship for normal tissues
- Oxygen Effect and reoxygenation
- Linear Energy transfer and Relative Biologic Effectiveness
- Time, Dose and Fractionation in Radiotherapy
- New Radiation Modalities
- Acute Effects of Total Body Irradiation
- Radiation Carcinogenesis, Hereditary Effects,
- Effects on Embryo and Foetus, Cataractogenesis
- Radiation Protection
- The Cell cycle ,effects of radiation on the normal cell and abnormal cell.
- Radio sensitivity of normal and tumours cells,

### B. APPLIED ANATOMY & PATHOLOGY

Tumours, Definition, formation of tumours, characteristics of benign and malignant tumours,spread of tumours. Types of benign tumours, Types of malignant tumours

- Epidemiology
- Aetiology
- Carcinogenesis
- Characteristic of neoplasia (Natural History)
- Histological classification of neoplasia
- Spread of neoplasia
- Staging and grading systems

### PATHOLOGY OF COMMON MALIGNANT DISEASE OF INDIVIDUAL SITES (in brief)

- Skin cancer
- Head and neck tumours
- Brain tumours
- GI tract tumors(oesophagus,rectum,andanus)
- Lung cancer
- Lymphomas

- Breast cancer
- Gynecological cancers
  - Prostate cancer
  - Bladder cancer
- Seminoma
- Pediatric Tumours and others

## **SECTION-B**

### **PRINCIPLES OF RADIOTHERAPY:**

- Basics of Oncology: Multi disciplinary approach to them and management of the Cancer Patient:- Radiation Therapy, Surgery and Chemotherapy.
- Development of neoplasia within the patient
- Clinical signs and symptoms of neoplasia,
- Physical effects of neoplasia on the body
- Staging of Cancer (TNM classification).
- External Beam Therapy & Brachytherapy: Rationale, Preparation of Patient, Techniques,
- Dose, Volume, Time, Fractionation, Simulation, Reduplication of Treatment, Results, Survival.
- Altered Fractionation Schedules
- Acute and Late Effects of Radiation Therapy
- Care & assistance during Sedation /Anesthesia
- Physical effects of radio therapy, chemotherapy, surgery and other treatments, in combination and alone on the body.
- Prevention and treatment of the acute side effects of radiotherapy and associated treatments
- Complications associated with cancer and its treatment, Causes of death



## PRACTICALS :

There shall be a university practical examination in the subject for 100 marks.  
The internal assessment is for 20 marks.

### Pattern for Practical Examination:

| Sl. No. | Particulars        | Marks |
|---------|--------------------|-------|
| 1       | Practical Exercise | 40    |
| 2       | Viva-Voce          | 40    |
| Total   |                    | 80    |

## PRACTICE OF RADIATION THERAPY TECHNIQUES

**Note: (E) Denotes Practical Prescribed in University Examinations.**

### 1. Mould Room(E)

- Equipments
- Preparation of
  - Plaster of Paris cast
  - Perspex cast
  - Orfit/Aqua plast immobilization cast and others
  - Shield(use of Styro foam Cutter)
  - Tissue Compensators
  - Electron Lead Cutout
  - Mouth Bite
  - Computerized Tissue Compensator Preparation(optional)

### 2. Teletherapy & Brachytherapy Treatment planning: (E)

- Iso-dose plotting
- Studying of dose distribution of tumor and Normal tissues
- Calculations of Teletherapy & Brachytherapy treatment time.
- 3DPlanning(optional)
- Use of Computers and TPS

### 3. Simulation equipment parts,operation,principles: (E) Simulation of:-

- AP/PA portals for pelvis in cancer cervix with SSD Techniques.
- Simulation of our fields of pelvis in cancer cervix with SAD Technique.
- Simulation of oblique fields for cancer oesophagus with SAD Techniques.
- Simulation of tangential field of a case of Ca. Breast
- Simulation of whole Brain Irradiation
- Routine X-ray Chest, Abdomen ,Extremities & Patient Positioning and

decubitus.

