COEP Technological University Pune

(A Unitary Public University of Govt. of Maharashtra)

School of Engineering and Technology

Curriculum Structure & Detailed Syllabus

S. Y. B. Tech.

<Mechanical Engineering>

(Effective from: A.Y. 2026-27)

Program Educational Objectives (PEOs)

After the completion of the program,

I. Student will be employable in the diversified sectors of the industry, government organizations, public sector and research organizations.

II. Student will pursue higher education in engineering or other fields of their interests, at institutes of repute and high ranking.

III. Student will demonstrate effective communication, lifelong learning ability, integrity, teamwork, leadership qualities, concern to environment and commitment to safety, health, legal and cultural issues in the fields they choose to pursue.

Program Outcomes (POs):

Engineering Graduate will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problem.

PO2: Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural science, and engineering sciences.

PO3: Design/Development Solution: Design solution for complex engineering problems and design system component or process that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, social and environmental conditions.

PO4: Conduct Investigation of Complex Problem: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusion.

PO5: Method, Tool Usage: Create, select and apply appropriately technique, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with understanding the limitation.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to access societal health, safety, legal and cultural and consequent responsibility relevant to the professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of the professional engineering solution in societal and environmental context, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principle and commitment to professional ethics and responsibilities and norms of the engineering practices.

PO9: Individual and Team Work: Function effectively as an individual, and as the member or leader in diverse team and multidisciplinary setting.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, and being able to comprehend and write effective reports and design documentation and effective presentation and give and receive clear instructions.

PO11: Project management and Finance: Demonstrate knowledge & understanding of the engineering and management principles and apply these to one's work, as the member and the leader in a team to manage projects and in multidisciplinary environment.

PO12: Lifelong Learning: Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in broadest context of technological change.

S.Y. B. Tech.
<Mechanical Engineering>

List of Abbreviations

Abbreviation	Title	No of Courses	Credits	% of Credits
BS	Basic Science Course	--	--	--
ESC	Engineering Science Course	--	--	--
PCC	Programme Core Course (PCC)	07	22	53.65
PEC	Programme Elective Course (PEC)	--	--	--
OE/SE	Open/School Elective (OE/SE) other than particular program	02	04	9.75
MDM	Multidisciplinary Minor (MDM)	01	03	7.31
VSEC	Vocational and Skill Enhancement Course (VSEC)	01	02	4.87
HSMC	Humanities Social Science and Management	03	04	9.75
IKS	Indian Knowledge System (IKS)	--	--	--
VEC	Value Education Course (VEC)	02	02	4.87
RM	Research Methodology (RM)	--	--	--
--	Internship	--	--	--
--	Project	--	--	--
CEA	Community Engagement Activity (CEA)/Field Project	01	02	4.87
CCA	Co-curricular & Extracurricular Activities (CCA)	--	--	--
AEC	Ability Enhancement Course	01	02	4.87
	Total	**16**	**41**	**100**

S.Y. B. Tech.
<Mechanical Engineering>

Semester -III

Sr. No	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme				
									Theory			Laboratory	
									MSE	TA	ESE	ISE	ESE
1	PCC	ME-24001	Engineering Thermodynamics	3	1	0	0	4	30	20	50	---	---
2	PCC	ME-24002	Solid Mechanics	2	0	0	1	2	30	20	50	---	---
3	PCC	ME-24003	Machine Drawing & Geometric Modeling	1	0	2	1	2	30	20	50	50	50
4	PCC	ME-24004	Manufacturing Technology	2	0	2	1	3	30	20	50	50	50
5	OE-03		Open Elective – I	2	0	0	0	2	30	20	50	---	---
6	HSMC	*<tbd>*	Design Thinking	1	0	0	0	1	CIE:100			---	---
7	VEC-I	*<tbd>*	Environmental Studies	1	0	0	0	1	CIE:100			---	---
8	HSMC	*HS-24004*	Principles of Economics	2	0	0	0	2	30	20	50	---	---
9	CEA	*AS-24004*	Community Engagement Activity/ Field Project *	0	0	4	0	2				CIE 100	
Total				**14**	**01**	**08**	**03**	**19**					

*** After SEM II during summer vacation and evaluation will be done in the start of SEM III with a duration minimum one and a maximum three month**

Semester -IV

Sr. No	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme				
									Theory			Laboratory	
									MSE	TA	ESE	ISE	ESE
1	PCC	ME-24006	Fluid Mechanics	3	0	2	1	4	30	20	50	50	50
2	PCC	ME-24007	Design of Machine Elements	2	1	0	1	3	30	20	50	--	--
3	PCC	ME-24008	Kinematics of Machines	3	0	2	1	4	30	20	50	50	50
5	OE		Open Elective - II	2	0	0	0	2	30	20	50	--	--
6	MDM 01		Multidisciplinary Minor I	3	0	0	1	3	30	20	50	--	--
7	VSEC-01	ME-24009	Numerical Methods and Programming Language	1	0	2	1	2	CIE:100			50	50
8	AEC-II	<*tbd*>	Indian Language: Sanskrit/Pali	2	0	0	0	2	30	20	50	--	–
09	HSMC	HS-24001	Entrepreneurship	1	0	0	1	1	CIE:100			--	--
07	VEC-II	<*tbd*>	Constitution of India and Universal Human Values	1	0	0	0	1	CIE:100			--	–
Total				**18**	**01**	**06**	**06**	**22**					

Semester - III

ENGINEERING THERMODYNAMICS						
Course Code	ME-24001		**Examination Scheme**			
Teaching Scheme	3-1-0-0		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	4		**Laboratory**	CIE: 50	ESE: 50	--

Course Outcomes: Students will be able to:

1. Apply fundamental thermodynamic concepts to identify systems, properties, and thermodynamic processes.
2. Apply First Law and Second Law of Thermodynamics to analyze energy interactions in engineering systems.
3. Analyze thermodynamic processes and evaluate performance of ideal gas systems.
4. Evaluate performance of air-standard cycles and internal combustion engines.
5. Analyze properties of pure substances and evaluate vapour power cycles.
6. Evaluate performance of boilers and steam generation systems.

