GOVERNMENT OF INDIA
MINISTRY OF
PARLIAMENTARY AFFAIRS

Azadi Ka Amrit Mahotsav

mygov मेरी सरकार

PREAMBLE TO THE CONSTITUTION

PREAMBLE

WE, THE PEOPLE OF INDIA,

having solemnly resolved to constitute India into a SOVEREIGN SOCIALIST SECULAR DEMOCRATIC **REPUBLIC** and to secure to all its citizens:

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity;

and to promote among them all

FRATERNITY assuring the dignity of the individual and the unity and integrity of the Nation;

IN OUR CONSTITUENT ASSEMBLY this 26th day of November, 1949, do HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.

I have read the Preamble

[redacted]

Signature

23-01-2022

SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

("Deemed to be University u/s 3 of the UGC Act, 1956")
Accredited 'A+' Grade by NAAC
Agalakote, B.H.Road, Tumkur – 572 107.KARNATAKA, INDIA.

No. SSAHE/ACA-S&C/20 /UG(BE)/2024 Date: 15/07/2024

N O T I F I C A T I O N

Sub: - Ordinance pertaining to Curriculum of Undergraduate Programme Bachelor of Engineering (2nd Year Mechanical Engineering)

Ref: 1). Proceedings of BOS (UG) held on 17/06/2023
2). Proceedings of the Academic Council meeting held on 30/08/2023 (vide agenda No.SSAHE/AC/XXVI-8/2023)

In exercise of the powers vested under section 6 of 6.05 of MoA / Rules of SSAHE, the Revised Ordinance pertaining to Curriculum of Undergraduate Programme Bachelor of Engineering (2nd Year Mechanical Engineering) is notified herewith as per Annexure.

By Order,

REGISTRAR

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

To,
Dean / Principal, Sri Siddhartha Institute of Technology,

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) All Officers of the Academy Examination Branch / Academic Section
4) Guard File / Office copy.

S.S.A.H.E TUMKUR

DEPARTMENT OF MECHANICAL ENGINEERING, SSIT

Vision:

To carve technically proficient and competent mechanical engineering graduates capable of addressing the needs of the society and the nation.

Mission:

- To impart quality technical education in core areas of Mechanical Engineering.
- To inculcate Industrial practices for better professional growth.
- To imbibe ethical values, promote entrepreneurship, impart soft skills and teamwork capabilities.
- To ensure self-learning capabilities with an aptitude for research focusing on societal needs

Program Educational Objectives [PEOs]:

PEO– 01 Provide students with sound foundation in mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyze problems in the core/allied areas of Mechanical Engineering.

PEO– 02 Provide graduates with competency in the synthesis, modeling and analysis of mechanical/thermal/fluid data, assemblies and systems, research and consultancy in core areas of mechanical engineering, ensuring noticeable social impact.

PEO– 03 Promote awareness about professional ethics, inculcate skills for usage of software tools and prepare graduates of the program for continuous learning capabilities in interdisciplinary/multidisciplinary domains

Program Outcomes [POs]:

Our Engineering Graduates will be able to:

Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals , engineering specialization to the solution of complex engineering problems.

1. **Problem Analysis:** Identify, formulate, review research literature, analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
2. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health, safety, cultural, societal and environmental considerations.
3. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and

interpretation of data, and synthesis of the information to provide valid conclusions.

4. **Modern Tool Usage:** Create, select, apply appropriate techniques, resources, modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
5. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, cultural issues and the consequent responsibilities relevant to the professional engineering practice.
6. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, demonstrate the knowledge and need for sustainable development.
7. **Ethics:** Apply ethical principles, commit to professional ethics, responsibilities and norms of the engineering practice.
8. **Individual and Team work:** Function effectively as an individual, as a member or leader in diverse teams in multidisciplinary settings.
9. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend , write effective reports and design documentation, make effective presentations, give and receive clear instructions.
10. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
11. **Life- Long Learning:** Recognize the need for, have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs):

Our Engineering graduates are able to

PSO1: Automated/Additive Manufacturing--demonstrates knowledge ,understanding of manual and automated assembly/manufacturing systems including additive manufacturing systems.

PSO2: Entrepreneurship--recognize the need for and ability to engage in entrepreneurial activities.

Scheme of Teaching and Examination-2022 (160 Credits Scheme, NEP-Batch)
Second Year B.E., Mechanical Engineering

3rd Semester BE: ME **Academic year 2024-25**

SI No	Course Code		Course Title	Teaching Dept.	L	T	P	Credits	CIE Marks	SEE Marks	Total Marks	Exam Hrs
1	BS	22ME301	Calculus of variation and Numerical Techniques	MA	3	-	-	3	50	50	100	3
2	PC	22ME302	Engineering Thermodynamics	ME	3	-	-	3	50	50	100	3
3	PC	22ME303	Mechanical Measurements and Metrology	ME	3	-	2	4	50	50	100	3
4	PC	22ME304	Machine Tools and Manufacturing Process.	ME	3	-	2	4	50	50	100	3
5	PC	22ME305	Engineering Mechanics	ME	3	-	-	3	50	50	100	3
6	PC	22ME306	Dept. Skill Lab-1: Machine Drawing	ME	1	-	2	2	50	50	100	3
7	HS	22HS307	Universal Human Values	ME	1	-	-	1	50	-	50	-
8	HS	22HS308	Environmental Studies	HS	1	-	-	1	50	-	50	-
L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination				**Total**	**18**	**-**	**6**	**21**	**400**	**300**	**700**	-

CALCULUS OF VARIATION AND NUMERICAL TECHNIQUES

Subject Code: 22MA301 **L – T – P - C: 3 – 0 – 0 – 3**

Sl. No	Course Objective
1	Understand the least square method to fit a curve for the given data and evaluate the correlation coefficient and regression lines for the data.
2	Introduce the Concept of Fourier series.
3	Study the concept of Numerical Methods and Calculus of Variations.
4	To learn the concept on Laplace transforms.

Unit	Description	Hours
I	**Statistical Methods:** Definition of Correlation-Karl Pearson's coefficient of correlation–problems, Regression lines (All results without proof)–Problems. **Curve fitting:** Curve fitting by the method of least squares- Fitting of the straight-line, second-degree parabola and exponential form of the curve $y = ab^x$ (All results without proof) –Problems.	**08**
II	**Calculus of Variations:** Functional, Euler's Equation (Without derivations) standard variation problems, Minimal surface of revolution, Hanging chain problem, Brachistochrone problem.	**08**
III	**Numerical solution of ordinary differential equations of first order and first degree**: Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order, Milne's and Adams-Bashforth Predictor and Corrector methods (No derivation of formulae) -problems.	**08**
IV	**Laplace Transforms:** Basicdefinition, Laplace transforms of elementary functions, Properties of Laplace transforms, Laplace transforms of Periodic function, Unit step function (All results without proof)-Problems only. **Inverse Laplace transforms**: Basic definition, Evaluation of inverse Laplace transforms by standard methods. - Problems only. Applications: Solutions of second order linear differential equations using Laplace transforms method.	**08**
V	**Fourier Series:** Periodic function, Dirichlet's conditions. Fourier series of even and odd functions. Fourier series of periodic functions with period 2π and 2l-problems. Half range Fourier series, Practical harmonic analysis - problems	**08**

Course outcome	Description
CO1	Understand the concept of Laplace Transform, statistics, Fourier series and calculus of variations.
CO2	Use the concept of Laplace Transform, Fourier Series and variational problems in Engineering field.
CO3	Apply Numerical Methods and Laplace transforms in Engineering fields.
CO4	Able to perform the simple linear regression and correlation for data samples in real life and in Engineering fields.