- vii. Barium Swallow Radiology Technique, Barium meal, Barium follow through
- viii. Intravenous pyelography
- ix. CT Simulation

#### **4. Radiation Safety and Protection (E)**

#### **5. Quality Assurance in Radiotherapy (E)**

### **PRACTICALS SCHEME OF EXAMINATION 100 Marks**

(Common Practical)

|                                                      |       |          |
|------------------------------------------------------|-------|----------|
| 1. Mould Room                                        | ----- | 20 Marks |
| 2. Teletherapy & Brachytherapy Treatment planning    | ----- | 20 Marks |
| 3. Simulation equipment parts, operation, principles | ----- | 20 Marks |
| 4. Radiation Safety and Protection                   | ----- | 20 Marks |
| 5. Quality Assurance in Radiotherapy                 | ----- | 20 Marks |

# 3rd Year - RADIOTHERAPY- PART-II A

## RADIATION PHYSICS

### Principles of Radiation detection and measurement:

Gas-filled detectors (ion chambers, proportional counters and Geiger Muller counters) scintillation detectors, thermo-luminescent dosimeters(TLD). Reasons for choice of air-ionization. Roentgen and Rad. Simple principles of dosimeters. Thimble chamber-electronic equilibrium and dose buildup. Secondary Dosimeter. Elementary principles of Scintillation detectors, Thermo-luminescence dosimeters, Semiconductor devices.

### Biological Effects of Radiation:

Chemical effects of Radiation, radiolysis of water, production of freed radicals, radical's reactions, G-value. Effects-Stochastic and non-stochastic effects, chromosome aberrations and mutations. Radiation effects on wholebody (early effects and late effects). Concept of doubling dose.

### Radiation Protection:

Philosophy of radiation protection-historical development , Maximum permissible exposure concept; Annual Dose Equivalent Limits (ADEL) ALARA concept; international recommendations and current code of practice. Annual dose limits for public & Radiation workers. Protection of Public and Radiation workers.

Protective materials: Concrete, lead, lead - impregnated substances, building materials, concept of barriers, lead equivalents and variations with quality.

Teletherapy Bunker (Room) Design (Telecobalt, Linear Accelerator). Radiation protection features taking into account the workload, use factor, occupancy factor. Wall features with respect to primary beam and secondary radiation .Ceiling thickness depending on occupancy on the floor above Teletherapy room. Positioning of Air conditioning outlets.

Design of Brachytherapy room: difference between public area and restricted areas. Radioactive source movement ,control and maintenance of records .Protection instruments and personnel and area monitoring. (Survey meters, area monitors, pocket dosimeters and contamination monitors).

## **Production of X- and Gamma Ray Beams for Therapeutic purposes:**

- Tubes and high-tension circuits for the production of X-ray from 5 to 500 kV.
- Insulation and cooling problems in Radiotherapy tubes.
- Mains voltage compensation. Control of tube voltage.
- The control panel and control. The filament circuit.
- Timers safety devices and interlocks,
- Basic principles of mega voltage X-ray Machines.
- Distribution of Radiation around the target.
- Gamma ray beam unit.

## **Interaction of X and Gamma Rays with Matter:**

- Photoelectric absorption; Compton scattering; pair production. Dependence on the nature and atomic number of the absorber and on the radiation energy.
  - Range of secondary electron and its practical importance.
  - Principles of filtration, protection and beam definition.
  - Filters, beam - flattening devices, diaphragms and applicators.

## **Measurement of X and Gamma Rays:**

- The roentgen and the rad,
- Quality. Half value thickness and its measurement,
- Methods of measurement; ionization; photographic; scintillation; calorimetric; thermo luminescent, their relative advantages.
  - Ionization dosimeters; dose - rate, integrating and capacitor types.
  - The Geiger - Muller counter.
  - Scintillation counters and dosimeters.