Fundamentals and First Law of Thermodynamics **[6 Hrs]**

Fundamentals of Thermodynamics: Introduction, Review of basic definitions, zeroth law of Thermodynamics, Macro and Microscopic Approach, State Postulate, State, Path, Process and Cycles, Point function and Path function, Quasi-static process, Equilibrium,
First Law of Thermodynamics: Concept of heat and work, Sign convention and its conversion. First law of thermodynamics, Joules experiments, Equivalence of heat and work. Application of first law to flow and non-flow Processes and Cycles. Steady flow energy equation (SFEE), Applications of SFEE to devices such as Nozzle, Turbine, Compressors, Boilers and Heat Exchangers; especially condensers and evaporators, PMM-I kind. (Numerical on SFEE).

Second Law of Thermodynamics, Entropy and Availability **[8 Hrs]**

Second Law of Thermodynamics: Limitations of first law of thermodynamics, Thermal reservoir, Heat Engine, Refrigerator and Heat pump: Schematic representation, Efficiency and Coefficient of Performance (COP), Kelvin-Planck & Clausius Statement of the Second law of Thermodynamics; PMM-II kind, Equivalence of the two statements (Numerical).
Entropy: Clausius Inequality, Concept of Reversibility and Irreversibility, Entropy as a property, Principle of increase of Entropy, Entropy changes for an Open and Closed System,

Ideal Gas and Air-Standard Cycles **[7 Hrs]**

Ideal Gas Equations: Ideal Gas definition, Gas Laws: Boyle's law, Charle's law, Avogadro's Law, Equation of State, Ideal Gas constant and Universal Gas constant, Ideal gas Processes-on P-v and T-s diagrams, Constant Pressure, Constant Volume, Isothermal, Adiabatic, Polytrophic, Throttling Processes (Open and Closed systems), Calculations of Heat transfer, Work done, Enthalpy, Entropy, Internal Energy (Numerical).
Air-Standard Cycles:
Assumptions of Air-Standard Cycle; basic terminology; analysis of Otto Cycle, Diesel Cycle and Dual Cycle; processes involved; thermal efficiency; mean effective pressure; comparison of cycles; P–V and T–S diagrams; numerical problems.

Fuel-Air Cycles and Actual Engie Performance **[5 Hrs]**

Concept and brief analysis of Fuel-Air Cycle; limitations of air-standard assumptions; basics of SI and CI engines; Classification of IC Engine, deviation of fuel-air and actual cycles from ideal cycles; actual P–V diagram; engine performance parameters— indicated power, brake power, mechanical efficiency, thermal efficiency, volumetric efficiency, mean effective pressure, brake mean effective pressure, specific fuel consumption; heat balance sheet; numerical problems.

Properties of Pure substances and Vapour Power Cycle **[7 Hrs]**

Properties of Pure Substances
Formation of steam; phase changes; phase diagram of pure substances; properties of steam; use of steam tables; study of P–v, T–s and h–s (Mollier) diagrams; dryness fraction and its determination using combined separating and throttling calorimeter; change of properties,
Vapour Power Cycle

Carnot Cycle; Rankine Cycle; comparison of Carnot and Rankine cycles; introduction to steam power plant; efficiency of Rankine cycle; effect of operating parameters such as superheat, boiler pressure and condenser pressure on performance of Rankine cycle; modified Rankine cycle; numerical problems (Carnot and Rankine cycles only).

Availability (Basic Concept)

Available and unavailable energy; concept of availability; maximum useful work; availability of heat source at constant temperature; brief relation of availability with vapour power cycle performance.

Steam Generators and Performance	**[3 Hrs]**

Steam Generators

Introduction to steam generation; classification of boilers; introduction to IBR Act; non-IBR boilers; fire tube and water tube boilers; boiler mountings and accessories.

Boiler Performance

Equivalent evaporation; boiler efficiency; heat balance sheet; numerical problems.

Textbooks:

[1]	P. K. Nag, "Engineering Thermodynamics", Tata McGraw Hill Publications.
[2]	R. K. Rajput, "Engineering Thermodynamics", EVSS Thermo, Laxmi Publications.
[3]	P. L. Ballaney, "Thermal Engineering", Khanna Publishers.
[4]	C.P. Arora, "Thermodynamics", Tata McGraw Hill.
[5]	Domkundwar, Kothandaraman and Domkundwar, "Thermal Engineering", Dhanpat Rai Publishers.
[6]	M. M. Rathore, "Thermal Engineering", Tata McGraw-Hill

Reference Books:

[1]	Rayner Joel, "Basic Engineering Thermodynamics", AWL-Addison Wesley
[2]	Cengel and Boles, "Thermodynamics an Engineering Approach", McGraw-Hill
[3]	G. Van Wylen, R. Sonntag and C. Borgnakke, "Fundamentals of Classical Thermodynamics", John Wiley & Sons
[4]	Holman J.P., "Thermodynamics", McGraw Hill
[5]	M. Achuthan, "Engineering Thermodynamics", PHI
[6]	Steam Tables/Data Book

SOLID MECHANICS						
Course Code	ME-24002		**Examination Scheme**			
Teaching Scheme	2-0-0-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	2		**Laboratory**	CIE: ---	ESE: ---	--

Course Outcomes: Students will be able to:

1. Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials.
2. Calculate the stresses and strains in axially loaded members, circular torsion members, and members subject to flexural loadings.
3. Calculate the stresses and strains associated with thin-wall spherical and cylindrical pressure vessels.
4. Determine the stresses and strains in members subjected to combined loading and apply the theories of failure for static loading.
5. Determine and illustrate principal stresses, maximum shearing stress, and the stresses acting on a structural member.
6. Determine the deflections and rotations produced by the three fundamental types of loads: axial, torsional, and flexural.
7. Analyze slender, long columns subjected to axial loads. 8. Design simple bars, beams, and circular shafts for allowable stress and loads.