Text Books:

Sl No	Title	Author	Volume and Year of Edition
1	Higher Engineering Mathematics	B.S. Grewal	43rd Edition Khanna Publications, 2015. ISBN:9788174091956
2	Higher Engineering Mathematics	B.V. Ramana	1st Edition, Tata McGraw-Hill, 2006. ISBN:9780070634190

Reference Books:

Sl No	Title	Author	Volume and Year of Edition
1	Advanced Engineering Mathematics	E. Kreyszig	10th Edition JonWiley& Sons, 2015. ISBN:9780470913611
2	Higher Engineering Mathematics	H.K. Das Er. Rajnish Verma	1st Edition, Chand publishing, 2011. ISBN:9788121938907

ENGINEERING THERMODYNAMICS

Subject Code: 22ME302 **L – T – P - C: 3 – 0 – 0 – 3**

Sl. No	Course Objective
1	To acquire the concept of work, heat, entropy and Internal energy changes for thermodynamic processes.
2	To remember and apply the laws of Thermodynamics and their corollaries for thermodynamic processes.
3	To acquire the knowledge of analyzing Thermodynamic property diagrams and properties of pure substance.
4	To understand, apply the concept of Entropy and the principle of increase of Entropy.

Unit	Description	Hours
I	**Basic Concepts:** Thermodynamics: definition and applications, Microscopic and Macroscopic approaches, Open & Closed systems, system, boundary and control surface, examples, Properties, State, Processes and Cycles, Quasi-static process, Equilibrium of systems, Equality of temperature, Zeroth law of thermodynamics, Temperature scales, *Simple Numerical problems on temperature scales*. **Ideal and perfect gases**: Ideal gas laws, differences between perfect, ideal and real gases, equation of state, Universal and characteristic gas constants evaluation of properties of perfect and ideal gases. Real Gases: Introduction. Vander Waal's Equation of state, Van der Waal's constants in terms of critical properties, law of corresponding states, compressibility factor; compressibility chart. *Simple Numerical problems*	**8**
II	**Pure substance:** Definition of a pure substance, phases of a substance, triple point and critical points, sub-cooled liquid, saturated liquid, dryness fraction, vapor pressure, two-phase mixture of liquid and vapor, saturated vapor and superheated vapor states of a pure substance with water as example. Representation of pure substance properties on P-T, T-h, T-S and P-V diagrams, Calorimeters, Steam tables and its use, *Simple Numerical problems*.	**8**
III	**Work and heat:** Thermodynamic definition of work; examples, sign convention, Displacement work; Expressions for displacement work-plotting on p-v diagrams, Other forms of work; electric work, shaft work, paddle wheel work, spring work. Free expansion with zero work transfer. Heat: definition, units and sign convention, Comparison of heat and work, *Simple Numerical problems.*	**8**
IV	**First law of thermodynamics:** Joule's experiments, equivalence of heat and work, Statement of the First law of thermodynamics, Extension of the	**8**

	First law to non -cyclic processes, Energy, Energy as a property, Modes of energy, Specific heats, Internal energy and enthalpy of ideal gas, PMMK-1, Principle of Conservation of mass, Energy balance for steady flow system, Some steady flow engineering devices, *Simple Numerical problems*.	
V	**Second law of Thermodynamics:** Limitations of First Law, Statements of second law, Thermal Energy reservoirs, Equivalence of Kelvin Plank and Clausius Statements, Heat Engines, Energy Conversion efficiencies, Refrigerators and Heat Pumps, Coefficient of performance, Perpetual motion machines, Reversible process, Factors that make a process irreversible, Carnot cycle, Carnot's Heat engine (reversible heat engines), Carnot Principle, Thermodynamic temperature scale, *Simple Numerical problems*. **Entropy:** Clausius inequality; statement, proof, definition, a property, Entropy, Increase of Entropy principle, Entropy generation, entropy as a quantitative test for irreversibility, isentropic process, property diagrams involving entropy, Tds relation, entropy change for liquids, solids, and gases (Ideal), Entropy balance, *Simple Numerical problems.*	**8**

Course outcome	Description
CO1	Understand the basic concept of thermodynamic system, control volume, control mass, thermodynamic properties, work, heat, entropy, Internal energy and pure substance.
CO2	Understand & apply the Laws of Thermodynamics for analyzing thermodynamic processes.
CO3	Analyze the thermodynamic processes for change in internal energy, change in entropy, work and heat transfer.
CO4	Adapt the knowledge of thermodynamics to suggest the solutions for thermodynamic problems.

Course Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		1	1					1		1		
CO2	3	3		2	1					1		1		
CO3	2	2		1	1							1		
CO4	3	3		2	2							2		

Text Books:

Sl No	Title	Author	Volume and Year of Edition
1	Engineering Thermodynamics (Principals and Practices)	Dr. D S Kumar	S.K. Kataria& Sons; Reprint 2013,6thedition (2012).
2	Thermodynamics An engineering approach	Yunus.A.Cenegel, Michael .A .Boles	Tata McGraw hill, 2002.

Reference Books:

Sl No	Title	Author	Volume and Year of Edition
1	Engg Thermodynamics	J.B.Jones and G.A.Hawkins	John Wiley and Sons Ltd; 2nd edition (May 7, 1986)
2	Thermal Engineering	R.K. Rajput	Laxmi Publications; Tenth edition (2018)
3	A Course in Thermal Engineering	Domakundawar	DhanpatRai& Co. (P) Limited (2016)

MECHANICAL MEASUREMENTS AND METROLOGY

Subject Code: 22ME303 **L – T – P - C: 3 – 0 – 2 – 4**

Sl. No	Course Objective
1	Apply the concepts to learn in metrology for applying the same in the selection of appropriate slip gauges, systems, application and standards.
2	Apply the concepts of limits, fits and tolerance during selective assembly and interchangeability in actual manufacturing process.
3	Understand and apply the concepts of measurement systems for checking accuracy, precision and calibration procedure of measuring instruments.
4	Understand the basic working principles of different transducers, intermediate and modifying devices and terminating devices, force, torque, pressure, temperature and strain.

Unit	Description	Hrs
I	**Introduction to Metrology**: Definition, objectives and concept of metrology, Need of inspection, Principles, process, methods of measurement, Classification and selection of measuring instruments and systems, errors in measurement. System of measurement, Material Standard, Wavelength Standards, Subdivision of standards, Line and End standards, Classification of standards and Traceability, calibration of End bars (Numerical problems) **Linear Measurement and angular measurements:** Slip gauges- Indian standards on slip gauges, wringing of slip gauges, uses slip gauges, care of slip gauges, problems on building of slip gauges (M87, M112). Auto collimator-applications for measuring straightness and squareness	**9**
II	**System of Limits, Fits, Tolerance and Gauging:** Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, limits of size, concept of limits of size and tolerances, definition of fits, hole basis system, shaft basis system, types of fits and their designation (IS 919-1963), Classification of gauges, brief concept of design of gauges (Taylor's principles), Types of gauges-plain plug gauge, ring gauge **Comparators:** Functional requirements, classification, mechanical - Johnson mikrokator, sigma comparators, dial indicator, LVDT.	**9**
III	**Measurement of screw thread and gear:** Terminology of screw threads, measurement of major diameter, minor diameter, pitch and angle, Tool maker's microscope, Types of gears, gear tooth terminology. **Measurements and Measurement systems**: Definition, requirements of measurement, significance of measurement, fundamental methods of measurement, generalized measurement system, definitions and basic concepts of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, Errors in measurement, classification of	**9**

	errors.	
IV	**Transducers:** Introduction to Transducers, transfer efficiency, primary and secondary transducers, mechanical transducers, advantages and disadvantages of each type transducers. **Intermediate modifying and terminating devices**: Mechanical systems, Cathode ray oscilloscope, oscillographs, X-Y plotters	**9**
V	**Force, Torque and Pressure Measurement:** force measuring instrument, Mechanical dynamometer (Prony brake), Hydraulic dynamometer, Pressure measurement, Bridgeman gauge, Pirani gauge. **Temperature and Strain measurement**: Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, measurement of thermal emf, total radiation pyrometers, optical pyrometer. Strain measurements, strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement.	**9**

LAB CONTENT

Sl. No	Experiment Description
1	Calibration of Pressure Gauge
2	Calibration of Thermocouple
3	Calibration of LVDT
4	Measurement using Optical Projector /Toolmaker Microscope.
5	Measurement of gear tooth profile using gear tooth Vernier/Gear Tooth micrometer
6	Calibration of Micrometer using slip gauges.
7	Measurement of angle using Sine Center / Sine bar/Bevel protractor
8	Calibration of Load cell
9	Measurement of flatness by using monochromatic check light.