## **Practical Dosage Measurements and Calculation:**

- Initial calibration. Site of focal spot or source; alignment of applicator or diaphragm to the end of the applicator or diaphragm.
  - Variation of dose rate across the beam in air.
  - Phantoms and phantom materials. Bolus materials.
  - Air, surface and depth doses; factors affecting them.
  - Calculation of treatment times.
  - Isodose curves.
  - The effect of focal spot or surface source site; penumbra.
  - Energy absorption in the body tissues and its effects on depth dose.

## **Protection :**

- Protective materials in common use,
- Room and machine radiation-protection in X- and Gamma-ray beam installations,

- Care and custody of small sealed radioactive sources (for example radium ,caesium-137, Strontium90).
  - Precautions to be taken in the use of dispensing of radioactive solutions.
- Personnel-monitoring methods. Department survey. Film badges, capacitor chambers and survey meters. Geiger-Muller detector.
  - Relevant protection recommendations and current code of practice

### **Technical aspects of X and Gamma Ray Therapy:**

- Tumour location and verification, principles of simulators,
- Field combinations and treatment planning,
- Beam direction devices,
- Compensating filters (for example wedges)
- Physical principles of moving field and grid therapy,
- Special aspects of Radiotherapy using megavoltage radiations, including electron beam therapy.

### **Clinical Dosimetry for Photon and Electron Beams**

- Dose distribution along beam axis
- Dose distribution of axis
- Variation of dose rate with distance and collimator settings
- Manual calculation of treatment times
- Beam modifiers (bolus, wedge, compensators)
- Computer dose calculations
- Definition of volumes and their significance
- Single, parallel and multi-field technique
- Effect of change of energy, beam direction, beam collimation ,irradiation
- Geometry
- Calculated and applied doses and beams against professional knowledge

### **EXTERNAL BEAM THERAPY**

#### **Radiation equipment**

- Principles and functioning of low energy x-rays
- Principles and functioning of Tele-cobalt machines
- Principles and functioning of linear accelerators

#### **Dose delivery to the patient**

- Immobilisation of patient
- Interpretation of the treatment prescription and plan

- Setting up of the prescribed beam parameters and check against reference marks
- Preparation, fixation and care of in vivo dosimeters (if available)
- Registration of the delivered beam parameters on a daily basis
- Documentation of portal verification and results of in vivo dosimetry
- Surveying the patient during the treatment procedure

### **Special techniques**

- Total body irradiation
- Meme-body irradiation
- Conformal Beam Radiation Therapy
  - Intensity Modulated Radiation Therapy
  - Stereo tactic radiotherapy
  - Intra-operative radiotherapy
  - Image guided radiotherapy
  - Tomotherapy

### **Technical Aspects of the use of Radioactive Sources in the Body:**

- Construction, measurement, testing and properties of small sealed radioactive sources,
- Dose calculations involving the inverse square law,
- Physical principles of moulds and implants,
- Superficial beta ray therapy. Measurement beta ray dose.
- Clinical beta-ray appliances.
- Physical principles of the clinical use of unsealed radioactive sources.

### **Construction of Cobalt -60 Teletherapy Units:**

- Types of source drawers (cylindrical/ Rotating Drum)
- Isocentric Setup and design of the Unit
- Collimation: Primary, secondary & tertiary
- Laser beam, Beam direction devices, back pointer, pin & arc principles.
- Beam modifying devices: Wedge Filters, Tissue compensators.
- Blocks, Breast cone.
- Radiation safety aspect
- Understanding why strength of Teletherapy source at a given distance, definition of RHM/RMM

### **Construction of Linear Accelerator**

- Isocentric Setup and design of the Unit
- Collimation: Primary, secondary & tertiary, Symmetric/Asymmetric.

- RF production, Accelerator Tube, Bending Magnets
- Targets of X-ray and Electron beam production
- Radiation safety aspect: Ionization chamber, quality assurance checks.
- Definition of TMR, TPR with respect to high energy x-ray beams
- Concept of monitoring units instead of timer as in Telecobalt
- Measurement of output factor and its calibration
- Multi leaf collimator: 3D conformal/
- Stereotactic Radiation therapy & Surgery/IMRT.
- Portal imaging/IGRT.