Simple stress and strain **[5 Hrs]**

Simple stress and strain- introduction to types of loads (static, dynamic and impact loading), various type of stresses with applications, Hook's law, Poisson's ratio, modulus of elasticity, modulus of rigidity, bulk modulus, interrelationship between elastic constants, stress-strain diagram for ductile and brittle materials, factor of safety, stresses and strains in determinate and indeterminate beams, homogenous and composite bars under concentrated loads and self-weight, thermal stresses in plane and composite members.

Shear force and bending moment diagram **[5 Hrs]**

Shear force and bending moment diagram (SFD & BMD)- introduction to SFD, BMD with application SFD & BMD for statically determinate beam due to concentrated load, uniformly distributed load, uniformly varying load, couple and combined loading, relationship between rate of loading, shear force and bending moment, concept of zero shear force, maximum bending moment, point of contraflexure.

Stresses, slope and deflection on beams **[8 Hrs]**

Bending stresses on a beam- introduction to bending stresses on a beam with application, theory of simple bending, assumptions in pure bending, derivation of flexural formula, moment of inertia of common cross section (circular, hollow circular, rectangular – I and T), bending stress distribution along the same cross section. Shear stresses on beam- introduction to transverse shear stresses on a beam with application, shear stress distribution diagram along the circular, hollow circular, rectangular I and T cross section Slope and deflection on a beam- introduction to slope and deflection on a beam with application slope, deflection and radius of curvature, Macaulay's method.

Torsion of circular shafts, Buckling of columns and strain energy **[6 Hrs]**

Introduction to torsion on a shaft with application, basic torsion formulae and assumption in torsion theory, torque transmission on strength and rigidity basis. Buckling of columns- Introduction to buckling of columns with its applications, different column conditions, critical and safe load, determination by Euler's theory, limitations of Euler's theory. Strain energy and impact loading- concept of strain energy, derivation, and use of expressions for deformation of axially loaded members under gradual, sudden and impact loads.

principal stresses and Theories of failure **[6 Hrs]**

principal stresses- introduction to principal stresses with applications, transformation of plane stress, principal stresses and planes (analytical methods and Mohr's circle), stresses due to combined normal and shear stresses. Theories of elastic failure- introduction to theories of failure with application, Maximum Principal stress theory, Maximum shear stress theory, Maximum distortion energy theory, Maximum principal stain theory, Maximum strain energy theory. Thin cylinders and spheres- Introduction, thin cylindrical vessel subjected to internal pressure, stresses in a thin cylindrical vessel

subjected to internal pressure, effect on internal pressure on dimensions of a thin cylindrical shell, thin spherical shell, effect on internal pressure on dimensions of a thin spherical shell.	
Textbooks:	
[1]	R K Bansal, “Strength of materials”, Laxmi Publication
[2]	S. Ramamurtham, “Strength of materials”, Dhanpatrai Publication
[3]	S S Ratan, “Strength of materials”, Tata McGraw Hill Publication Co. Ltd.
[4]	S K Sarkar, “Strength of materials”, McGraw Hill New Delhi
[5]	Singer and Pytel, “Strength of materials”, Harper and row Publication
[6]	R C Hibbeler, “Mechanics of materials”, Prentice Hall Publication
Reference Books:	
[1]	Egor P Popov, “Introduction to mechanics of solids”, Prentice Hall Publication
[2]	G H Ryder, “Strength of materials”, McMillan Publication
[3]	Beer and Johnston, “Strength of materials”, CBS Publication
[4]	James M. Gere, “Mechanics of materials”, CL Engineering
[5]	Timoshenko and Young, “Strength of materials”, CBS Publication

MACHINE DRAWING AND GEOMETRIC MODELLING						
Course Code	ME-24003		**Examination Scheme**			
Teaching Scheme	1-0-2-1		**Theory**	CIE:100		
Credits	2		**Laboratory**	ISE: 50	ESE: 50	--

Course Outcomes: Students will be able to:

1. Comprehend various types of drawings, including production drawings, assembly drawings, and part drawings and apply standardization principles for creation of drawings.
2. Evaluate the application of fits, limits, geometric tolerances, and surface finish, and apply them using appropriate nomenclature, symbols, and rules.
3. Evaluate positional and orientation tolerances, understand material modifiers, and apply surface profiles and runout controls effectively in production drawings, ensuring quality and precision in manufacturing processes.

Introduction to Machine Drawing **[2 Hrs]**

Types of Drawings, Standardization, Production Drawing, Assembly and part drawings, Blueprint reading, Study, and preparation of bill of materials. Design considerations – Limits, fits, and standardization; Friction and lubrication.

Limits, Fits and Tolerances **[4 Hrs]**

Limits, Fits and Tolerances ISO system of tolerance, Tolerance charts, Hole - base and shaft -base system of tolerance, Types of fits, symbols and applications, values related to various manufacturing processes, Application of fits. specific heats, sensible heat and latent heat, triple point, critical point, superheat and total heat of steam.