Course outcome	Description
CO1	Remember and understand the terminology associated with metrology, tolerance, screw thread profiles, generalized measurement system.
CO2	Understand and explain the theoretical working principles of comparators, gauges, transducers, intermediate and modifying and terminating devices.
CO3	Apply the basic principles and concepts of limit gauges, fits, tolerance and determine its solutions.
CO4	Analyze the type of fit as specified in the problem and evaluate the corresponding dimensions of hole and shaft.

Course Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2									2		1		
CO2	2	1			2					1				
CO3	3	2								1		2		
CO4	3	2								1				

Text Books:

Sl No	Title	Author	Volume and Year of Edition
1	Mechanical Measurements,	Beckwith Marangoni and Lienhard	Pearson Education, 6th Edition, 2006.
2	Engineering Metrology,	R.K. Jain	Khanna Publishers, Delhi, 2009.

Reference Books:

Sl No	Title	Author	Volume and Year of Edition
1	Mechanical Measurements	R.K. Jain	Khanna Publishers, 1994
2	Engineering Metrology	Gupta I.C.	Dhanpat Rai Publications,2016.
3	Engineering Metrology and Measurements,	N.V.Raghavendra and L.Krishnamurthy,	Oxford University Press,2018.

MACHINE TOOLS & MANUFACTURING PROCESS

Subject Code: 22ME304 **L – T – P - C: 3 – 0 – 2 – 4**

Sl. No	Course Objective
1	To develop fundamental knowledge on metal cutting parameters tool materials, cutting fluids and tool wear mechanisms.
2	To understand the fundamentals of machining processes and machine tools
3	To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes.
4	To inculcate team qualities, expose students to shop floor activities and enrich their practical skills and educate about safety standards.

Unit	Description	Hrs
I	**Theory of Metal Cutting**: Single point cutting tool nomenclature, tool geometry, Chip formation, Orthogonal and Oblique cutting, Shear angle relationship (only formula), tool wear , tool failure, tool life, effects of cutting parameters on tool life, tool failure criteria, Taylor's tool life equation, numerical. Cutting tool materials: Properties, types of cutting tool materials – HSS, coated carbide tools, carbide tools, ceramics, CBN, Cutting fluids: properties, types and selection of cutting fluids Heat generation in metal cutting: Factors affecting heat generation, heat affected zones.	**9**
II	**Lathe:** Classification of lathe, constructional features of capstan and turret lathe, lathe operations, tool layout, tool and work holding devices, machining time calculation. **Drilling Machines:** Classification of drilling machines, constructional features of Bench drilling and Radial drilling machine, tool and work holding devices, types of drill bits, nomenclature of twist drill, machining time calculation.	**9**
III	**Shaping and Planing Machines**: Classification, constructional features of horizontal shaper, constructional features of double house planner, Operations, tool and work holding devices, machining time calculations, **Broaching Machines:** Classification, principle of broaching, nomenclature of broach, application of broaching machine	**9**
IV	**Milling Machines**: Classification of milling machines. Constructional features of Column and knee milling machine, milling cutters- types. Cutter nomenclature. Milling operations, machining time calculation. Indexing: Indexing mechanism, Simple, Angular types of indexing, numerical.	**9**
V	**Grinding Machines:** Classification of grinding machines, constructional features of grinding machines, grinding wheels-types, grinding wheel nomenclature, applications.	**9**

LAB CONTENT

Sl. No	Experiment Description
1	Preparation of model on lathe involving facing, Counter sinking, Plain turning, Step turning
2	Preparation of model on lathe involving Taper turning, Thread cutting
3	Preparation of model on lathe Knurling, Drilling, Boring,
4	Preparation of model on lathe Internal Thread cutting, Parting-off
5	Cutting of V Groove/ dovetail / Rectangular groove using a shaper.
6	Cutting of Gear Teeth using Milling Machine.
7	Making hole of different diameters using drilling machine
8	Use of different work holding devices and tool holding devices

Course outcome	Description
CO1	Identify cutting tool geometry and understanding of metal cutting principles.
CO2	Explain the basic working principles of machine tools, operations of machining processes.
CO3	Analyze the process parameters of various machine tools
CO4	Perform facing, counter sinking, turning, taper turning, thread cutting, drilling, parting off Indexing, key ways, slots, grooves, gear tooth cutting, grinding operations on specific machine tools employing proper tools

Course Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		3						2					
CO2	3				2							1		
CO3	1		2	3										
CO4					1				2			3		

Text Books:

Sl No	Title	Author	Volume and Year of Edition
1	Manufacturing Technology Metal cutting and Machine tools.	P.N. Rao	Tata McGraw-Hill publications,2018.

Reference Books:

Sl No	Title	Author	Volume and Year of Edition
1	Workshop Technology	Hazra Choudhry	Vol-II, Media Promoters & Publishers Pvt Ltd,2004
2	Production Technology.	R.K. Jain	Khanna Publications,2003
3	Production Technology.	HMT	TATA McGraw Hill, 2001

ENGINEERING MECHANICS

Subject Code: 22ME305 **L – T – P - C: 3 – 0 – 0 – 3**

Sl. No	Course Objective
1	To understand the principles of mechanics and resolution of forces and moments for a given force system and apply them to practical engineering problems.
2	To draw the free body diagram of a system of coplanar forces and determine its equilibrium.
3	To analyze the types of friction for static bodies and problems related to friction.
4	To determine the centroid and second moment of area.

Unit	Description	Hours
I	**Basic Concepts of Engineering** Mechanics - Definition, Law of Parallelogram of Forces, Lami's Theorem, Resolution of a Force, Moment of a Force, Laws of Mechanics, Principle of Transmissibility of Forces. **Force System and Classification** – Coplanar Collinear and Concurrent Forces, Classification of a Force System, Resultant of Several Forces, Resultant of Coplanar Forces, Resultant of Collinear Coplanar Forces, Resultant of Concurrent Coplanar Forces.	**8**
II	**Equilibrium of Coplanar Force System and Free Body Diagram**: Equilibrium of Coplanar Force System, Action and Reaction, Free body diagrams, Equilibrium of a Body under three forces, Lami's Theorem. Numerical Problems.	**8**
III	**Determination of Support Reactions**: Introduction, Types of Supports, Types of Loading, Determination of Reaction of a Beam. Numerical Problems.	**8**
IV	**Friction:** Introduction, Co-efficient of Friction, Angle of Friction, Cone of Friction, Types of Friction, Coulomb's laws of Friction, Angle of Response, Equilibrium of a body lying on a rough inclined plane, Applications of Friction, Wedge Friction, Belt Friction	**8**
V	**Centroid:** Determination of centroid of simple geometric figures such as triangle, rectangle, and segment of a circle, Centroid of combinations of plane Geometric figures. Moment of Inertia: Parallel and perpendicular axis theorems, Radius of gyration Determination of moment of inertia and radius of gyration of triangle rectangle circular areas, moment of inertia of combination of plane geometric figures.	**8**

Course outcome	Description
CO1	Understand the basic concepts, illustrate, formulate, and solve engineering mechanics problems.
CO2	Apply the principles and laws of mechanics to determine the equilibrium of a particle.
CO3	Analyse the action of forces, Moments of other loads on systems of rigid bodies and compute the relative forces that develop as a result of the external loads.
CO4	Evaluate the frictional forces on general plane motion, determine the centroid and compute Moment of Inertia.

Course Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2						1		1		
CO2	3	3	2	1						1		1		
CO3	3	3	3	2						1		1		
CO4	3	3	3	2						1		1		

Text Books:

Sl No	Title	Author	Volume and Year of Edition
1	Engineering Mechanics	R K Bansal	Revised 8th Edition, Laxmi Publications (p) Ltd, 2019.
2	Engineering Mechanics	S SBavikatti, and K G Rajashekharappa	New Age International (P) Ltd,2016.