### **BRACHYTHERAPY**

- Knowledge of use of radionuclides and after loading equipment (low, medium, high and pulsed dose rate)
  - Preparation of the source holders (applicators, catheters)
  - Preparation of the patient including radiographs for dosimetry and preparation of templates.
- Monitoring of the patient before, during and after treatment
- Accurate and complete recording of documentation of all the parameters relevant to the treatment
- After care of the used radioactive sources with emphasis on safety
- Clinical Dosimetry for Brachytherapy

### **OTHER TREATMENT MODALITIES**

- Gene therapy
- Photodynamic therapy
- Unsealed radioactive nuclides
- Radiation enhancers - hyperthermia, radio-sensitisers

### **LOCALISATION AND SIMULATION**

- Principles and functioning of simulators
- Patient positioning, knowledge of fixation techniques
- Knowledge of simulation techniques for a broad range of indications and use of contrast media
- Contour taking techniques and reference marking
- Use of CT and MR images
- Data recording and transfer

### **QUALITY ASSURANCE - METHODS**

- Equipment and auxiliary materials (to include care of)
- Treatment procedures - accuracy, reproducibility and verification
- Data handling

- Monitoring and evaluation of QA procedures
- Calibration of instruments
- Emergency procedures

### **MOULD ROOM TECHNIQUES**

- Immobilization Devices & techniques for patients and their preparation
- Beam shaping devices (block, compensators etc.) and their preparation
- Bolus material and their preparation
- Moulds for Brachytherapy

### **BASIC RADIOLOGIC IMAGING TECHNIQUES**

- Radiologic Film-types, exposure, development
- Production of Radiographic Image using simulator, CT Scanner or conventional x-ray machines
- Improving Image Quality
- Fluoroscopy
- Dark Room Procedures



# 3rd Year - RADIOTHERAPY- PART-II B

## PRINCIPLES AND PRACTICE OF RADIO THERAPY

Sec A 1. Diagnostic Workup and Treatment Principles and Radiotherapy Techniques.

### A Radiotherapeutic Management of the following Cancer & occasional Benign Diseases

- Skin cancer
- Head and neck tumours
- Brain tumours
- GI tract tumors (oesophagus, rectum, anus)
- Lung cancer
- Lymphomas
- Breast cancer
- Gynecological cancers
- Prostate cancer
- Bladder cancer
- Seminoma
- Pediatric Malignancies

### B. Clinical applications of techniques of Radiotherapy:

- Teletherapy techniques
- Use of conventional fields SSD, SAD, Rotation
- Use of complex treatment plans-quality assurances, verification etc
- Use of radiation sensitizers & radiation protectors and their importance with respect to timing of the radio therapy exposure
- Patient positioning, immobilization, daily reproduction errors and corrections
- Combination of Teletherapy and Brachytherapy
- Post & Pre-operative Radiotherapy
- Special Techniques: 3D Conformal RT, IMRT, SRS/SRT-
- Patient setup, Immobilization
- Simulation/CT Simulation and Verification with quality assurance checks
- Use of Immobilization devices & Frames-careful handling
- Daily reproduction and quality assurances
- Port filming and isocenter verification

### C. Clinical applications of Special teletherapy techniques.

- Total body irradiation
- Hemi-body irradiation
- Conformal Beam Radiation Therapy
- Intensity Modulated Radiation Therapy
- Stereotactic radiotherapy
- Intra-operative radiotherapy
- Image guided radiotherapy
- Tomotherapy

## **Sec B**

### **2. PSYCHOSOCIALMANAGEMENT**

- Procedures for adaptation and rehabilitation of the person with cancer-Body Mechanics, Moving & Transferring Patients- Patients with Spinal cord injury, Fractured Extremity, Agitated & Confused patients
- Pediatric, Geriatric Patients.
- Patient with Ostomy, Gastric tube, Tracheotomy.
- Assisting with Drug and Contrast Administration,
- Counselling skills
- Role of effective communication
- Complementary therapies
- Stress and stress management
- Hospice and terminally ill