Geometric Tolerances **[4 Hrs]**

Introduction, Nomenclature, Rules, Symbols, datums and applications of Geometric Tolerances, Max & Min Material principles, Positional, Orientation tolerance (axis, midplane and surface), Material modifiers (MMC, LMC, RFS), Surface profiles, Surface form tolerance, Runout controls.

Surface Roughness & Production Drawing **[2 Hrs]**

Surface Textures, Roughness values and Roughness Grades, Machining symbols Conventional Representation on part drawings.

Textbooks:

[1]	Machine Drawing, K. L. Narayana, P. Kanniah, & K.V. Reddy, SciTech Publications
[2]	Production Drawing, K. L. Narayana, P. Kanniah, & K.V. Reddy, New Age International Pvt Ltd

Reference Books:

[1]	IS Code: SP 46 – 1988, Standard Drawing Practices for Engineering Institutes
[2]	Machine Drawing, PS Gill, Katsons
[3]	Machine Drawing, O.P Jahkar, Amit Mathur, Khanna Publishing House
[4]	Machine Drawing, ND Bhat, Charotar Publishing House
[5]	Manual of Engineering Drawing, Colin H Simmons, and Neil Phelps and Dennis Maguire, Elsevier Newnes.
[6]	Machine Design, Sadhu Singh, Khanna Book Publishing, 2021
[7]	Fundamentals of Machine Component Design, Juvinal, R.C., John Wiley, 1994.
[8]	R. L. Norton, “Mechanical Design – An Integrated Approach,” Prentice Hall, 2009.
[9]	Sadhu Singh, “Machine Design Data Book”, Khanna Book Publishing, 2022.
[10]	Computer Aided Engineering Drawing, S. Trymbaka Murthy, I.K. International Publishing House Pvt. Ltd, Pune
[11]	Engineering Drawing and Computer Graphics, Shah, Pearson

List of Experiments

[1]	**Lab learning** Studies and demonstration of standard components Machine elements such as keys, Joint between links, springs, gears, cams, shafts, rack and pinions, belt and chains drives, sprockets, pulleys, flywheels, bearings, couplings, clutches and breaks. Threaded parts and Locking Arrangements. Bolted, Riveted, Welded and Adhesive Joints. Conventional

	representation of piping layouts, pipe fittings, valves, joints. Stuffing box & glands, Expansion joints etc. **Lab work:** Component and assembly study Observe all machine elements in a machine. Describe their relative position, sequence of assembly, relation with other mating components, classify fits, surface finish, mention feature details, requirement of lubrication etc. **Self-Study:** Observation and studies of different assemblies and their parts such as vehicles, IC engines, machine tools, manufacturing and any mechanical
[2]	**Lab learning:** Standards and conventions: Dimensioning Techniques, Sections and other conventions. **Lab learning:** Orthographic CAD: Orthographic representation of machine drawing, Draw, Modify, and Edit features/commands in drafting software. Lab work: Orthographic drawing: Orthographic drawing of machine elements using 2D drafting software. Complete 3 views along with required sectional views, select machine element with more features along with few internal features which requires use of technical notes, and symbols on machine drawing. ● Orthographic drawing No.1 ● Orthographic drawing No.2 **Self-Study:** Use of any AutoCAD software for drafting and 3D part modelling.
[3]	**Lab learning**: Solid Modelling using CAD: Part Modeling & Assembly Modeling, editing of solids, Sheet metal modeling, Surface modelling, 3-D operations such as shading and rendering etc. Introduction to CAD customization. Lab work: Production drawing: 3 4 Production drawing of a machine part using part modelling (3D) CAD software. Complete 3 views along with sectional views, select machine element with more features along with few internal features which requires use of technical notes, and symbols, limits, and surface finish on machine drawing. ● Production drawing No.1 assuming that the part is manufactured using machining/forging/casting and surface treatment. ● Production drawing No.2 assuming the part is made using sheet metal operations and welding/riveting. **Self-Study:** Use of any AutoCAD software for drafting and 3D part modelling.
[4]	**Lab learning**: Assembly and part drawings Blueprint reading, Study, and preparation of bill of materials. Use of Limits, fits, tolerances, surface finish and production requirements on part drawing. **Lab work:** Assembly and details using Manual and CAD tools: Select an Assembly and detail drawing example having at least 6-12 different components. Complete 3 views along with sectional views of assembly and parts. Include required details for production drawing such as limits, fits and tolerances (Size, form, orientation etc.), all symbols, methods and conventions. Also include isometric and exploded views for assembly. ● Complete the assembly and detail drawing on an A1 drawing sheet using manual tools. ● Complete the assembly and detail drawing using Part/solid (3D) modelling software. **Self-Study:** Use of any AutoCAD software for drafting and 3D part modelling.
[5]	**Lab learning: Collaborative teamwork:** Use of online tools and features in CAD software for concurrent engineering. **Lab work: Assembly and detail drawing using CAD as group assignment in collaborative online CAD environment**: Select an Assembly and detail drawing example having at least 10-15 different components. Select assembly with at least 4 times the number of students. The minimum size of a group should not be less than 2 or more than 4. Complete the assembly and detail drawing using Part/solid (3D) modelling software. Complete 3 views along with sectional views of assembly and parts. Include required details for production drawing such as limits, fits and tolerances (Size, form, orientation etc.), all symbols, methods and conventions. Also include isometric and exploded views for assembly. **Self-Study**: Use of any AutoCAD software for drafting and 3D part modelling.

MANUFACTURING TECHNOLOGY

Course Code	ME-24004		**Examination Scheme**			
Teaching Scheme	2-0-2-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	3		**Laboratory**	ISE: 50	ESE: 50	--

Course Outcomes: Students will be able to:

1. Analyze various manufacturing & finishing processes and select the particular process for a given job.
2. Estimate the indexing movements related to various types of indexing used in milling related processes.
3. Apply knowledge of manufacturing processes to solve the related problems.
4. Identify and explain the function of the basic components of machine tools and its accessories.