Reference Books:

Sl No	Title	Author	Volume and Year of Edition
1	Engineering Mechanics	K L Kumar,	Tata McGraw-Hill Publication Ltd,2016.
2	Applied Mechanics	S Ramamurtham	DhanpathRai& sons,2018.
3	Applied Mechanics	I B Prasad	Khanna Publishers,2019.

MACHINE DRAWING (Skill Lab-1)

Subject Code: 22ME306 **L – T – P - C: 1 – 0 – 2 – 2**

Sl. No	Course Objective
1	To provide basic understanding & drawing practice of simple mechanical parts, Bolts,Nuts, Riveted joints and sectional views of solids.
2	To develop the skills for usage of SOLIDEDGE modeling software package for developing assembly drawing in 2D and 3D views from the individual 3D part drawing.

Unit	Description	Hrs
	PART A	
I	**Orthographic views:** Conversion of pictorial views into orthographic projections of simple machine parts without section.(Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions and Precedence of lines. Section views of machine parts	10
	PART B	
II	**Fasteners:** Hexagonal headed bolt and nut with washer (assembly) ,square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and locknut. **Riveted Joints:** Single and double riveted lap joints ,butt joints with single/double cover straps(Chain and Zig-zag).	10
	PART C	
III	**Assembly drawings:**(part drawings should be given) **1.** Universal Coupling **2.** Screwjack(Bottletype) **3.** Plummerblock(PedestalBearing) **4.** Machine vice	20

Question paper Pattern:

The question paper should contain two questions from each part, in which student can answerany one. Part A & B each carries 10 marks and Part C carry 30 marks. Part A & B should bemanual 2D drawingonly.Part Cis *COMPUTERIZATION* using *SOLID EDGE* software and Assembled view should be in 3D & other 2 views in 2D views.

Course	Description

outcome	
CO1	Understand the elements and annotation of a detail drawing ,3D modeling and assembling features of software package.
CO2	Understand and remember the orthographic views and sectional views of basic parts of machine elements for drawing.
CO3	Apply the empirical design concepts for 2D drawing of couplings ,riveted joints, nuts and bolts as per BIS standards.
CO4	Apply the skills required for usage of Modeling and Assembling tools of "SOLIDEDGE" Software Package.

Course Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1		2				2	1		2		
CO2	1	2	1		2				3	1		2		
CO3	2	2	1		2		1	1	3	1		2		
CO4	2	2	1		3		1	1	3	1		2		

Text Books:

Sl No	Title	Author	Volume and Year of Edition
1	MachineDrawing	ND Bhat & VM Panchal	CharotarpublishingLtd., 2014,50th edition
2	APrimeron Computer aidedMachinedrawing	VTU	PublishedbyVTU,Belgaum, 2017.

Reference Books:

Sl No	Title	Author	Volume and Year of Edition
1	Machinedrawing	Sri.KL Narayan, P.Kannaiah & K.Venkat Reddy	New-AgeInternational publications,2001.
2	Machinedrawing	SriK RGopalKrishna	Subhaspublications, Bangalore,2014.

UNIVERSAL HUMAN VALUES

Subject Code: 22HS307 **L – T – P - C: 1 – 0 – 0 – 1**

Sl. No	Course Objective
1	This introductory course input is intended: To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings
2	To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3	To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.
4	This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

COURSE TOPICS: The course has 28 lectures in 5 Units. The lectures are of 1-hour duration. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

Unit	Description	Hours
I	**Introduction to Value Education:** 1. Understanding Value Education-Need, Guidelines, content, Role of education-Sanskar 2. Process for Value Education-Self-exploration, the Dialogue Within. 3. Continuous Happiness and Prosperity – the Basic Human Aspirations 4. Right Understanding, Relationship and Physical Facility 5. Exploring the Meaning of Happiness and Prosperity. 6. Method to Fulfill the Basic Human Aspirations	**06**
II	**Harmony in the Human Being:** 7. Understanding the Human being (As the Co-existence of the Self and Body) 8. Distinguishing between the Needs of the Self and the Body 9. The Body as an Instrument of the Self-The response of the self and the body 10. Understanding Harmony in the Self-State of imagination 11. understanding Harmony of the Self with the Body 12. Programme to ensure self-regulation and Health-Nurturing the body	**06**
III	**Understanding Harmony in the Family and Society**	**06**

	13. Harmony in the Family – the Basic Unit of Human Interaction 14. Values in Human-to-Human Relationship 15. 'Trust' – the Foundational Value in Relationship 16. 'Respect' – as the Right Evaluation 17. Other Naturally Acceptable Feelings in Relationship- Affection, Care, Guidance, Reverence, Glory, Gratitude and Love 18. Vision for the Universal Human Order-from family to world family	
IV	**Understanding Harmony in the Nature/Existence:** 19. Understanding Harmony in the Nature 20. Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature 21. Realizing Existence as Co-existence at All Levels 22. The Holistic Perception of Harmony in Existence	**04**
V	**Implications of the Holistic Understanding – a Look at Professional Ethics** 23. Natural Acceptance of Human Values 24. Definitiveness of (Ethical) Human Conduct 25. A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order 26. Competence in Professional Ethics 27. Holistic Technologies, Production Systems and Management Models-Typical Case Studies 28. Strategies for Transition towards Value-based Life and Profession	**06**

Course outcome	Description
CO1	By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO2	They would have better critical ability, also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO3	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.
CO4	This is only an introductory foundational input. It would be desirable to follow it

	up by **a)** Faculty-student or mentor-mentee programs throughout their time with the institution **b)** Higher level courses on human values in every aspect of living

Text Books:

Sl No	Title	Author	Volume and Year of Edition
1	A Foundation Course in Human Values and Professional Ethics,	R R Gaur, R Sangal G P Bagaria	Excel Books, New Delhi,2010
2	The Teacher's Manual for A Foundation Course in Human Values and, Professional Ethics,	R R Gaur, R Asthana, G P Bagaria	2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Book:

Sl No	Title	Author	Volume and Year of Edition
1	Jeevan Vidya: Ek Parichaya	A Nagaraj	Jeevan Vidya Prakashan, Amarkantak, 1999.
2	Human Values,	A.N. Tripathi	New Age Intl. Publishers, New Delhi, 2004
3	The Story of Stuff (Book) i)Small is Beautiful ii)Slow is Beautiful	 E. F Schumacher Cecile Andrews	
4	The Story of My Experiments with Truth	Mohandas Karamchand Gandhi	

SUGGESTED ASSESSMENT:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions; self-assessment will be used in evaluation.

Example: Assessment through 2-Tests, each carries 25 marks. The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

ENVIRONMENTAL STUDIES

Subject Code: 22HS308 **L – T – P - C: 2 – 0 – 0 – 1**

Sl. No	Course Objective
1	To identify the major challenges in environmental issues and evaluate possiblesolutions.
2	Develop analytical skills, critical thinking and demonstrate socio-economic skills for sustainable development.
3	To gain knowledge on different types of pollution in the environment.
4	To analyze an overall impact of specific issues and develop environmental management plan.