### **3. QUALITATIVEANDQUANTITATIVEMETHODSOFRESEARCH**

- Basic statistics, Interpretation of Research Publications
- Report writing

### **4. MEDICAL, LEGAL AND ETHICAL ASPECTS**

- Getting the consent of the patient
- Confidentiality, Data handling and information control
- Non-discriminatory practice
- The professional role of the Radiotherapy technologists

### **5. HEALTH AND SAFETY**

- Waste management and source Disposal
- Legislation :National and international
- Health and safety at work
- Emergency procedures
- Cardiopulmonary Resuscitation Procedures(CPR)
- Self Help Groups & NGO's and other organizations
- Funding agencies

### **6. RECENTADVANCESINRADIOTHERAPY.**

3D CRT, IMRT, Particle Beam Therapy, IGRT, Radiation Sensitizer and Protectors, Cyber Knife, Tomotherapy, Gamma Knife

## **PRACTICALS:**

### **RADIOTHERAPY-II**

Note: (E) Denotes Practical Prescribed in University Examinations.

1. Cobalt-60 machine :various parts ,its working, its Accessories ,Beam Direction devices and control console.(E)
2. Linear Accelerator: Various parts, it's working its Accessories ,Beam Direction devices and control console.(E)

### **3. Simulation and Treatment Techniques(E)**

Execution of Treatment as Per Doctors Prescription in radiation therapy chart  
Ability to understand the, patients disease, patients general condition, shifting the patient into treatment room & couch, patient positioning, use of immobilization devices and preparation of the same, verification and quality assurances.

- a. Cancer Oesophagus
- b. Cancer Cervix
- c. Cancer Breast
- d. Glottic cancer
- e. Nasopharyngeal cancer
- f. Brochogenic cancer
- g. Whole Brain
- h. Cranio-Spinal Axis Irradiation(optional)
- i. Irregular Field (including Mantel Field)
- j. Special Techniques(Rotation/Arc etc.)
- k. Newer Techniques(optional)

### **4. Brachytherapy:**

- l. Manual after loading applicators: Various types: I/c, I/V vaginal, I/L Principles ,its care, sterilization, uses, safety measures.
  - m. (Optional)Remote After Loading machines,-LDR/HDR: Parts, working, operation and precautions.
  - n. Various after loading sources for Interstitial Implantation: Physical features.
  - o. Preparation of Radioactive Source for Brachytherapy
5. I/c application cancer cervix. Application, simulation study of dose distribution, preparation of sources, loading of sources and treatment and care and removal and storage of sources.(E)

6. I/L Radiotherapy application. Application, simulation, study of dose distribution, preparation of sources, loading of sources and treatment and care and removal and storage of sources.

7. Advanced Training

- a. Dynamic Wedges
- b. StereoTactic Radiotherapy/Surgery
- c. 3DCRT
- d. IMRT
- e. Portal Imaging Method
- f. HDR Brachytherapy

**PRACTICALS SCHEME OF EXAMINATION      80Marks**  
(One Common Practical)

|                                        |       |          |
|----------------------------------------|-------|----------|
| 1. Cobalt-machine                      | ----- | 20 Marks |
| 2. Linear Accelerator                  | ----- | 20 Marks |
| 3. Simulation and Treatment Techniques | ----- | 20 Marks |
| 4. Spotters                            |       | 20 Marks |
| a. I/c application cancer cervix       | ----- |          |
| b. I/L Radiotherapy application        | ----- |          |
| c. Advanced Training                   |       |          |

# CLINICAL TRAINING

## **Content and purpose**

The clinical component has been designed to complement the academic program and runs throughout the course. The placements have to be designed so that the students will be able to observe the practical application of the academic course wherever possible. Content can be tailored to meet either National or Local needs as is deemed to be most appropriate.

