SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

SSAHE-PhD Technical Aptitude Test (S-TAT)

Entrance Syllabus

Syllabus	Marks
General Aptitude Research Methodology, Logical reasoning, Data Interpretation, Mental Ability, Analytical & Quantitative aptitude, General Science, Basic Computer and Health Science	30 M
Core Subject Please refer SSAHE-PhD Technical Aptitude Test (S-TAT) Entrance Syllabus for the respective Subject below	70 M

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COMPUTER SCIENCES

1. Discrete Mathematical Structures (Set Memory Fundamentals of Logic, Relations functions)
2. Computer Organization (as per CSE46 Syllabus)
3. Data Structures using C (Stack, recursion, Queues and lists, Trees, sorting, searching)
4. Operating systems (as per CS 52 Syllabus)
5. OOP with C++ (as per CSE 36 Syllabus)
6. DBMS (as per CS53 Syllabus)
7. Analysis & Design of Algorithms (as per CSE 43 Syllabus)
8. Object oriented Analysis & design (as per CS 72 Syllabus)
9. Software Engineering. (Overview, Requirements Engineering, Software Design, verification & Validation)

MECHANICAL ENGINEERING SCIENCE

Prime movers (IC Engine)

Classification of I. C Engines - 2 Stroke & 4 Stroke Petrol & Diesel Engines. Concept of Mechanical efficiency BHP & IHP Laws of Ist & IInd Thermodynamics, zeroth Law, applications.

Refrigeration & Air-conditioning

Properties – COP unit of Refrigeration, Refrigeration effect, Tonne Refrigeration.

Manufacturing Process

Part of a lathe, operation in a lathe, Types of Drilling Machine, operation a Drilling machine. Types of milling machines, operation on milling machines Grinding machines, bonding materials, grinding terminology. Type of grinding machine, Soldering, brazing & welding classification & types. Lubrication & bearing types.

Power transmission & mechatronics

Belt drives, gear drives, Introduction to mechanics- open loop & closed loop control System Advantages & Disadvantages.

Heat treatment of Metals

Anreding, Normalizing harding, tempering, carburizing, cyaniding, Nitriding and flame hardening, Iron, Carbon equilibrium diagram Composite Materials – Types of martin materials, FRP & MMC advantages & applications.

ELECTRICAL AND ELECTRONICS ENGINEERING

Network Analysis and Field Theory: Network Theory, Electrostatics, Steady magnetic fields, Time varying fields and Maxwell's equations.

Analog and Digital Circuits: Transistor frequency response, Feedback amplifiers, Power amplifiers, Oscillators, Analysis and design of combinational logic circuits, Sequential Circuits.

Microcontroller and Operational Amplifiers: Programming in C, Timer programming in assembly and C, Interrupt programming in assembly and C, ABC, DAC and senor interfacing, Comparators & converters, A/D & D/A converters, Phase Locked Loop (PLL), Timer.

Signals and Processing: Continuous-time Fourier transform, Discrete-time Fourier transform, Ztransform, Design of IIR and HR filters.

Electrical Machines: Transformers, Equivalent, Synchronous generations, DC Motors, Three-Phase Induction Motor.

Control Systems: Time domain Analysis, Routh Stability Criterion, Root locus, Bode and Nyquist plots.

Power Electronics: Controlled Rectifiers, AC Voltage Controllers, DC-DC Converters, DC-AC Converters.

Transmission lines and fault analysis: Performance of Transmission lines, Faulty Analysis.

High Voltage Engineering and Power System Protection: Conduction and Breakdown, Generation of High voltage and currents, Overvoltage Phenomenon and Insulation Coordination, Overcurrent protection, Circuit Breakers, Protection against Overvoltage.

ELECTRONICS AND COMMUNICATION

Networks: Network theorems;Superposition, Thevenin's and Norton's, maximum power transfer;Wye- Delta transformation; Steady state sinusoidal analysis; Time domain analysis of simple linearcircuits; Transients, Resonance – Series and Parallel Resonance Solution of network equationsusing Laplace transform; Frequency domain analysis of RLC circuits; Linear 2-port networkparameters: driving point and transfer functions; State equations for networks.

Signals and Systems: Continuous-time signals; Fourier series and Fourier transform representations,sampling theorem and applications; Discrete-time signals: Various types, discrete-time Fouriertransform (DTFT), DFT, FFT, Z-transform, interpolation of discrete-time signals; LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay, digital filter design techniques.

Electronic Devices: Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equations; P-N junction, Zener diode, BJT, MOS Capacitor, MOSFET, SCR, IGBT, LED, photo diode and solar cell; Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process.Thick and thin film techniques**.**

Analog Circuits: Small signal equivalent circuits of diodes, BJTs and MOSFETs; Simple diode circuits: clipping, clamping and rectifiers; Single-stage BJT and MOSFET amplifiers: biasing, bias stability, mid-frequency small signal analysis and frequency response; BJT and MOSFET amplifiers: multi-stage, differential, feedback, power and operational; Simple op-amp circuits; Active filters; Sinusoidal oscillators: criterion for oscillation, single-transistor and op- amp configurations; Function generators, wave-shaping circuits and 555 timers; Voltage reference circuits; Power supplies: ripple removal andregulation. Voltage Regulators

Digital Circuits: Number systems; Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, Logic Families. logic gates, CMOS implementations, Logic gates, code converters, multiplexers, decoders and PLAs; Sequential circuits: latches and flip-flops, counters, shift-registers and finite state machines; Data converters: sample and hold circuits, ADCs and DACs; Semiconductor memories: ROM, SRAM and DRAM. Cache Memories. Sensors, Transducers – Display Devices – LED and LCDs.