COURSE TOPICS: The course has 28 lectures in 5 Units. The 2- lecture hours per week of 1-hour duration

Unit	Description	Hours
I	Introduction: Environment - Components of Environment Ecosystem: Types of Ecosystems, Balanced ecosystem. Human Activities – Food, Shelter, And Economic & Social Security, Effects of human activities on environment- Agriculture, Housing, Industry, Mining & Transportation. Environmental Impact Assessment (EIA), Sustainable Development.	**06**
II	Natural Resources-Introduction, types of resources, Water resources – Availability & Quality aspects, Water borne diseases & water induced diseases, Fluoride problem in drinking water. Mineral resources**,** Forest Wealth. Material Cycles – Carbon Cycle, Nitrogen Cycle & Sulphur Cycle.	**06**
III	Energy – Different types of energy, Conventional sources &non-conventional sources of energy Solar energy, Hydro electric energy, Wind Energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy.	**06**
IV	Environmental Pollution – Air Pollution & Automobile Pollution Water Pollution, Noise pollution, Land Pollution, Public Health Aspects. Global Environmental Issues: Population Growth, Urbanization, Land Management, Water & Waste Water Management.	**04**
V	Definition, Effects – Global Warming, Acid rain & Ozone layer depletion, controlling measures. Solid Waste Management, E - Waste Management & Biomedical Waste Management -Sources, Characteristics & Disposal methods. Environmental Acts & Regulations, Role of government, Legal aspects, Role of Non-governmental Organizations (NGOs) , Environmental Education	**06**

Course outcome	Description
CO1	Understand the principles of ecology and environmental issues that apply to air, land and water issues on a global scale.
CO2	Develop critical thinking and/or observation skills and apply them to the analysis of a problem or question related to the environment.
CO3	Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components.
CO4	Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Text Books:

Sl No	Title	Author	Volume and Year of Edition
1	Environmental Studies	Benny Joseph	Tata McGraw– Hill Publishing Company Limited(2005), Delhi.
2	Environmental Studies	R Rajagopalan	From Crisis to Cure", Oxford University Press, 2005.

Reference Books:

Sl No	Title	Author	Volume and Year of Edition
1	Environmental Science and Engineering	Aloka Debi	Universities Press (India) Pvt. Ltd. 2012
2	Environmental Studies	R.J.Ranjit Daniels & Jagadish Krishnaswamy	Wiley India Private Ltd., New Delhi(2009)
3	Text Book of Environmental and Ecology	Dr.Pratiba Sing, Dr.AnoopSingh and Dr.Piyush Malaviya	Acme Learning Pvt. Ltd. New Delhi,2017.
4	Environmental Scienceworking with the Earth	G.Tyler Miller Jr	EleventhEdition, Thomson BrooksCole, 2006

SUGGESTED ASSESSMENT:

Internal Assessment through 2-Tests, each carries 25 marks.The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

Scheme of Teaching and Examination-2022 (160 Credits Scheme, NEP-Batch)

Outcome-Based Education (OBE) and Choice Based Credit System(CBCS)

4th Semester BE Group 1: ME **Academic year 2024-25**

SI No	Course Code		Course Title	Teaching Dept.	L	T	P	Credits	CIE Marks	SEE Marks	Total Marks	Exam Hrs
1	BS	22ME401	Probability and complex analysis	**MA/ME**	3	-	-	**3**	50	50	100	3
2	PC	22ME402	Materials Science and Metallurgy	**ME**	3	-	-	**3**	50	50	100	3
3	PC	22ME403	Fluid Mechanics	**ME**	3	-	2	**4**	50	50	100	3
4	PC	22ME404	Strength of Materials	**ME**	3	-	2	**4**	50	50	100	3
5	PC	22ME405	Metal Casting Forming & Processes	**ME**	3	-	-	**3**	50	50	100	3
6	PC	22ME406	Dept. Skill Lab 2: Computer Aided Machining Lab	**ME**	1	-	2	**2**	50	50	100	3
7	HS	22SK407	Skill Development-1 (T&P)	**TP**	1	-	-	**1**	50	-	50	-
8	HS	22HS408	Constitution of India	**HS**	1	-	-	1	50	-	50	-
L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination				**Total**	**18**	**-**	**6**	**21**	**400**	**300**	**700**	-

PROBABILITY AND COMPLEX ANALYSIS

Subject Code: 22MA401 **L – T – P - C: 3 – 0 – 0 – 3**

Sl. No	Course Objective
1	Understand the concept of Probability Distribution, Joint of Probability Distribution and Complex Analysis.
2	Solve the system of equations by Cremer's rule and LU- Factorization method**.**
3	Demonstrate Stochastic problem as Markov model and solve the problem.
4	Illustrate the applications of Probability and statistics in Engineering field.

Unit	Description	Hours
I	**Probability Distributions:** Review of basic probability theory**.** Random variables (Discrete and Continuous), Probability of mass/density functions. Binomial distribution, Poisson's distribution, exponential distribution and Normal distribution (without derivations) and problems.	**8**
II	**Linear Algebra:** Solution of System of Equations by Cramer's rule and LU-Factorization method**.** Recapitulation ofEigen values and Eigen vectors of a real matrix. Properties of Eigen values and Eigen vectors, problems on Cayley - Hamilton Theorem. Diagonalization of matrices by Orthogonal Transformation, Reduction of a quadratic form to Canonical form, Nature of quadratic forms, problems.	**8**
III	**Numerical Integration:** Simpson's $1/3^{rd}$ rule, Simpson's $3/8^{th}$ rule and Weddle's rule (without proof)- problems. **Joint probability distribution:** Joint probability distribution for two discrete random variables, Marginal distributions, Expectation, Co-variance - problems.	**7**
IV	**Markov Chain:** Probability Vector, Stochastic Matrix, Regular Stochastic Matrix, definition of Markov Chain, Transition Probabilities and Transition probability Matrix, Higher Transition Probabilities, state transition diagram, stationary distribution of regular Markov chains, problems	**9**
V	**Complex Analysis:** Review of function of a complex variables, limits, continuity, and differentiability. Analytic functions, Cauchy-Riemann equations in Cartesian and polar forms (without proof). Construction of analytic functions by Milne-Thompson Method-problems. Bilinear Transformations.	**8**

Course outcome	Description
CO1	Understand the concept of Probability Distribution, Eigen values and Eigen vectors of a matrix,Markov Chain and Complex Analysis.
CO2	Apply Numerical Integration, Stochastic process and Complex Analysis in Engineering fields.
CO3	Make use of Probability Distribution and Complex Analysis to solve various Engineering problems.
CO4	Analyze and apply the concept of Orthogonal Transformation and Joint of Probability Distribution in Engineering field.

Text Books:

Sl No	Title	Author	Volume and Year of Edition
1	Higher Engineering Mathematics	B.S.Grewal	43rd Edition KhannaPublications,2015.ISBN:9788174091956
2	An Introduction to Probability Theory and its Applications	W. Feller	3rdEdition,JohnWiley&Sons,Inc,2008,ISBN:9788126518050

Reference Books:

Sl No	Title	Author	Volume and Year of Edition
1	A First Course in Probability	S. Ross	8thEdition,Pearson,2010,ISBN:9780136033134
2	Higher Engineering Mathematics	B.V.Ramana	1st Edition, Tata McGraw-Hill, 2006. ISBN:9780070634190

MATERIALS SCIENCE AND METALLURGY

Subject Code: 22ME402 **L – T – P - C: 3 – 0 – 0 – 3**

Sl. No	Course Objective
1	To gain an understanding of the relationships between the structures, properties, processing and applications of various engineering materials.
2	The foundation for understanding the various modes of failures in mechanical engineering materials.
3	To discuss the phase transformations in metals, microstructural and property change in iron carbon alloys.
4	Acquire knowledge of composite materials and their processing methods used for various Engineering applications and other materials.