Hot and cold working of metals **[8 Hrs]**

Principles of rolling, forging, drop, press, upset, roll forging, extrusion, drawing, spinning, and effect of hot working. Cold working processes, Cold rolling, swaging, forging, extrusion- forward, backward and impact roll forming, tube drawing, wire drawing, spinning, shot penning, high energy rate forming, sheet metal working, types of presses, drives, different operations and types of dies, Forging design.

Joining processes **[6 Hrs]**

Arc welding- Theory, SMAW, GTAW, GMAW, FCAW, Submerged arc welding, Stud welding Resistance welding- Theory, spot and seam projection welding processes Gas welding Friction welding, Ultrasonic welding, Thermit welding, EBW and LASER welding Use of adhesive for joining, classification of adhesives, types of adhesive and their application, surface preparation and various joints welding defects and quality.

Foundry- Pattern making, moulding and casting **[8 Hrs]**

Sand casting, types of pattern material, pattern making allowances, core print moulding, sand properties and testing, hand and machine moulding, core boxes, core making, melting and pouring, melting furnaces- Cupola, electric arc and induction furnaces. Cleaning, finishing and heat treatment of casting, defects in casting, shell moulding and investment casting. Permanent mould dies casting- Die-casting, low-pressure permanent mould casting, hot and cold chamber processing, centrifugal casting, semi centrifugal casting and continuous casting.

Machining processes-Turning, drilling, reaming and milling **[8 Hrs]**

Turning and boring, lathe construction, accessories and operations. Fundamentals of drilling processes, drill geometry, types of drilling machines, operations performed on drilling machines, type of drill. Reaming processes and reamer types. Fundamental aspects, cutter types and geometry, Operations performed on milling machine, dividing head method of indexing. Fundamentals of CNC Machining- Lathe & milling.

Grinding and Finishing Processes **5 Hrs**

Grinding wheels, wheel marking, wheel selection, wheel mounting, and types of grinding machines. Honing, lapping, super finishing, buffing and burnishing processes.

Textbooks:

[1]	Chapman W.A.-"Workshop Technology, Vol. II, III, & I", Edward Arnold Pub.Ltd. London
[2]	Hajra Chaudhary S.K.- Elements of Workshop Technology, Vol. I& II, Media Prom & Pub, Mumbai.

Reference Books:

[1]	HMT Hand book- Production Technology
[2]	Roy A. & Linberg- "Processes and materials of manufacturing", Prentice Hall of India, Delhi.
[3]	Campbell J.S.- Principles of manufacturing Materials and Processes, McGraw-Hill, New York.
[4]	Begeman - "Manufacturing processes", Asia Publishing house Bombay.

List of Experiments

Term work: Each candidate shall be required to complete and submit the following term work: Jobs: Plain and Taper turning – one job (Conventional & CNC Lathe), Thread cutting – one Job, Welding (gas or arc or resistance) – one job
Assignments on machine tools will be in the form of a journal based on demonstrations on machine tools. This should include sketches and relevant descriptions as given below: ● Machines (Any Two) ● Lathe ● Universal milling machine ● Radial drilling machine ● Cylindrical grinder. ● Mechanisms (Any Two) ● Spindle arbor (assembly) drive of milling machine ● Half nut mechanism ● Thread cutting mechanisms. ● Accessories ● Universal dividing head ● Milling cutter

DESIGN THINKING						
Course Code	*<tbd>*		**Examination Scheme**			
Teaching Scheme	1-0-0-0		**Theory**	CIE:100		
Credits	1		**Laboratory**	ISE: --	ESE: --	--

Course Outcomes: Students will be able to:

1. Demonstrate the critical theories of design, systems thinking, and design methodologies.
2. Produce great designs, be a more effective engineer, and communicate with high emotional and intellectual impact.
3. Demonstrate the diverse methods employed in design thinking and establish a workable design thinking framework to use in their practices.
4. Conceive, organize, lead and implement projects in interdisciplinary domain and address social concerns with innovative approaches

Design process **[6 Hrs]**

Traditional design, Design thinking, Existing sample design projects, Study on designs around us, Compositions/structure of a design, Innovative design: Breaking of patterns, Reframe existing design problems, Principles of creativity Empathy: Customer Needs, Insight-leaving from the lives of others/standing on the shoes of others, Observation

Design team **[6 Hrs]**

Team formation, Conceptualization: Visual thinking, Drawing/sketching, New concept thinking, Patents and Intellectual Property, Concept Generation Methodologies, Concept Selection, Concept Testing, Opportunity identification Prototyping: Principles of prototyping, Prototyping technologies, Prototype using simple things, Wooden model, Clay model, 3D printing; Experimenting/testing.

Sustainable product design **[6 Hrs]**

Ergonomics, Semantics, Entrepreneurship/business ideas, Product Data Specification, Establishing target specifications, Setting the final specifications. Design projects for teams.