Control Systems: Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; error coefficient, steady state error, Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag-lead compensation; State variable model and solution of state equation of LTI systems, Closed loop response - M & N Circles, Nichols Chart. Basics of Non Linear controls, Industrial Automation and Robotics.

Communications: Random processes: autocorrelation and power spectral density, properties of white noise, filtering of random signals through LTI systems; Analog communications: amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, super heterodyne receivers, circuits for analog communications; Information theory: entropy, mutual information and channel capacity theorem; Digital communications: PCM, DPCM, digital modulation schemes, amplitude, phase and frequency shift keying (ASK, PSK, FSK), QAM, MAP and ML decoding, calculation of bandwidth, SNR and BER for digital modulation; Fundamentals of error detection correction and Hamming code; Basics of Spread spectrum communications,TDMA, FDMA, CDMA and OFDM. CCN: Basics, Ethernet, Internet Relevant Protocols Services.

Computer Organization: Organization and architecture. Computer components and functions. Various generations of computers. Addressing—Zero, single, two and three address machines. Hardwired and microprogramming. Arithmetic Circuits-Binary adder, subtractor, multiplier and divider circuits. Fast adder. BCD adder, Floating point representation and arithmetic operations. I/O devices. RISC, CISC machines, Parallel computing and organization.

Electromagnetics: Electrostatics; Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Pointing vector; Plane waves and properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth; Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart; Waveguides: modes, boundary conditions, cut-off frequencies, dispersion relations; Antennas: antenna types, radiation pattern, gain and directivity, return loss, antenna arrays; Basics of radar; Light propagation in optical fibers, Dipole and Yagi antennas

Microprocessor and Microcontrollers: Microprocessor family. Evolution, advances in architecture.8086 processor—Architecture, pin details, functions, Instruction set, assembler directives, Simple programs. Interrupts and interrupt handling. I/O and memory interfacing. Buses—RS232 and USB. Microcontroller—8051, architectural details, Instruction sets, Interrupts, Programming Arm Processor-Basics. Embedded system

CIVIL ENGINEERING SCIENCE

Structural Analysis: Structural Systems Methods of Joints and Sections and Truss Analysis Strain Energy Arches and Cables.

Fluid Mechanics: Open Channel Flow Water Hammer, Dimensional Analysis, Impact of Jets on Vanes Turbines, Centrifugal Pumps.

Concrete Technology: Fresh Concrete and Hardened Concrete Mix Design, Special Concretes, Nondestructive Testing of Concrete.

Design of Concrete Structures: Principles of Limit State Design Serviceability Limits, Effective Lengths Design Loads, Anchorage of Bars, Lateral Stability of Beams.

Geotech: Index Properties of Soil Classification of Soils Soil Structures, Compaction of Soil Consolidation of Soils, Shear Strength of Soil.

Transportation: Highway Planning and Alignmen, Design Principles Pavement Materials and Construction, Wind Analysis and Site Selection for Airports.

Irrigation Engineering: Water Requirements of Crops Canals, Diversion Works, Gravity and Earthen Dams.

Steel Structures: Steel Structural Fasteners Tension – Compression – Flexure Members Connections

Theory of Elasticity: Plane Stresses and Plane Strain, Principal Stresses and Principal Strains Strain Displacement Relationship, Equilibrium and Boundary Condition Generalised Hook's Law

PHYSICS

Mechanics and Properties of Matter: Frames of Reference – Rigid body dynamics – Moment of Inertia – Laws of Conservation. Elasticity – Viscosity – Surface Tension.

Heat and Thermodynamics: Kinetic Theory – Laws of Radiation –Thermodynamics – Liquification of Gases – Entropy – Heat engines and Refrigeration. Thermal Conductivity.

Waves Acoustics: Progressive waves – Superposition – Doppler effect – Acoustics of Buildings – Fourier transforms – Ultrasonics.

Optics: Theories of Light – Interference – Diffraction – Polarisation – Optical Instruments – Resolving Power. Laser – Production, Properties and Applications.

Electricity and Magnetism: Electrostatics – Galvanometers – Measuring Instruments) - Alternating and Direct current – Generation and Analysis –Thermoelectricity – Electromagnetism .

Atomic and Molecular Physics: The electron – Atomic Models – Atomic spectra – Molecular spectra – Related measurements. Zeeman effect. X – rays – Crystallography

Nuclear Physics: The nucleus – Nuclear models - Mass spectrographs –Radioactivity –Accelerators – Nuclear detectors – Nuclear reactions - Cosmic ray -Mossbauer effect -Magnetic Resonance – Applications – Elementary Particles.

Solid State Physics: Relativity - Special and General Theories of relativity –Statistical Physics – Specific Heats of Solids – Band Theory of solids –Classification of solids - Electrical Conductivity in solids – Dielectric and Magnetic Properties – Specific Heats of Solids – Semiconductors – Applications –Semiconductor devices – Transistors - Amplifiers – Oscillators - Digital electronics– Superconductivity

Quantum Physics: Failure of Classical Physics – Duality – Wave function –Schrodinger wave equations. Solutions – Eigen values

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CHEMISTRY

Periodic Properties: Atomic radii – Ionization energy in groups and periods – Electron affinity Chemical Bonding.

Organic Chemistry: Classification and nomenclature of organic compounds. Electronic effects and reactive intermediates –Principles of purification of organic compounds – Halogens – Cycloalkanes – Aromatic hydrocarbons – Elimination Reaction – Organo-metallic compounds – Alcohols – Phenols – Carboxyl compounds – Carboxylic acid – Hydroxy acids – Amines – Diazonium Compounds. Active methyl compounds Carbohydrates – Stereo-chemistry – Amino acids – Peptides – proteins. Oils and Fats – Waxes – Dyes – Terpenes. Drugs - Hormones – Vitamins

Inorganic Chemistry: Molecular orbital theory – General characteristics of s –block and Gravimetry – results. P-block - elements Statistical analysis of quantitative measurements (errors – accuracy – precession etc). Nobel Gases –Non-aqueous solvents Ion exchange - Metallurgy – Gaseous fuels.