Unit	Description	Hours
I	**Mechanical Behavior:** Stress - strain diagrams to show ductile behaviour of materials, linear and non-linear elastic properties. Mechanical properties in plastic range yield strength, offset yield strength, ductility, ultimate tensile strength, toughness and yield point phenomena. Plastic deformation of single crystal by slip, and twinning.	**08**
II	**Fracture, fatigue & creep:** Introduction, Fracture, Types of fracture, Ductile & Brittle fracture, Fatigue, fatigue Test, S-N curve, factors affecting fatigue life, fatigue protection methods, Creep, creep Test, creep curve, factors affecting creep. **Solidification:** Mechanism of solidification, crystal growth, Cast metal structures.	**08**
III	**Phase diagram:** Solid solutions, substitution, and interstitial solid solutions, Hume Rothary rules, Phase Rule - Gibbs phase rule, Types of phase diagram, construction and Interpretation of Phase diagrams, Binary Phase diagrams lever rule. Numerical on phase diagrams. **Iron - Carbon system:** Iron - carbon equilibrium diagram description of phases, Solidification of steels and cast irons and invariant reactions.	**08**
IV	**Heat treatment of metals:** Time-Temperature-Transformation (T-T-T) diagrams, continuous cooling Transformation diagrams, Annealing and its types, Normalizing, Hardening, Tempering, Martempering, Austempering, Hardenability, surface hardening methods like Carburizing, cyaniding, Nitriding, flame hardening and induction hardening, age hardening of aluminum-copper alloys. **Introduction to Composite Materials:** Definition, Classification of composites, advantages, limitations and application of composites.	**08**
V	**Manufacturing of Composites:** Lay-up and curing - open and closed mould processing, Hand lay-Up techniques, spray Lay-up process, filament winding, Pultrusion, compression moulding, stir casting, Sheet Moulding compound (SMC) process. **Smart Materials:** Introduction, Classification and application of smart materials.	**08**

Course outcome	Description
CO1	Understand the concepts of atomic configuration and crystalline structure of Engineering Materials, inherent defects and their relationship with Mechanical behaviour.
CO2	Understand the concepts underlying the fracture, creep and fatigue stresses of materials
CO3	Understand and apply the rules, governing the formation of solid solution, Phase diagram, Iron-Carbon Equilibrium, TTT diagrams .
CO4	Understand the principles underlying various heat treatments processing for altering the crystal structure of metals and basics of composites materials and different manufacturing processes of composite materials and other.

Course Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			2								
CO2	2	1	2			1								
CO3	1	2	1			1								
CO4	1	3	2			3								

Text Books:

Sl No	Title	Author	Volume and Year of Edition
1	Materials science and metallurgy for engineers	Dr. V.D. Kodigere	Everest Publishing House, Pune, 38th Edition, 2016.
2	Material science and Engineering	William D. Callister	Ed. 5, John wiley& sons, 2001

Reference Books:

Sl No	Title	Author	Volume and Year of Edition
1	Foundations of Materials Science and Engineering	Smith	3rd Edition McGraw Hill, 1997.
2	Structure and properties of Engineering materials	V.S.R Murthy	Tata McGraw Hill, 2003.
3	An Introduction to Metallurgy	Alan Cottrell	University Press India, Oriental Longman Pvt. Ltd, 1974.

FLUID MECHANICS

Subject Code: 22ME403 **L – T – P - C: 3 – 0 – 2 – 4**

Sl. No	Course Objective
1	Know the knowledge of fluid and its properties and behaviour under various conditions of internal and external flows.
2	Understand principles of pressure, hydrostatic law, principle of buoyancy and stability of a floating body.
3	Understand Fluid Dynamics and estimate the associated pressure variations in moving fluids using Euler's and Bernoulli's equations.
4	Inculcate the importance of fluid flow measurement, determine the losses in a flow system and its applications in Industries.

Unit	Description	Hrs
I	**Properties of Fluids**: Introduction, properties of fluids like Density, Specific weight, Specific volume, Specific gravity, Viscosity, Kinematic viscosity, Newton's law of viscosity, Variation of viscosity with temperature, Classification of fluids, Surface tension & capillarity, Vapour pressure and cavitation. Numerical problems. **Fluid Statics**: Pressure and Measurement: Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, Absolute, gauge, atmospheric and vacuum pressures, simple manometers, differential manometers and inverted manometers, Numerical problems.	**9**
II	**Hydrostatics:** Total pressure and center of pressure on vertical plane surface submerged in liquid and inclined plane surface submerged in liquid, Numerical problems. **Buoyancy:** Buoyancy, Archimedes Principle, center of buoyancy, meta-center and metacentric height, conditions of equilibrium of floating bodies, determination of Metacentric height experimentally and theoretically, Numerical problems	**9**
III	**Fluid Kinematics:** Introduction, types of flow, Continuity equation in three dimensions (Cartesian co-ordinate system only), Velocity and acceleration. Stream function and velocity potential function. Simple Numerical. **Fluid Dynamics:** Introduction, equations of motion, Euler's equation of motion Bernoulli's equation from Euler's equation, Numerical examples.	**9**
IV	**Fluid flow measurements:** Introduction, Concept of fluid flow measurement, Principle and derivation of expression for discharge through - Venturimeter, Orifice meter, Pitot tube, rectangular and triangular notches, Numerical problems. **Flow through pipes**: Frictional loss in pipe flow, Darcy Equation for loss of head due to friction in pipes, Chezy's equation for loss of head due to friction in pipes, Numerical problems.	**9**
V	**Hydraulic Turbines:** Classification of turbines; Euler's Turbine Equation, Heads and efficiency of hydraulic turbine, Pelton Turbine-velocity triangles, Design parameters, turbine efficiency, volumetric efficiency; Francis turbine – velocity triangles, runner	**9**

	shapes for different blade speeds, Design parameters of Francis turbine; Function of a Draft tube, types of draft tubes; Simple Numerical problems. **Centrifugal Pumps:** Working, Classification, Heads and efficiency of centrifugal pump, Types of vane shapes,	

LAB CONTENT

Sl. No	Experiment Description
1	Determination of Meta-centric Height by experimental Method.
2	Calibrate and determine the co-efficient of discharge through Venturimeter.
3	Calibrate and determine the co-efficient of discharge through orifice meter.
4	Calibrate and determine the co-efficient of discharge through V-notch.
5	Calibrate and determine the co-efficient of discharge through rectangular notch.
6	Determine the co-efficient of friction and loss of head in flow through pipes.
7	Determine minor losses of energy in flow through pipes.
8	Determination of force developed by impact of jets on vanes.
9	Performance testing of Turbines.1. Pelton wheel.2. Francis Turbine.
10	Performance testing of Centrifugal pumps.

Course outcome	Description
CO1	Understand and remember the properties of fluids for analyzing fluid flow applications.
CO2	Understand and apply the principles of pressure, buoyancy, floatation to solve the forces on submerged and floating bodies.
CO3	Apply and analyze effect of fluid properties on static and dynamics of fluid flow and fluid measurement.
CO4	Evaluate the fluid flow measurement and analyze the fluid flow in open channel and closed channel and their major and minor losses in the fluid flow and evaluated the performance characteristics of hydraulic turbines & pumps.

Course Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		1				1	2	1		2		
CO2	3	3		2	1				2	1		2		
CO3	2	3		3	1				2	1		2		
CO4	2	3		3	1			1	3	1		2		

Text Books:

Sl No	Title	Author	Volume and Year of Edition
1	Fluid Mechanics	Dr. Bansal.R. K.	Lakshmi Publications, 2006
2	Fluid Mechanics, Fundamental & Applications,	Yunus A Cenegel, John M Cimbala	Tata McGraw Hill, 2006.

Reference Books:

Sl No	Title	Author	Volume and Year of Edition
1	Fluid Mechanics	John F. Douglas, Janul and M. Gasiosek and john A Swaffield	Pearson Education Asia, 5th ed., 2006
2	Fluid Mechanics and Fluid Power Engineering,	D.S. Kumar.	Kataria and Sons., 2004.
3	Hydraulics and Fluid Mechanics	Modi and Seth.	Standard Book House, 22nd Edition, Delhi, 2010.

STRENGTH OF MATERIALS

Subject Code: 22ME404 **L – T – P - C: 3 – 0 – 2 – 4**

Sl. No	Course Objective
1	To prepare the students understand the basic concepts of theory of stress, strain, deflections, principal stresses and strains.
2	Study & analyze beams under various loading conditions.
3	Analyze the stress distribution in the shafts of circular section subjected to torsion.
4	Analyze and study stress distribution in thick and thin cylinders subjected to internal pressures.