## **1ST YEAR: INTRODUCTION TO THE HOSPITAL SETTING**

### **The purpose of this phase is:**

- i. For the students to become familiar with some of the practical applications of the academic course,
- ii. To introduce the wider hospital setting,
- iii. To help the students to identify the various disciplines within a hospital, their role & the importance of cooperation,
- iv. To introduce patients in a clinical setting and begin to acquire basic communication skills.

## **2ND YEAR: SKILLS NECESSARY TO WORK IN A HOSPITAL**

To be completed very early in the training. The following procedures will be demonstrated to the students who will be expected to be serve or participate as appropriate.

### **General procedures to be observed when patients attend for appointment:**

- Lifting and moving techniques
- Administration of bed pans, vomit bowls, etc.
- Care and management of drugs in the hospital setting

### **Correct procedures when dealing with patients with infectious diseases**

- Universal precautions

### **Correct procedures when dealing with immuno-compromised patients:**

- Hygiene practices,

- Simple dressings,
- Sterile procedures,
- Oxygen administration.

#### **Care of patients with:**

- Breathing difficulties,
- Terminal illness,
- Mental impairment,
- Physical disability.
- Special care of the geriatric and pediatric patient.
- Stomach care.
- Handling of patients with bone metastases.
- Care of the patient following an anaesthetic.
- Care of lines in the incubated patient.
- Communication skills with patients and relatives
- Terminally ill and Hospice

#### **2ND & 3RD YEAR : SKILLS RELATED TO WORKING IN A RADIOTHERAPY DEPARTMENT**

Introduction to the Radiotherapy Department. Time will be spent on each unit within the department. The purpose of this phase is to:-

#### **In the Department:**

- Familiarize the students with the different units within the department and the procedures carried out on each unit.
- Enable the student to recognize and relate to the basic terminology introduced in the academic program.
- Help to establish a sense of identity within the student group and to understand the role of the RTT in the management of cancer.
- Introduce the students to the staff of the department.
- Help the student to understand team roles.
- Familiarize the students with written QA programs within the department.

#### **Equipment's and integration:**

- Begin to become competent in the manipulation of the radiotherapy equipment.
- Be able to communicate effectively with patients.
- Begin to integrate into the department as part of the radiotherapy and

multidisciplinary teams.

- iv. Begin to empathize with patients and to appreciate their own feelings in the clinical situation.
- v. Being able to handle and achieve proficiency in Mould room techniques.

### **Safety & Precautions in Practice:**

- i. Identifying the functions on the pedestal/handset and safely operating these on the treatment units.
- ii. Identifying the functions on a control panel, indicating their purpose and safely using these when appropriate.
  - iii. Safely using the accessory equipment in the correct context.
  - iv. Correctly and safely using equipment related to patient immobilization.
  - v. Identifying, locating, understanding and safely using the radiation protection features incorporated in the treatment areas, e.g. Door interlocks, visible and audible warning signs, primary and secondary barriers, etc.
  - vi. Setting up single and parallel opposed fields under supervision.
  - vii. Assisting in these types of multifield techniques.
  - viii. Identifying the cassettes and films commonly used for localization and verification on the simulator and treatment units.
  - ix. Demonstrating the correct procedure for developing films (daylight processing and darkroom practice) and correctly unloading and reloading cassettes.

### **TO ACHIEVE CLINICAL COMPETENCE**

The purpose of this phase is for the students to:

- i. Demonstrate competence in the manipulation of radiotherapy equipment.
- ii. Demonstrate an ability to anticipate the physical and psychological needs of the cancer patient and respond to them.
- iii. Demonstrate the ability to communicate with ease with other staff involved in the multidisciplinary treatment of the cancer patient.
- iv. Increasingly participate as a team member in all aspects of the patient's management in radiotherapy in preparation to work as a qualified radiation therapist.
- v. Demonstrate competence in simulator procedures.
- vi. Acquire basic computer skills.
- vii. Participate in the development/ revision of formal written quality assurance procedures/ programme.
- viii. Setup a patient on their first visit.