Physical Chemistry: Liquid mixtures Properties of liquid Mixtures– Colligative Properties - Chemical Kinetics – Colloids – Emulsions – Crystallography. Electrochemistry –Hydrolysis of salts – Ionic equilibria. Distribution law.

Nuclear chemistry: Fundamental properties of nucleons – isotopes – nuclear stability – binding energy – nuclear models – fission and fusion – nuclear transmutation – radioactivity – nuclear reactors – accelerators. Application of nuclear chemistry.

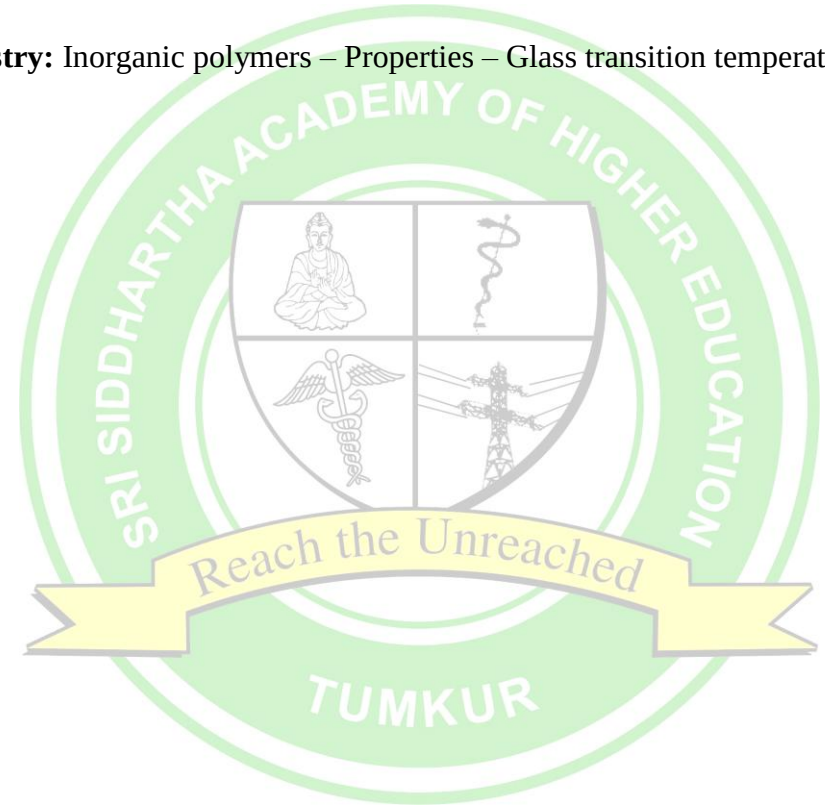
Thermodynamics: Gas laws - Thermodynamic processes – State function – Laws of Thermodynamics - Heat engine - Free energy – Entropy – Phase equilibria.

Co-ordination Chemistry: Basic concepts – Valance bond theory – Crystal field theory – Bio-inorganic chemistry – Enzymes – Occurrence – properties and structure of enzymes.

Radiation Chemistry: Primary and secondary states in radiochemical reactions. Ionic yield – energy yield – comparison with photochemistry – Radiolysis – Units of Measurement of radiation.

Molecular Chemistry: Types of spectra – Rotational energy – Calculation of bondb length – Vibrational energy - Selection rules and transitions. NMR Spectroscopy.

Polymer Chemistry: Inorganic polymers – Properties – Glass transition temperature.



MATHEMATICS

Trigonometry: Trigonometric ratios and relations, simple problems. Complex numbers: Definition and properties, De moivre's theorem, roots of complex numbers

Infinitte Series: Convergence and divergence of series of positive terms. Standard tests for convergence. Alternating series, Leibnitz test.

Linear Algerbra: Matrices and determinants, Inverse of a matrix, rank of a matrix, consistency of a system of linear equations. Eigen values and eigen vectors

Calculus: Differential Calculus: nth derivative of standard functions, polar curves, angle between polar curves. Partial differentiation, maximum and minimum for function of single and two variables. Curvature and radius of curvature, mean value theorems, Taylor's and Maclaurin's expansion for a function of single variable. Indeterminate forms.

Integral Calculus: Tracing of standard curves. Beta and gamma functions. Length, Area, Volume using multiple integrals

Differential Equations: Solutions of first order and first degree differential equations

Applied Mathematics: Laplace Transforms, Fourier Series & Fourier transform Numerical Method - Solutions of algebraic and transcendental equations, finite differences and related problems, numerical differentiation and numerical integration, Numerical solution of ordinary and partial differential equations, application to Engineering problems. Statistics and Probability statistics and Probability

Probability : Axiams ,Including Bayes theorem, conditional probability, probability distribution- Binomialpoisson, normal, geometric and exponential distribution

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MANAGEMENT STUDIES (MBA)

Economics: Demand and Supply - Production and Cost decisions - Pricing (policies and strategies in different market structure) - Measurement of National Income - Fiscal and Monetary Policy - Economic Reforms since 1991 - Inflation and Deflation - Money and Capital market, Indian Financial markets and Regulatory Bodies, Reforms in Indian Financial Markets - FDI - Business cycles.

Organizational Behaviour and Human Resource Management: Personality - Learning Motivation - Emotions at workplace - Group Dynamics, Organizational 6 Climate - Culture Change & Development - Leadership - Managing Conflicts - Organizational Development - Human Resource Development - HR Planning - Recruitment - Selection - Training and Development - Performance and Potential appraisals - Career and Succession Planning.