Unit	Description	Hrs
I	**Simple Stress and Strain**: Introduction, Properties of Materials, stress, strain, Hook's law, Poisson's Ratio, Stress-Strain diagram for ferrous and non-ferrous materials, Principles of super position, total elongation of tapering bars of circular and rectangular cross sections. Elongation due to self-weight. **Volumetric strain:** expression for volumetric strain, elastic constants, relationship among Elastic constants, thermal stresses including compound bars.	**9**
II	**Bending moment and shear force in beams:** Introduction, types of beam loading and supports, shearing force in beams, bending moment, sign convention, relationship between loading shear force and bending moment, SFD, BMD for cantilever beams, simply supported beams and overhanging beams considering point loads, UDL, UVL, Couple.	**9**
III	**Bending stress and shear stress in beams:** Introduction, Bending stress in beams, assumptions in simple bending theory and pure bending, modulus of rupture, section modulus, flexural rigidity, beam of uniform strength, expression for horizontal shear stress in beams, shear stress diagram for rectangular, symmetrical I and T section. (Fletched beams not included) **Principal stresses and strains**: Principal planes, principal stresses and strains, biaxial state of stress combined with shear, concept of Mohr's circle diagram.	**9**
IV	**Deflection of beams:** Derivation of the relations between curvature, slope, deflection and moment. Assumptions, methods of determining slope and deflections. Determination of deflection of a simply supported beam subjected to concentrated load at centre, subjected to UDL, cantilever beam subjected to point load at free end, and also UDL. **Elastic stability of columns:** Introduction, effective length, slenderness ratio, short and long columns, radius of gyration, buckling load, assumptions derivations of Euler's theory, Rankine's formula.	**9**

V	**Torsion of circular shafts:** Introduction, pure torsion equations of circular shafts, strength and stiffness, Torsional rigidity, torsional flexibility, polar modulus, power transmitted by solid and hollow circular sections. Thin and Thick cylinders: thin and thick cylinders subjected to pressure, change in length, diameter, volume, Lame's equation (compound cylinders not included).	**9**

LAB CONTENT

Sl. No	Experiment Description
1	Conduction of tensile and compression test of metallic and nonmetallic specimen using a universal testing machine.
2	Conduction of shear and bending test of metallic and nonmetallic specimen using a universal testing machine.
3	Conduction of Izod and Charpy test on mild steel specimen.
4	Experiments on wear studies using ferrous, nonferrous & composite materials for different parameters.
5	Brinell, Rockwell and Vicker's hardness test.
6	Torsion test
7	Fatigue test.

Course outcome	Description
CO1	Understand the concepts of stresses, strains, deflections, principal stresses and strains.
CO2	Analyze Beams under various loading and support conditions.
CO3	Analyze the stress distribution in the shaft of circular cross section, strength deflection and rigidity criteria.
CO4	Understand the Analysis of thick and thin cylinders subjected to internal pressure and theory of torsion.

Course Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1					1	1		2		
CO2	2	2	1	1					1	1		1		
CO3	3	3	3	1					1	1		1		
CO4	3	2	2	3					1	1		1		

Text Books:

Sl No	Title	Author	Volume and Year of Edition
1	Strength of Materials	R K Bansal	Laksmi Publications, New Delhi,2018.

Reference Books:

Sl No	Title	Author	Volume and Year of Edition
1	Strength of Materials	S.S. Bhavikatti	Vikas Publications Pvt. Ltd., New Delhi,2016.
2	Strength of Materials	B.C. Punmia, Ashok Jain	Lakshmi Publications,2010.
3	Strength of materials	Ramamrutham	DhanpathRai publishers, New Delhi,2014.

METAL CASTING AND FORMING PROCESSES

Subject Code: 22ME405 **L – T – P - C: 3 – 0 – 0 – 3**

Sl. No	Course Objective
1	Understand the casting process and prepare different types of casting.
2	Acquire knowledge of pattern, core, gating, riser and moulding machines for expandable moulds, explore different furnaces and compare special moulding techniques of casting.
3	Acquire knowledge on metal forming process, hot and cold working process, various forging operations, rolling operations, drawing operations, extrusion process and various sheet metals operations.
4	Understand the soldering, Brazing and different types of welding process

Unit	Description	Hours
I	**Introduction:** Definition, Classification of manufacturing processes, introduction to casting, steps involved in making a casting, procedure for making casting, advantages, disadvantages and application of casting process. **Patterns:** Definition, function of pattern, materials used for pattern, pattern allowances and classification of patterns. **Cores:** Definition, types of cores **Concept of gating and risers**: principle of gating system, types of gates, types of risers, casting defects.	**08**
II	**Study of important moulding process:** sweep mould, shell mould, investment mould. **Casting using metal moulds:** Gravity die casting, pressure die casting, squeeze casting and continuous casting processes. **Melting furnaces:** Classification of furnaces, Resistance furnace, Coreless induction furnace, constructional features & working principle of cupola furnace.	**08**
III	**Mechanical Working of Metals:** Introduction to metal forming processes & classification of metal forming processes, advantages and disadvantages of metal working process. **Forging:** Classification of forging processes, defects in forging, advantages & disadvantages of forging. **Sheet Metal Operations:** Blanking, punching (piercing), Deep drawing, Trimming, and Shearing	**08**
IV	**Rolling:** classification of Rolling process, Types of rolling mills, Rolling defects. **Drawing & Extrusion:** Drawing process, drawing equipments, Extrusion of rod, types of extrusion. **Joining process:** principle of soldering and brazing**,** Advantages and disadvantages of soldering, advantages and limitations of brazing, comparison of soldering and brazing.	**08**

V	**Welding:** Principle of welding, classification of welding process, Application of welding, Advantages and limitations of welding. **Arc welding:** Principle, Metal arc welding (MAW) ,Tungsten Inert Gas Welding (TIG), Metal insert gas (MIG) welding, Gas welding, oxy-Acetylene welding, and types of flames produced in gas welding process. **Special type of welding:** Spot welding, Seam welding, Friction welding, Explosive welding, Laser welding and Electron beam welding.	**08**

Course outcome	Description
CO1	Understand the concepts of casting process and its terminologies, Core, Gating, Riser and important moulding process.
CO2	Understand the principle of Casting using metal moulds, melting furnaces, mechanical working of metals, forging and sheet metal operations.
CO3	Understand the process of Rolling, drawing, extrusion, soldering and brazing
CO4	Understand the concepts of metal joining process and special types of welding.

Course Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		1		2							1		
CO2	2		2		1							1		
CO3	1		2		1							1		
CO4	3		1		2							2		

Text Books:

Sl No	Title	Author	Volume and Year of Edition
1	Principles of metal casting	Rechard W. Heine, Carl R. Loper Jr, Philip C. Rosenthal, Tata	McGraw Hill Education Private Limited Ed.1976.
2	Manufacturing Process-I	Dr. K. Radhakrishna	Sapna Book House, 5th Revised Edition 2009.

Reference Books:

Sl No	Title	Author	Volume and Year of Edition
1	Process and Materials of Manufacturing	Roy A Lindberg	4th Ed. Pearson Edu. 2006.
2	Manufacturing Technology	SeropeKalpakjian, Steuen.R. Sechmid.	Pearson Education Asia, 5th Ed. 2006.

COMPUTER AIDED MACHINING LAB(Skill Lab – 2)

Subject Code: 22ME406 **L – T – P - C: 1 – 0 – 2 – 2**

Sl. No	Course Objective
1	To know fundamental knowledge and understand the concepts of CNC machine tool technology.
2	To expose the students to the techniques of CNC programming and cutting tool path generation through CNC simulation software by using G-Codes and M-codes
3	To educate the students on the usage of CAM packages and cut part on virtual CNC machine simulator.