Textbooks:

[1]	Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publishers Ltd.
[2]	Idris Mootee, Design Thinking for Strategic Innovation,2013, John Wiley & Sons Inc

Reference Books:

[1]	Brenda Laurel Design Research methods and perspectives MIT press 2003.
[2]	Terwiesch, C. & Ulrich, K.T., 2009. Innovation Tournaments: creating and identifying Exceptional Opportunities, Harvard Business Press.
[3]	Ulrich &Eppinger, Product Design and Development, 3rd Edition, McGraw Hill, 2004
[4]	Stuart Pugh, Total Design: Integrated Methods for Successful Product Engineering, Bjarki Hallgrimsson, Prototyping and model making for product design, 2012, Laurence King Publishing Ltd

ENVIRONMENTAL STUDIES						
Course Code	*<tbd>*		**Examination Scheme**			
Teaching Scheme	1-0-0-0		**Theory**	CIE:100		
Credits	1		**Laboratory**	ISE: --	ESE: --	--

Course Outcomes: Students will be able to:

1. Develop an understanding of sustainable techniques for conservation and management of natural resources, the importance of Sustainable Development Goals (SDGs), and critically analyze environmental issues on local, regional, and global scales.
2. Understand the sources and types of pollution, adverse health impacts, and the prevention and management techniques for pollution.
3. Recognize the factors affecting biodiversity loss, ecosystem degradation, and major conservation strategies in India and globally, with a focus on climate change, its impacts, and adaptation strategies.
4. Learn about environmental management systems, laws, policies, and international treaties, along with India's responses to global agreements and the role of international institutions in environmental preservation.

Humans and the Environment: **[1 Hr]**

The man-environment interaction: Humans as hunter-gatherers; Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment; Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change. The emergence of environmentalism: Anthropocentric and eco-centric perspectives (Major thinkers); The Club of Rome- Limits to Growth; UN Conference on Human Environment 1972; World Commission on Environment and Development and the concept of sustainable development; Rio Summit and subsequent international efforts.

Natural Resources and Sustainable Development: **[2 Hrs]**

Overview of natural resources: Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable. Biotic resources: Major type of biotic resources- forests, grasslands, wetlands, wildlife and aquatic (fresh water and marine); Microbes as a resource; Status and challenges. Water resources: Types of water resources- fresh water and marine resources; Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges; Water scarcity and stress; Conflicts over water. Soil and mineral resources: Important minerals; Mineral exploitation; Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation. Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources- coal, oil, natural gas, nuclear energy; non-conventional energy sources- solar, wind, tidal, hydro, wave, ocean thermal, geothermal, biomass, hydrogen and fuel cells; Implications of energy use on the environment. Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.

Environmental Issues: Local, Regional and Global: **[2 Hrs]**

Environmental issues and scales: Concepts of micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena. Pollution: Impact of sectoral processes on Environment, Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Transboundary air pollution; Acid rain; Smog. Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Biodiversity loss: past and current trends, impact. Global change: Ozone layer depletion; Climate change.

Conservation of Biodiversity and Ecosystems: **[2 Hrs]**

Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories. Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristics forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance. Threats to biodiversity and ecosystems: Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change.

Environmental Pollution and Health: **[2 Hrs]**

Understanding pollution: Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution. Air pollution: Sources of air pollution; Primary and secondary pollutants; Criteria pollutants- carbon monoxide, lead, nitrogen oxides, ground-level ozone, particulate matter and Sulphur dioxide; Other important air pollutants- Volatile Organic compounds (VOCs), Peroxyacetyl Nitrate (PAN), Polycyclic aromatic hydrocarbons (PAHs) and Persistent organic pollutants (POPs); Indoor air pollution; Adverse health impacts of air pollutants; National Ambient Air Quality Standards. Water pollution: Sources of water pollution; River, lake and marine pollution, groundwater pollution; water quality Water quality parameters and standards; adverse health impacts of water pollution on human and aquatic life. Soil pollution and solid waste: Soil pollutants and their sources; Solid and hazardous waste; Impact on human health. Noise pollution: Definition of noise; Unit of measurement of noise pollution; Sources of noise pollution; Noise standards; adverse impacts of noise on human health. Thermal and radioactive pollution: Sources and impacts on human health and ecosystems.

Climate Change: Impacts, Adaptation and Mitigation: **[2 Hrs]**

Understanding climate change: Natural variations in climate; Structure of atmosphere; Anthropogenic climate change from greenhouse gas emissions– past, present and future; Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Climate change projections for the Indian sub-continent. Impacts, vulnerability and adaptation to climate change: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health, urban infrastructure; the concept of vulnerability and its assessment; Adaptation vs. resilience; Climate-resilient development; Indigenous knowledge for adaptation to climate change. Mitigation of climate change: Synergies between adaptation and mitigation measures; Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; National and international policy instruments for mitigation, decarbonizing pathways and net zero targets for the future; Energy efficiency measures; Renewable energy sources; Carbon capture and storage, National climate action plan and Intended Nationally Determined Contributions (INDCs); Climate justice.

Environmental Management: **[2 Hrs]**

Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control.

Environmental management system: ISO 14001, Life cycle analysis; Cost-benefit analysis, Environmental audit and impact assessment; Environmental risk assessment, Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Eco mark scheme

Environmental Treaties and Legislation: **[2 Hrs]**

Major International organizations and initiatives: United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN), World Commission on Environment and Development (WCED), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC), and Man and the Biosphere (MAB) programme.

Case Studies and Field Work: **[1 Hrs]**

Discussion on one national and one international case study related to the environment and sustainable development.

Field visits to identify local/regional environmental issues, make observations including data collection and prepare a brief report.

Documentation of campus biodiversity, Campus environmental management activities such as solid waste disposal, water management and sewage treatment

Reference Books:

[1]	**J. Donald Hughes**, *An Environmental History of the World: Humankind's Changing Role in the Community of Life*, 2nd Edition, Routledge, 2009.
[2]	**Gilbert M. Masters**, *Introduction to Environmental Engineering and Science*, 3rd Edition, Pearson, 2015.