Accounting & Financial Management: Financial Accounts - Financial Statement Analysis and Ratio Analysis - Fund flow and cash flow Statements - Costing Budgetary Control. Goals of Financial Management - Capital budgeting - Capital Structure - Leverage - Cost of Capital, Working Capital Policy.

Marketing: Consumer Markets and Business Markets - Segmentation - targeting and Positioning - Marketing Mix 4P's - Product life cycle - Services Marketing: Additional Ps - Customer Relationship Management, Digital and Social Media Marketing - Brand Management - Retailing on the net.

Strategy: Strategic Management - Vision- Mission - Objectives - Environmental analysis - Strategy formulation - Corporate Level SBU Level - Functional Strategies - Strategy implementation.

Corporate Governance: Procedures and Principles, Governance Reforms in India - Business Ethics: Ethics and Management System; Ethical issues and Analysis in Management; Value based organizations; Personal framework for ethical choices; Ethical pressure on individual in organizations; Gender issues; Ecological consciousness; - Corporate Social Responsibility.

International Business: Modes of International Business - Liberalization - Globalization - Privatization - Entry Strategies and FDI in International Business - Internationalization process of multination enterprises - Cross culture management - EXIM Policy - World Trade Organization.

Entrepreneurship: Entrepreneurship and the Entrepreneurial Mind-Set - Entrepreneurial Intentions and Corporate Entrepreneurship - Entrepreneurial Strategy: Generating and Exploiting New Entries - Creativity and the Business Idea - Identifying and Analyzing Domestic and International Opportunities - Intellectual Property and Other Legal Issues for the Entrepreneur - The Business Plan - The Marketing Plan - The Organizational Plan - The Financial Plan - Sources of Capital - Strategies for Growth and Managing the Implication of Growth - Qualities required for future Entrepreneurs.

ANATOMY

General Embryology: A brief account of the male and female reproductive system, gestation period - subdivisions; testis, ovary; definition of gamete; sperm, ovum, gametogenesis, migration of primordial germ cells into gonadal ridge; structure of sperm, growth of ovarian follicles, and uterine cycle. Principles of Family Planning (contraception), Invitro fertilisation (for integrated teaching.

First week of Development: Definition and process of fertilisation, formation of zygote; cleavage, formation of morula and blastocyst; implantation; formation of decidua- its subdivision. Types of implantation and abnormal sites of implantation.

Second week of Development: Differentiation of embryoblast and trophoblast; changes in the embryo blast, bilaminar germ disc changes in the trophoblast, formation of cytotrophoblast, syncytiotrophoblast, amniotic membrane, yolk sac, extra embryonic mesoderm, extra embryonic coelom, connecting stalk, formation of chorion, amniotic cavity, primary yolk sac and appearance of prochordal plate.

Third week of Development: Appearance of primitive streak and primitive node; formation of intraembryonic mesoderm resulting in trilaminar germ disc; formation of notochord, buccopharyngeal and cloacal membranes, pericardial sac, paraxial, intermediate and lateral plate mesoderm, secondary yolk sac, intraembryonic coelom and allantonic diverticulum; derivatives of ectoderm, endoderm and mesoderm.

Fourth to Eight week of Development: Formation of sonites, neural tube, cephalocaudal folding, lateral folding, body form, stomodeum, proctodeum, gut and vitelline duct; subdivisions of gut into foregut, midgut and hindgut.

Placenta: Formation of placenta and chorionic villi; decidua basalis; features and functions of placenta, placental circulation; abnormalities, placental barrier and types of placentae.

Umbilical Cord: Formation and features of umbilical cord.

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MEDICAL PHARMACOLOGY

General Pharmacological Principles

- Introduction, Routes of Drug Administration
- Pharmacokinetics: Membrane Transport, Absorption and Distribution of Drugs
- Pharmacokinetics: Metabolism and Excretion of Drugs, Kinetics of Elimination
- Pharmacodynamics: Mechanism of Drug Action; Receptor Pharmacology
- Aspects of Pharmacotherapy, Clinical Pharmacology and Drug Development
- Adverse Drug Effects

Drugs Acting on Autonomic Nervous System

- Autonomic Nervous System: General Considerations
- Cholinergic System and Drugs
- Anticholinergic Drugs and Drugs Acting on Autonomic Ganglia
- Adrenergic System and Agonists
- Antiadrenergic Drugs (Adrenergic Receptor Antagonists)
- Drugs for Glaucoma

Autacoids and Related Drugs

- Histamine and Antihistaminic drugs
- 5-Hydroxytryptamine, its Antagonists and Drug Therapy of Migraine
- Prostaglandins, Leukotrienes (Eicosanoids) and Platelet Activating Factor
- Nonsteroidal Anti-inflammatory Drugs and Antipyretic-Analgesics
- Antirheumatoid drugs
- Antigout Drugs

Respiratory System Drugs

- Drugs for Cough and
- Drugs for Bronchial Asthma

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MEDICAL MICROBIOLOGY

General Microbiology: Historical introduction to Microbiology, Classification & morphology of bacteria, viruses and fungi. Physiology of bacteria including growth requirements & metabolism, Sterilization, Disinfectants. Types of microscopes ,micrometry and microscopy. Bacterial genetics and drug resistance to antimicrobial agents. Host parasite relationship and bacterial infections. Antimicrobial agents – mode of action, MIC, MBC detection and disc diffusion techniques, Bacterial genetics & nucleic acid amplification technologies. Laboratory waste management. Definition of waste, classification, segregation, transport and disposal.