Unit	Description	Hrs
	PART A	
I	• Study of functions assigned to Alphabets and Symbols. G and M codes, grouping of codes, Assigned and Unassigned, Model and Non-Model codes. • Writing and execution of CNC program for Turning and Facing. • Writing and execution of CNC program for Step Turning. • Writing and execution of CNC program for Taper Turning. • Writing and execution of CNC program for Threading.	20
	PART B	
II	• Writing and execution of CNC program for Drilling. • Writing and execution of CNC program for Milling. • Writing and execution of CNC program for key ways. • Writing and execution of CNC program for counter boring.	20

Question paper Pattern:

The student has to write and execute one program from each part. Part - A carries 20 marks Part - B carries 20 marks and Viva voce for 10Marks	Total: 50 marks

Course outcome	Description
CO1	Understand and write CNC part program for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning, Circular interpolation.
CO2	Analyse CNC Mill Part programming for Point to point motions, Line motions, Circular interpolation and Contour motion.
CO3	Choose CAM packages for machining complex parts and state of art cutting tools and related cutting parameters.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1		2				2	1		2		
CO2	1	2	1		2				3	1		2		
CO3	2	1	1		2				3	1		2		

Text Books:

Sl No	Title	Author	Volume and Year of Edition
1	CAD/CAM: Computer-Aided Design and Manufacturing	M. Groover	Pearson Education, Edition-1, January 2003
2	CAD/CAM Principles and Applications	P.N. Rao	MH, New Delhi, 2002.

Reference Books:

Sl No	Title	Author	Volume and Year of Edition
1	CAD/CAM/CIM	P. Radhakrishnan, S. Subramanyan	New Age International Publication, Revised Third Edition 2007.
2	CAD/CAM	Mikell P-groover, Emory W.Zimrners	Jr Pearson Education inc 2003

SKILL DEVELOPMENT - 1

Subject Code: 22SK407 **L – T – P - C: 2 –0 – 0 – 1**

Sl. No	Course Objective
1	Improve Communication Skills: Enhance students' ability to express ideas clearly, listen actively, adapt communication style to different contexts and audiences.
2	Faster Effective Teamwork: Develop students' teamwork skills, including cooperation, active participation, conflict resolution, leveraging diverse strengths for collaborative success.
3	Enhance Leadership Abilities: Cultivate leadership qualities by helping students develop self-awareness, problem-solving skills, and decision-making abilities
4	Promote Professional Etiquette: Instill a sense of professionalism in students, emphasizing appropriate workplace behavior, business etiquette and ethical conduct.

COURSE TOPICS: The course has 28 lectures in 5 Units. The 2- lecture hours per week of 1-hourduration. The syllabus for the lectures is given below.

Unit	Description	Hours
I	**Communication Skills:** Basics, Method, Means, Process and Purpose, Basics of Business Communication, Written & Oral Communication, Listening. Communication with Confidence & Clarity- Interaction with people, the need the uses and the methods, Getting phonetically correct, using politically correct language, Debate & Extempore.	**06**
II	**Assertive Communication**: Concept of Assertive communication, Importance and applicability of Assertive communication, Assertive Words, being assertive. **Presentation Skills**: Discussing the basic concepts of presentation skills, Articulation Skills, IQ & GK, how to make effective presentations, body language & Dress code in presentation, media of presentation	**05**

III	**Team work:** Team work and its important elements clarifying the advantages and challenges of team work understanding bargains in team building defining behavior to sync with team work stages of team building features of successful teams. **Body Language & Proxemics**: Rapport Building - Gestures, postures, facial expression and body movements in different situations, Importance of Proxemics, right personal space to maintain with different people.	**05**
IV	**Group discussion, Motivation and Stress Management** a. Theory & Evaluation: Understanding why and how is the group discussion conducted. b. Techniques of group discussion c. Discussion on FAQs of group discussion d. Body language during group discussion Self-motivation, group motivation, leadership abilities, Stress clauses and stress busters to handle stress and de-stress, understanding stress, Concept of sound body and mind, Dealing with anxiety, tension, and relaxation techniques. Individual Counseling & Guidance, Career Orientation. Balancing Personal & Professional Life	**06**
V	**Interview Skills, Professional Practice** a. Personal and Group Interviews b. Mock Interviews - Questions asked & how to handle them c. Body language in interview d. Etiquette, Dress code in interview e. Behavioral and technical interviews f. Practice on stress interviews, technical interviews, General HR interviews **Professional Practice**: Professional Dress Code, Time Sense, Respecting People & their Space, Relevant Behavior at different Hierarchical Levels. Positive Attitude, Self-Analysis and Self-Management. Professional Ethics values to be practiced, standards and codes to be adopted as professional engineers in the society for various projects. Balancing Personal & Professional Life	**06**

Course outcome	Description
CO1	Improved Communication Skills: Students will demonstrate enhanced verbal and written communication abilities, effectively expressing ideas, actively listening and adapting their communication style to different situations.
CO2	Effective Teamwork and Collaboration: Students will exhibit improved teamwork skills, actively contributing to group projects, resolving conflicts constructively and leveraging the strengths of team members to achieve shared goals.
CO3	Professional Etiquette and Conduct: Students will display professional behavior, adhering to workplace etiquette, demonstrating appropriate appearance, punctuality and practicing ethical conduct in professional settings.

CO4	Strengthened Aptitude Skills: Students will demonstrate improved aptitude skills, including logical reasoning, analytical thinking, problem-solving abilities, enabling them to excel in competitive exams, interviews and real-life problem-solving scenarios

Reference Books:

Sl No	Title	Author	Volume and Year of Edition
1	Technical Communication Principles and Practices	Meenakshi Raman and Sangeeta Sharma	Oxford Publishers, 2004
2	Tools for Talking When Stakes are High,	Kerry Patterson, Joseph Grenny, Ron McMillan, Crucial Conversation	McGraw-Hill Publication, ISBN: 9780071772204,2011.

SUGGESTED ASSESSMENT:

Internal Assessment through 2-Tests, each carries 25 marks.The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

CONSTITUTION OF INDIA

Subject Code: 22HS408 **L – T – P - C: 2 – 0 – 0 – 1**

Sl. No	Course Objective
1	To be familiar with salient features and preamble of the constitution of India. Including fundamental rights of the citizen of India and types of fundamental rights
2	To understand the relevance of directive principles under part-IV and the responsibilities of the individuals towards society.
3	To understand the powers and functions of the Legislature, Executive and judicial bodies.
4	To provide the information of FDs, Electoral Process, emergencies and amending procedures.

COURSE TOPICS: The course has 28 lectures in 5 Units. The 2- lecture hours per week of 1-hour duration

Unit	Description	Hours
I	Introduction, Meaning and definitions. Salient features, Sources, Constituent Assembly, Drafting Committee. Preamble to the constitution of India.	**06**
II	Fundamental rights under part III – details of exercise of rights, Scopes & Limitations and important cases	**06**
III	Relevance of directive principles of state policy under part-IV Fundamental duties and their significance-part-IV A.	**06**
IV	Union Executive- President, Prime minister, Parliament and Supreme Court of India. State Executive – Governors, Chief Ministers, State legislature and High Courts.	**04**
V	Constitutional Special Provisions for Scheduled Castes and Tribes, Women, Children and backward classes. Emergency provisions under Part XVIII. Electoral process, Amendment procedure, 42nd, 44th, 74th, 76th, and 91stConstitutional amendments.	**06**

Course outcome	Description
CO1	Have general knowledge and legal literacy and thereby to take up competitive examinations
CO2	Understand the freedom, rights and restrictions including directives, through fundamental duties
CO3	Understand the importance of the three main organs of the constitution, Viz-the legislature, the executive and the judiciary.
CO4	Understand the power and functions of political institutions established throughout the country

Text Books:

Sl No	Title	Author	Volume and Year of Edition
1	Introduction to the Constitution of India" (student edition)	DurgaDas Basu,	EEE, 19th/20th Edn.,2001
2	An Introduction to Constitution of India	MV Pylee.	Vol-1, Vikas Publishing, 2002

Reference Book:

Sl No	Title	Author	Volume and Year of Edition
1	An Introduction to Constitution of India"	BrijKishore Sharma	prentice-Hall of India, Vol-1, 2002
2	Constitution of India and Professional Ethics	V. Rajaram	Second Edition New Age International Publication. 2011

SUGGESTED ASSESSMENT:

Internal Assessment through 2-Tests, each carries 25 marks. The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.