[3]	**Rajagopalan, R.**, *Environmental Studies: From Crisis to Cure*, 3rd Edition, Oxford University Press, 2021.
[4]	**Krishnamurthy, K.V.**, *Textbook of Biodiversity*, 3rd Edition, Science Publishers, 2020.
[5]	**Pittock, Barrie**, *Climate Change: Science, Impacts and Solutions*, 2nd Edition, Routledge, 2014.
[6]	**Jackson, A.R.W. and Jackson, J.M.**, *Environmental Science: The Natural Environment and Human Impact*, 3rd Edition, Pearson, 2020.
[7]	**United Nations**, *Transforming Our World: The 2030 Agenda for Sustainable Development* (Open Access).
[8]	**IPCC, *Climate Change 2023:*** *Synthesis Report of the Sixth Assessment Report (AR6)*, Intergovernmental Panel on Climate Change**,** March 2023.

PRINCIPLES OF ECONOMICS						
Course Code	HS-24004		**Examination Scheme**			
Teaching Scheme	2-0-0-0		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	2		**Laboratory**	ISE: --	ESE: --	--

Course Outcomes: Students will be able to:

1. Understand and analyze fundamental economic theories and policies.
2. Identify and solve economic problems using knowledge, techniques, and available frameworks.
3. Compare and evaluate economic scenarios to draw logical conclusions.
4. Adapt to dynamic economic environments and propose viable alternative solutions.

Introduction to Economics **[8 Hr]**

Definitions, basic concepts of economics: Cost, efficiency and scarcity, Opportunity Cost, Types of economics: Microeconomics, Macroeconomics and Managerial Economics, Difference between microeconomics and macroeconomics, Application of Managerial economics

Microeconomics Analysis **[8 Hrs]**

Demand Analysis, Supply Analysis, Theories of Utility and Consumers Choice, Cost analysis, Competition and Market Structures. Application of microeconomics theories

Macro-Economic Analysis **[8 Hrs]**

Aggregate Demand and Supply, Economic Growth and Business Cycles, inflation, Fiscal Policy, National income, theory of Consumption, savings and investments, Commercial and Central banking. Use of macroeconomic theories.

International Economics **[8 Hrs]**

Balance of Trade and Balance of Payments, Barriers to Trade, Benefits of Trade/Comparative Advantage, Foreign Currency Markets/Exchange Rates, Monetary, Fiscal and Exchange rate policies, Economic Development. Application of exchange rate policies

Reference Books:

[1]	N. Gregory Mankiw, Macroeconomics: 12th Edition, 2023.
[2]	Paul Keat and Philip Young, Managerial Economics: Economic Tools for Today's Decision Makers: 10th Edition, 2020.
[3]	Misra and Puri, Principles of Macro Economics: 12th Edition, 2021, Himalaya Publishing House, New Delhi.
[4]	A. Koutsoyiannis, Modern Microeconomics: 2nd Edition, 2003, Macmillan, London.
[5]	Robert S. Pindyck and Daniel L. Rubinfeld, Microeconomics: 9th Edition, 2017, Pearson Education, New Delhi.
[6]	K. N. Verma, Micro Economics: 3rd Edition, 2019.

Semester - IV

FLUID MECHANICS

Course Code	ME-24006		**Examination Scheme**			
Teaching Scheme	3-0-2-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	4		**Laboratory**	ISE: 50	ESE: 50	--

Course Outcomes: Students will be able to:

1. Understand and apply the basic concepts of Fluid Mechanics for solving problems involving fluid properties: Static and kinematic.
2. Derive and apply the governing equations of Fluid Dynamics.
3. Apply energy equations for various Fluid systems and measuring devices.
4. Apply and understand various dimensionless numbers for problems in fluid
5. mechanics.

Basics with fluid statics: **[6 Hrs]**

Definition of fluid, fluid properties such as viscosity, vapor pressure, compressibility, surface tension, capillarity, Mach number etc., pressure at a point in the static mass of fluid, variation of pressure, Pascal's law, pressure measurement by simple and differential manometers using manometric expression. Introduction to Hydrostatic forces and Centre of pressure, Buoyancy, Centre of buoyancy, stability of floating bodies, metacenter and metacentric height and its application in shipping.

Fluid Kinematics: **[4 Hrs]**

Velocity of fluid particle, types of fluid flow, description of flow, acceleration of fluid particle, rotational & irrotational flow, path line, streamline and streak line, Laplace's equation in velocity potential and Poisson's equation in stream function, flow net, Vorticity and Circulation.

Governing equations in Fluid Dynamics **[6 Hrs]**

Continuity equation (Cartesian, polar and cylindrical coordinates). Derivation of Momentum equations using differential approach, Reynolds transport theorem, Integration of Euler's equation to obtain Bernoulli's equation, Bernoulli's theorem, Application of Bernoulli's theorem such as Venturi meter, Orifice meter, pitot tube (static, dynamic and stagnation pressure) and orifices etc. Introduction to Navier Stokes Equation.

Laminar flow and Introduction to Boundary layer **[6 Hrs]**

Laminar flow: Hagen-Poiseuille equation, flow through parallel plates, Couette flow.
Introduction to boundary layer:
Thickness, over a plate, Equations of boundary layer, Laminar
and turbulent boundary layer, introduction to flow separation of layer, and methods for control.
Introduction to External flow: Drag, lift, Drag on cylinder, Development of lift in Cylinder

Turbulent flow: **[6 Hrs]**

Introduction to RANS (Models). Development in pipes, Velocity distribution in pipes, hydrodynamic smooth and rough pipe. Introduction to compressible flow.

Flow through pipes: **[8 Hrs]**

Reynolds's experiment, frictional loss in pipe flow, major and minor losses, HGL and TEL, flow through series and parallel pipes, Equivalent Pipe, Loss of head due to friction in a pipe with side tapping's, siphon, Power Transmission, Pipe networks.
Dimensional homogeneity, Rayleigh's method, Buckingham's theorem. Similitude and Model analysis: similarity laws and dimensionless numbers.