Immunology: Introduction, Definition of immunity, types of immunity, factors responsible, mechanism of innate Immunity, active and passive immunity, local immunity. Antigen, Antibodies, Serological Reactions, Immune system. Immune response. Complement, Hypersensitivity, Autoimmunity. Autoimmunity -Definition, mechanism, classification, pathogenesis. Transplantation & tumor immunology, Immunodeficiency diseases. Preventive inoculations, immunomodulation and Immunotherapy

Systemic Bacteriology: Isolation, description and identification of bacteria. The epidemiology, pathogenesis**,** antigenic characteristics and laboratory diagnosis of disease caused by them. Staphylococcus and Micrococcus; Anaerobic Gram positive cocci. Streptococcus and Lactobacillus. Neisseria. Corynebacterium and other coryneform organisms. Bacillus: the aerobic spore-bearing bacilli. Clostridium: the spore-bearing anaerobic bacilli. Non-sporing anaerobes The Enterobacteriaceae. Vibrios, Aeromonas, Plasiomonas, Campylobacter and Spirillum, H.pylori. Erysipelothrix and Listeria. Pseudomonas. Chromobacterium, Flavobacterium, Acinetobacter and Alkaligens. Pasteurella, Francisella. Haemophilus and Bordetella,Brucella, Mycobacteria. The spirochaetes. Actinomyces, Nocardia and Actinobacillus. Mycoplasmatales: Rickettsiae. Chlamydiae.

Mycology: General characteristics & classification of fungi. Laboratory diagnosis of fungi, Dermatophytes. True yeast, yeast like fungi, mould and dimorphic fungi of medical importance. Pneucocystis carinii infection. Mycetismus & mycotoxicosis. Fungi causing superficial mycoses. Fungi causing subcutaneous mycoses. Fungi causing systemic infections

Virology: General properties, morphology and classification of viruses. Laboratory diagnosis of viral diseases. DNA viruses of medical importance. RNA viruses of medical importance. Bacteriophage. Immunoprophylaxis & anti-viral drugs. The nature of viruses. Virus replication. Bacteriophages. Pox viruses. Herpes viruses. Rubella virus. Arbo viruses. Influenza virus. Respiratory disease: Rhinoviruses, adenoviruses, corona viruses. Paramyxoviridae. Enteroviruses : Polio, Echo, Coxsackie viruses. Hepatitis viruses. Rabies virus. Slow viruses. Human immunodeficiency viruses. Oncogenic viruses. Teratogenic viruses. Viruses of gastroenteritis. Prion diseases

Parasitology: General characters& classification of Parasites. Laboratory diagnosis of parasitic diseases. Host – parasite relationship. Parasites found in various organs (final abode) and larva migrans. Protozoans of medical importance. Cestodes of medical importance. Trematodes of medical importance. Nematodes of medical importance. Ectoparasites of human body and disease transmitted by them. Rhinosporidium seeber

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MEDICAL BIOCHEMISTRY

Applied and Clinical Biochemistry: History & scope of Biochemistry, Biochemistry of Cell, Chemistry & biological importance of carbohydrates, proteins & amino acids, lipids, nucleic acids, Chemistry of blood & hemoglobin, plasma proteins, Blood coagulation, Environmental Biochemistry, Chemistry, composition & functions of biological fluids, Urine formation, excretion & urine analysis.Composition, chemistry & functions of specialized tissues like muscle, bone, nerve, connective tissue, & brain adipose tissue. Acid base balance & imbalance. Biochemistry of Diabetes mellitus, Atherosclerosis, Fatty liver, and obesity. Organ function tests : Liver function tests, Kidney function test, Thyroid function tests, Adrenal function tests, Pancreatic function tests, Gastric function tests. Radioisotopes & their clinical applications, Biochemistry of aging. Neurochemistry in Health & Disease. Biochemical changes in pregnancy & lactation. Water & electrolytes balance & imbalance. Total Quality Management of Laboratories: Internal Quality control, External Quality control, Accreditation of laboratories. Basics of Medical statistics. Inborn errors of metabolism. Biotrasformations of Xenobiotics. Basic concepts of Biochemical Defense Mechanisms.

Vitamins, Minerals, Hormones and Nutrition: Principles of Nutrition – Balanced diet & its planning, Nutritive importance of various food sources, Calorific value of food , toxins & additives , Obesity, Protein Energy Malnutrition (PEM)-Kwashiorkor & Marasmus. Diet in management of chronic diseases viz, Diabetes mellitus, Coronary artery disease, Renal disorders, Cancer, Hypertension, Anemia, Rickets & Osteomalacia. Diet for overweight person, pregnant woman and during lactation. Vitamins- chemistry, biological importance, deficiency manifestations & recommended daily allowance. Macro & micro – elements & their role in health & disease. Hormones: Communication among cells & tissues, Hormone- General mechanism of action of hormones, chemistry, functions, synthesis of steroid hormones, polypeptide hormones, & thyroid hormones. Chemistry & functions of hormones of pancreas and parathyroid. Local hormones. Clinical disorders of hormones, Hormone receptors. Principles of Nutrition –Balanced diet & its planning, Nutritive importance of various. Food sources, Calorific value of food , toxins & additives , Obesity, Protein Energy. Malnutrition (PEM)-Kwashirkor & Marasmus.

COMMUNITY MEDICINE

Concepts in Public Health

- Concept of Disease control strategies.
- Public Health importance of the Health Promotion Approach.
- Concept of Health for All, Millennium development goals.
- Multi-sector approach in Health care programs.
- Health Care as part of Community Development Community Participation in health care programs.