### **TO ACHIEVE FINAL COMPETENCY SUBSTANTIAL TIME WILL BE SPENT:**

- i. Setting up multifield techniques under supervision.
- ii. Participating in the quality control procedures in the department in accordance with the protocols.

- iii. Simulating and localizing at target volume.
- iv. Describing the purpose of health and safety and ionizing radiation regulations.
- v. Discussing the role of local rules and outline those in place in the different departments.

### **Graded Responsibility (structured Training Schedule)**

**1 Year:** Theory classes, observation in treatment planning and treatment execution.

**II year:** Theory classes, Participation in OPD, Mould room techniques, Treatment planning, treatment, execution under the supervision of consultant, Senior RTT, Project Work.

**III Year:** Theory classes, Participation in OPD, Treatment planning and execution under supervision of Consultant & Senior RTT. Submission of Projectwork, Mould Room Techniques, Quality Assurance.

### **Rotation Posting**

Students may be posted to other relevant departments or other centers with better and latest equipment's for a minimum period of 1 to 2 months, for completion of training in recent advances in the Specialty. The student on completion of the training shall submit a report duly signed by the concerned department to the HOD Radiotherapy/ Radiation Oncology.

### **MONITORING LEARNING PROGRESS**

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only also helps teachers to evaluate students but also students to evaluate themselves. The monitoring be done by the staff of the department based on participation of students in various teaching/learning activities. It may be structured and assessment be done using sample checklist provided (Assessment forms).

The learning outcomes to be assessed should include: (I) personal Attitudes

- ii. Acquisition of Knowledge (iii) Clinical and operative skills (iv) Teaching skills

Candidate should be encouraged to participate in teaching activities, seminars and literature reviews.



**1. Periodic tests:**

2.

The departments may conduct periodic tests (Internal Assessment). The tests may include written papers, practical with viva voce.

**3. 6) Workdiary/ Log Personal Attitudes. The essential items are:**

- Caring attitudes
- Initiative
- Organizational ability
- Potential to cope with stressful situations and undertake responsibility
- Trustworthiness and reliability
- To understand and communicate intelligibly with patients and other
- To behave in a manner which establishes professional relationships with patients and colleagues
- Ability to work in team
- A critical enquiring approach to the acquisition of knowledge

The methods used mainly consist of observation. It is appreciated that these items require a degree of subjective assessment by the guide, supervisors and peers.

**4. Acquisition of knowledge:**

The methods used comprise of LogBook 'which records participation in various teaching/learning activities by the students. The number of activities attended and the number in which presentations are made are to be recorded. The logbook should periodically be validated by the supervisors, some of the activities are listed. The list is not complete. Institutions may include additional activities, if so, desired.

**5. Technical skills**

Day to Day work: Skills on the Machines should be assessed periodically. The assessment should include the candidates' sincerity and punctuality, analytical ability and communication skills.

Clinical and procedural skills: The candidate should be given graded responsibility to enable learning by apprenticeship. The performance is assessed by the guide by direct observation. Particulars are recorded by the student in the log book.

## 6. Teaching

### Skills:

### Book:

Every candidate shall maintain a work diary and record his/her participation in the training

Programs conducted by the departments such as practical, literature reviews, seminars, etc. Special

mention may be made of the presentations by the candidate as well as details of Practical or laboratory procedures, if any conducted by the candidate.

## 7. Records:

Records, logbooks, Project Report and marks obtained in tests will be maintained by the Head of the Department and will be made available to the University as indicated. The record books maintained by the student should be submitted to the Head of the department 6 months prior to completion of the course and the head of the department makes a certification of the academic progress an assessment of student performance throughout the said course shall be made by the HOD.

The logbook is a record of the important activities of the candidates during his training internal assessment should be based on the evaluation of the logbook collectively, logbooks are a tool for the evaluation of the training programme of the in situation by external agencies. The record includes academic activities as well as the presentations and procedures carried out by the candidate.