Role of Social sciences in Health

- Need and Importance and Role of Medico- Social work in Public Health Behavioural sciences. Need and importance of Health - Seeking Behaviour in implementing Health care programs.
- Meaning and relationship of Behavioural Sciences to Health.
- Principles of Social Psychology as applicable to Health.
- Principles of social Anthropology as applicable to Health

Principles and Practice of Information, Education and Communication

- Principles of IEC Health Education.
- Objectives of Health Education.
- Content of Health Education.
- Relevance of using Communication Methods in the implementation of Health care.
- Meaning of Communication.
- Principles of effective Communication, relevant to health.
- Communication Blocks and means of overcoming the blocks.
- Communication strategies for facilitating effective implementation of Heath programs.
- At individual and community levels.
- The use and influence of Mass Media for IEC.
- Practice (Methods) of IEC and its application in Community Health.
- Quantitative and Qualitative Evaluation of impact of IEC programs.
- Population Education.

Maternal and Child Health Care

- Meaning and relevance of Risk Approach to Maternal and Child Health.
- Review of the public health relevance of Maternal and Child health physical, mental, social and behavioral problems.
- Rationale, Components and Implementation of Antenatal, Intranatal and Postnatal Care.
- Rationale, Components and Implementation of Child Health Care.
- Maternal and Childhood Disease control strategies.
- Indicators of MCH care and their interpretation.
- Child rights, life skill education.

Biostatistics

- Collection / Organisation of data / Measurement scales.
- Presentation of data and Record keeping.
- Measures of central tendency.
- Measures of variability.
- Sampling and Planning of health survey.
- Probability, Normal distribution and inductive statistics.
- Estimating population values.
- Tests of significance (Parametric / Non-parametric).
- Analysis of variance.
- Multi-Variate Analysis and Meta-analysis.
- Association and correlation and Regression.
- Vital Statistics.
- Evaluation of health and measurement of morbidity / mortality.
- Life table and its uses, survival analysis.
- Use of computers.
- Census.
- Qualitative Research methodologies.
- Evaluation methodologies.

Principles and Application of Epidemiology.

- Principles of Epidemiology.
- Types and detailed methodologies of Epidemiological studies such as descriptive, Analytical, Experimental and importance of Multi-Centric studies.
- Appropriate choice of epidemiological approach for given situations.
- Interpretation of Epidemiological studies.
- Community diagnosis.
- Meta-analysis and systematic review.

Health Information System.

- Uses of Health Information System in Health planning including Situational analysis, Prioritization, Monitoring and Evaluation.
- Sources and methods of data acquisition.
- Applications of health information on National and International Notification of diseases.
- Use of Internet and Intranets including NICNET, etc.
- Health Management Information System (HMIS), Mother and Child Tracking system (MCTS).

MEDICAL PHYSIOLOGY

History of Physiology & General Physiology: History of Physiology, Genetic control mechanism, Biophysics principles, bioelectric potentials, Growth, Development and Ageing, Regulations of Body fluids & electrolyte & applied aspects.

Environmental Physiology: Physiology at High attitude, Hyperbarism, Regulation of body temperature, Space Physiology; Environmental pollution- radiation, smoke, noise, industrial.

Yoga & Meditation: Yoga Asanas, Physiological Effects of Yoga, Physiological Effects of Meditation, Health Benefits of Yoga & Meditation.

Endocrine System: Introduction; Mechanism of hormone action; Endocrine functions of Hypothalamus; Anterior pituitary hormones: functions, regulation, disorders. Posterior pituitary hormones- ADH & Oxytocin functions, regulation, disorders; Thyroid hormones: synthesis, fate, functions, regulation, disorders; Parathyroid hormone: synthesis, functions, regulation, disorders. Adrenal cortex and Adrenal medulla Hormone: secretion, functions, regulation, disorders; Pancreatic hormones- Insulin & Glucagon secretion, functions, regulation, disorders.

Reproductive System: Sex Chromosomes, Determination, Differentiation; Functional Anatomy of Reproductive System; Puberty & Menopause ; Spermatogenesis & Testosterone ; Oogenesis; Menstrual cycle ; ovarian cycle & Ovulation; Estrogen & progesterone ; Placenta – Circulation, functions & Physiological basis of fertilization & implantation ; Pregnancy; parturition ; Lactation and contraception.

Cardiovascular System: General organization of CVS; Physiological anatomy of Heart; Cardiac muscle ; Excitatory and Conducting tissue; Electrocardiography: Normal ECG & abnormal ECG; Cardiac Cycle; Heart sounds; Heart rate and its regulation; Hemodynamics of lood flow; Arteries and Arterioles; Blood pressure, its regulation, applied; Microcirculation; Local Blood Flow Regulation, Lymphatic system; Oedema; Cardiac Output; Venous Return; Coronary Circulation; Ischemic heart disease; Cardiac failure; Circulatory Shock; Congenital heart Disease; Regional Circulations; Effect of exercise on CVS.

Respiratory System: Internal & External Respiration; Functional Anatomy of Respiratory Tract; Functions of respiratory system; Mechanics of respiration; Compliance; Surfactant; Lung volumes and capacities; Dead space; Diffusion of Gases; Respiratory membrane; Transport of O2; Oxygen–hemoglobin dissociation curve; Transport of CO2 ; Neural control of Respiration; Chemical control of Respiration; Pulmonary Circulation; Ventilation perfusion ratio; Hypoxia ; Respiratory adjustments in exercise; Artificial Respiration; Pulmonary function Test.

Kidney: Structure & Functions of kidney; Nephron- Functional unit; Juxtaglomerular Apparatus; Renal Circulation; Clearance ; Formation of urine: Glomerular Filteration, Tubular reabsorption & secretion; Concentration & Dilution of urine; Role of kidney in acid base balance; Physiology of micturition; Renal failure, dialysis; renal transplant; artificial kidney; diuretics; Composition of urine & abnormal constituents ; Renal Function Tests.