## RECOMMENDED

### BOOKS BASIC

### BOOKS:

1. Principles of Anatomy and Physiology, 10<sup>th</sup> Edition. Tortura Grabowski. Wiley International Press.
2. Anatomy and Physiology in Health and illness. 9<sup>th</sup> edition. Kathleen J.W. Wilson and Anne Waugh. Churchill Livingstone.
3. Anatomy and Physiology for Nurses,

T.W.A. Glenister, William Heilemann Medical Books LTD., London

4. Textbook of Radiotherapy, Radiation Physics, Therapy and Oncology  
.6<sup>th</sup>Edition.C.K.Bomford. Churchill Livingstone.
5. Anatomy and Physiology in Health and Illness,  
Anne Waugh, Allison Grant, Illustrations by Graeme Chambers.
6. Rossand Wilson, Anatomy and Physiology in health and illness, Kathleen  
J.W.Wilson, 8<sup>th</sup>Edition, Churchill and Livingstone.
7. Walterand Millers,TextBook of Radiotherapy, Radiation Therapy Physics, Therapy  
and Oncology.  
C.K. Bomford, 6th Edition, Churchill Living Stone.
8. A Nurses Guide to Cancer Care, Brenda M. Nevidjon ,Lippincott.
9. Radiotherapy :Principles and Practice, A Manual for quality in  
Treatment delivery, Sue E.Griffith, Churchill Livingstone.
10. Principles and Practice of Radiation Therapy, Introduction to Radiation  
Therapy. Charles M. Washington & Dennis T. Leaver, Mosby.
11. Clinical Oncology for Medical Students and Physicians,  
Multidisciplinary Approach, Edition 1983 another editions,  
Published by the American Cancer Society.
12. Basic Medical techniques and patient care for Radiologic  
Technologists, Second Edition.
13. Principles of Imaging Science and Protection,  
Michael A. Thompson, Janice D. Hall, Marian P. Hattaway, Steven B. Dowd,
14. Fundamental Physics of Radiology, W.J. Meredith ,J.B .Massey, Bristol:  
JohnWright&Sons Ltd.,1977
15. Basic Clinical Radiobiology for Radiation Oncologist,  
G. Gordon Steel, Edward Arnold, A Member of the Hodder Headline Group,  
London Boston Melbourne Auckland.
16. Textbook of Radiobiology, Eric J Hall.

## REFERENCE BOOKS:

1. B.D.Chaurasia, Human Anatomy, CBS Publishers
2. Radiographic Imaging, D.Noreen Chesney, Blackwell Scientific Publications, Oxford Scientific Publications, Oxford London Edinburgh, Boston Melbourne.
3. Radiation Therapy Physics
4. William Hendee  
Mosby
5. The Physics of Radiation Therapy ,Second Edition, Fiaz M.Khan,Ph.D.  
Williams & Wilkins.
6. Clinical Oncology,  
Geoffrey R. Weiss, Associate Professor of Medicine, The University of Texas Health Science Center at San Antonio.
7. Cancer Facts ,A concise Oncology Text, James F.Bishop,  
Harwood Academic Publishers,
8. Review of Medical Physiology, 20<sup>th</sup> edition, William F. Ganong, LANGE
9. A Colour Atlas of Human Anatomy, Wolfe Medical Publications
10. Medical Physics Handbook 6 , Fundamentals of Radiation Dosimetry , JR Greening, Adam Hilger Ltd, Bristol.
11. Principles and Practice of Radiation Oncology, Carlos A Perez,
12. Principles and Practice of Radiation Therapy, G.K. Rath & B.K .Mohanthi. ILBS
13. Principles of Radiological Physics .3<sup>rd</sup> edition. Donald T. Graham. Churchill Livingstone.

14. Radiation Oncology: Rational technique and results .8<sup>th</sup>edition .James D & K. KhanAng.
15. Clinical Oncology for Medical Students and Physicians. Philip Rubin. American Cancer Society.
16. Text of radiation physics; Author - khan; 5th edition, and Meredith and Massey