Special Senses: Vision: Functional anatomy of eye; Optics, Errors of refraction; Aqueous humor; Pupillary reflexes; Microscopic structure of retina, Rods & Cones, Photochemistry of vision ; dark & light adaptation; Colour vision ; Visual pathway; Visual cortex. Movements of eyeballs. Hearing: Physiological anatomy and Functions of external ear; middle ear and inner ear; Cochlea, Mechanism of hearing; Place principle, Auditory pathway & auditory cortex; Deafness, Audiometry. Taste: Functional anatomy of taste buds, different taste modalities, pathway, receptors of taste, pathways, applied. Smell: Functional anatomy of receptors, primary olfactory sensations, pathway, Applied.

Central Nervous System: General organization of Nervous System; Structural and Functional divisions and Levels; Synapse; Receptors; Ascending Tracts; Physiology of pain; Internal analgesia system; Sensory Cortex; Thalamus. Motor system - Organization and different motor components; Spinal cord – Organization for motor functions, Cord reflexes, Spinal shock; Reflexes; Muscle Spindle and Golgi tendon organs; Motor Cortex; Descending Tracts; Upper motor Neuron Lesion , Lower Motor Neuron Lesion. Brain stem - Role in control of Motor functions, Vestibular apparatus and brainstem nuclei, Maintenance and regulation of tone, posture and equilibrium; Cerebellum and its motor function; Basal Ganglia and its motor functions; Parkinson's disease. Higher function of the brain - learning, Memory, Language; Limbic system; Hypothalamus; Reticular activating system; Electroencephalogram; Sleep; Cerebral blood Flow and Cerebrospinal fluid.

PERIODONTICS

Applied anatomy, physiology, biochemistry of the periodontium.

Characteristics of periodontal disease, etiology, pathogenesis and microbiology Etiopathogenesis

- Classification of periodontal diseases and conditions
- Epidemiology of gingival and periodontal diseases
- Defense mechanisms of gingiva
- Periodontal microbiology
- Basic concepts of inflammation and immunity
- Microbial interactions with the host in periodontal diseases
- Pathogenesis of plaque associated periodontal diseases
- Dental calculus
- Role of iatrogenic and other local factors
- Genetic factors associated with periodontal diseases
- Influence of systemic diseases and disorders of the periodontium
- Role of environmental factors in the etiology of periodontal disease
- Stress and periodontal diseases
- Occlusion and periodontal diseases
- Smoking and tobacco in the etiology of periodontal diseases
- AIDS and periodontium
- Periodontal medicine
- Dentinal hypersensitivity

Clinical and Therapeutic Periodontology Clinical periodontology includes gingival diseases, periodontal diseases, instrumentation, diagnosis, prognosis and treatment of periodontal diseases

- Surgical aspects of periodontics.
- Traumatic periodontal disturbances.
- Interrelationship of periodontics with other Dental and medical clinical disciplines.
- Public health aspects of periodontal diseases-preventive Periodontics.
  Current advances in periodontics.

RADIO-DIAGNOSIS

Management and Planning of radiology department with compliance to national & international guidelines

- Regulatory Bodies & regulatory Requirements: International Commission on Radiation Protection (ICRP) / National Regularity body (AERB - Atomic Energy Regulatory Board) - Responsibilities, organization, Safety Standard, Codes and Guides, Responsibilities of licenses, registrants & employers and Enforcement of Regulatory requirements. (ICRP, NRPB, NCRP and WHO guidelines for radiation protection, pregnancy and radiation protection).
- Personal monitoring and occupational exposures: Personal monitoring for Radiation workers. Monitoring devices. Body badges and ring badges. Thermoluminescent dosimeters, Pocket ionization chambers. Applications, advantages and limitations of each device, Values for dose equivalent limits for occupational radiation exposures.
- Radiation safety and radiation protection

Modern Imaging techniques including Fusion and Hybrid imaging technologies

- Angiography, venography and cardiac catheterization procedures
- CT, MRI, Ultrasound – Technique, protocol and acquisition techniques
- Techniques of Fusion and Hybrid imaging technology including PET CT, PET MRI, PET ULTRASOUND , MRI, CT, FLUOROSCOPY, Hybrid imaging as well as advanced interventional suite

Advances Physics of Radiology and Imaging

- CR, DR, CT, MRI and ultrasonography

Modern Radiological and Imaging equipment

- CT, MRI, Ultrasonography, Fluoroscopy and IITV

Radiological imaging procedures

- Barium studies including single and double contrast, enteroclysis, Sialography, Intravenous cholangiography, PTC, T-tube cholangiogram including MRI special techniques
- IVP, RGU, MCU, Cystography
- Breast imaging techniques - Mammography basic views, Wire localization, Biopsy procedures
- HSG, Sinography and Fistulogram, Arthrography

Quality Assurance and quality control in Diagnostic Radiology and Imaging Intervention

Radiological Techniques and Care of Patient

Newer development in Advanced Imaging technology

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PROSTHETIC DENTISTRY

Study of human masticatory apparatus and its functions in health, in deranged occlusalstates and in conditions incidental to partial or complete loss of teeth and/or facialstructures.Study of the principles, procedures and techniques of constructing and maintainingvarious types of dentures and allied prosthesis including the material used. (RemovableProsthodontics And Implants, Fixed Prosthodontics) Study of biological and mechanical consideration related to various types of dentures and allied prosthesis. Removable Prosthodontics and Implants a. Prosthodontic treatment for completely edentulous patients – Complete denture, immediate complete denture, single completedenture, tooth supported complete denture, Implant supported Prosthesis for completelyedentulous b. Prosthodontic treatment for partially edentulous patients:

- partial dentures,intra coronal and extra coronal precision attachments retained partial dentures,maxillofacial prosthesis. Prosthodontic treatment for edentulous patients: -Complete Dentures and Implant supported Prosthesis for Edentulous in both the arches Complete Denture Prosthesis - Definitions, terminology, G.P.T., Boucher's clinical dentalterminology Scope of Prosthodontics - the Cranio Mandibular system and its functions, the reasons forloss of teeth and methods of restorations, Infection control, cross infection barrier -clinical and laboratory and hospital and lab waste management. Prosthodontic treatment for partially edentulous patients - RemovablepartialProsthodontics - a. Scope, definition and terminology, Classification of partiallyedentulous arches - requirements of an acceptable methods ofclassification, Kennedy's classification, Applegate's rules for applying the Kennedy classification b. Componentsof RPD - major connector - mandibular and maxillary,minor connectors, design,functions, form and location of major and minor connectors, tissue stops, finishing lines,reaction of tissue to metallic coverage. Maxillofacial Rehabilitation: Scope, terminology, definitions, cross infectioncontrol andhospital waste management, work authorization. Occlusion Evaluation, Diagnosis and Treatment of Occlusal Problems Scope,definition, terminology, optimum oral health, anatomic harmony, functional harmony, occlusalstability, causes of deterioration of dental and oral health, Anatomical, physiological,neuro - muscular, psychological, considerations of teeth, muscles of mastication,Temporo-mandibular joint, intra oral and extra oral and facial musculatures, the functionsof Cranio mandibular system.

Fixed Prosthodontics Scope, definitions and terminology, classification and principles,design, mechanical and biological considerations of components - Retainers, connectors,pontics, work authorization.

TMJ – Temporo-mandibular joint dysfunction - Scope, definitions, and terminologyTemporo-mandibular joint and its function, Orofacial pain, and pain from the temporomandibular joint region, temporo-mandibular joint dysfunction, temporo-mandibularjoint sounds, temporo- mandibular joint disorders Anatomy related, trauma, discdisplacement, Osteoarthrosis /Osteoarthritis, Hypermobility and dislocation, infectiousarthritis, inflammatory diseases, Eagle's syndrome (Styloid -stylohyoid syndrome),Synovial chondromatosis, Osteo-chondrrosis disease, Ostonecrosis, Nerve entrapmentprocess, Growth changes, Tumors, Radiographic imaging.

Aesthetics: Scope, definitions - Morpho psychology and esthetics, structural esthetic rules- facial components, dental components, gingival components physical components.Esthetics and its relationship to function – Crown morphology, physiology of occlusion,mastication, occlusal loading and clinical aspect in bio esthetic aspects, Physical andphysiologic characteristic and muscular activities of facial muscle, perioral anatomy andmuscle retaining exercises.

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PATHOLOGY

Transfusion Medicine AND Chemical Pathology:

- ABO, Rh blood groups and its significance.
- Blood component therapy.
- Transfusion therapy including the use of whole blood and RBC concentrates.
- Rationale of pre transfusion testing.
- Adverse reactions to transfusion of blood and components.
- Quality control in Blood Bank.
- Renal Function Test
- Liver function test
- Pancreatic function test
- Endocrine function test
- Tests for malabsorption
- Gastric function tests
- Tests for myocardial diseases.
- Applied Anatomy, Physiology, Biochemistry, Histology and Cytopathology in context to the subject of Pathology.
- Techniques in pathology pertaining to all the sub disciplines in the subject of pathology.
- Recent advances in pathology encompassing its sub disciplines.

Immunology &Immunodiagnostics AND Genetics & MolecularGenetics:

- Current concepts of structure and function of immune system, its abberations and mechanisms involved.
- Scope, principles, limatations and interpretation of the results of the procedures employed in clinical and experimental studies.
- ELISA Techniques.
- Principles of molecular biology related to the understanding of disease process and its use in various diagnostic tests.
- Principles and steps of interpretation of polymerase chain reaction (PCR), Western blot test, Southern blot, Northern blot and hybridization process.
- Applied Anatomy, Physiology, Biochemistry, Histology and Cytopathology in context to the subject of Pathology.
- Techniques in pathology pertaining to all the sub disciplines in the subject of pathology.

Recent advances in pathology encompassing its sub disciplines.

General Pathology:

- Normal cell and tissue structure and function.
- The changes in cellular structure and function in disease.
- Causes of disease and its pathogenesis.
- Reaction of cells, tissues, organ systems and the body as a whole to various sublethal and lethal injuries.
- Applied Anatomy, Physiology, Biochemistry, Histology and Cytopathology in context to the subject of Pathology.
- Techniques in pathology pertaining to all the sub disciplines in the subject of pathology.
- Recent advances in pathology encompassing its sub disciplines.

Systemic Pathology

- Normal structure and function of various organ systems.
- Etiopathogenesis, gross features and microscopic alterations of structure of these organ
- Systems in disease and functional correlation with clinical features.
- Histogenetic and pathophysiologic process associated with various lesions.
- Applied Anatomy, Physiology, Biochemistry, Histology and Cytopathology in context to the subject of Pathology.
- Techniques in pathology pertaining to all the sub disciplines in the subject of pathology.
  Recent advances in pathology encompassing its sub disciplines.

Hematopathology

- Principles of the practice of haematology for the planning of tests, interpretation and diagnosis of diseases of the blood and bone marrow.
- Various eqipments used in haematology.
- Automation and quality assurance in Haematology
- Applied Anatomy, Physiology, Biochemistry, Histology and Cytopathology in context to the subject of Pathology.
  Techniques in pathology pertaining to all the sub disciplines in the subject of pathology. Recent advances in pathology encompassing its sub disciplines.