Textbooks:

[1]	Hydraulics and Fluid Mechanics including Hydraulic Machines, Dr. P. N. Modi and Dr. S. M. Seth, Standard Book House S. Ramamurtham, "Strength of materials", Dhanpatrai Publication.
[2]	Textbook of Fluid Mechanics and Hydraulic Machine, Dr. R. K.Bansal, Laxmi Publications, New Delhi S K Sarkar, "Strength of materials", McGraw Hill New Delhi.
[3]	Fluid Mechanics – Fundamentals and application. YunusCengel and John Cimbala.
[4]	Introduction to Fluid Mechanics and Fluid Machines. S. K.Som, GautamBiswas and Suman Charaborty. Mc-Graw Hill Publication.

Reference Books:

[1]	Introduction to Fluid Mechanics, Fox R W, Pritchard P J, A T Mc Donald. John Wiley and Sons Publication G H Ryder, "Strength of materials", McMillan Publication
[2]	Fluid Mechanics, Frank M. White. McGraw Hill Publications
[3]	Engineering Fluid Mechanics, Prof K L Kumar, Chand Publication
[4]	Fluid Mechanics, P. K. Kundu, I. M. Kohen and David Dowling Fifth Edition Elsevier Publication
List of Experiments	
[1]	Measurement of viscosity using Red Wood viscometer/Falling sphere viscometer.
[2]	Study and demonstration of pressure measurement using manometers.
[3]	Determination of the metacentric height of a floating body and its stability.
[4]	Verification of Bernoulli's Principle and Total energy.
[5]	Calibration Venturi meter for flow measurement
[6]	Calibration Orifice meter for flow measurement
[7]	Demonstration of Pitot tube for velocity measurement
[8]	Demonstration and flow visualization of laminar and turbulent flow using Reynolds apparatus.
[9]	Determination of the frictional losses and friction factor in pipes.
[10]	Determination of pressure variation around a circular body/surface when it is submerged in a flow.
[11]	Small application-oriented assignment based on concepts in fluid mechanics.
[12]	Flow through pipe using CFD software

DESIGN OF MACHINE ELEMENTS

Course Code	ME-24007		**Examination Scheme**			
Teaching Scheme	2-1-0-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	3		**Laboratory**	ISE: --	ESE: --	--

Course Outcomes: Students will be able to:

1. Apply fundamentals of machine design to identify the type of design to formulate the design problem statement and apply the design procedure.
2. Evaluate the different types of modes of failures/stresses induced in a component due to different types of static loading conditions and design the elements/simple joints like cotter or knuckle joint against the most critical mode of failure.
3. Apply the shaft design codes to design various shafts, design of keys and couplings, springs like, helical compression, helical torsion and leaf spring.
4. Design various types of bolted joints and power screws and welded joints subjected to static loads and bending moments.

Fundamental aspects of design: **[6 Hrs]**

The meaning of design, engineering design, phases of design, design considerations, stress and strain considerations, factor of safety, standardization, preferred series.

Design against static load: **[6 Hrs]**

Modes of failure, Critical mode of failure, stresses due to bending and torsional load, eccentric loading, Design for biaxial loading through theories of failure, design of cotter and knuckle joints.

Design of shafts, keys, and couplings: **[6 Hrs]**

Shaft, Types of Shafts, Shaft subjected to bending and torsion, Shaft design on strength basis and rigidity deflection basis, A.S.M.E code for shaft design, types of keys and their design, design of rigid and flexible couplings.

Design of threaded Joints and Power screws: **[6 Hrs]**

Threaded Joints, I.S.O Metric screw threads profile, Coarse and fine threads, designation of metric threads, Bolts of uniform strength, Design of bolted and threaded joints, eccentrically loaded bolted joints, Design of power screws.

Design of welded joints: **[6 Hrs]**

Types of welded joints, stresses in welded joints, strength of welded joints, eccentrically loaded welded joints, and welded joints subjected to bending moment.

Design of Mechanical Springs **[6 Hrs]**

Mechanical Spring, Types of springs, Terminology of helical spring, Design of mechanical springs, helical torsion spring, design of multi leaf spring, nipping and shot peening of spring.

Textbooks:

[1]	Shigley I.E. and Mischke C.R., “Mechanical Engineering Design”, McGraw Hill Education (India) Ltd.
[2]	Bhandari V.B., “Design of Machine Elements”, McGraw Hill Education (India) Ltd.
[3]	Khurmi and Gupta, “A textbook of Machine Design” S Chand Publication.

Reference Books:

[1]	Spotts M. F., "Design of Machine Elements", Prentice Hall International.
[2]	Black P.H. and Eugene Adams, "Machine Design", McGraw Hill Book Co. ltd.
[3]	P.S.G. College of Technology, "Design Data, Coimbatore.
[4]	Hall A.S., Holowenko A.R. and Laughlin H.,"Theory and Practice of Machine Design", Schaumis outline series, McGraw Hill Publication

KINEMATICS OF MACHINES

Course Code	ME-24008		**Examination Scheme**			
Teaching Scheme	3-0-2-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	4		**Laboratory**	ISE: 50	ESE: 50	--

Course Outcomes: Students will be able to:

1. Understand the concepts of motion transmission.
2. Determine the displacement, velocity, acceleration of points in given mechanisms analytically and graphically.
3. Calculate the torque and power transmitted by different types of gears.
4. Determine and illustrate the motion, acceleration of different types of cams and followers and illustrate the various types of governors.

Fundamentals of kinematics: **[8 Hrs]**

Kinematic link, Kinematic pair, Types of constrained motions, Types of Kinematic pairs, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom (Mobility), Kutzbach criterion, Grubler's criterion, Grashoff's law for four bar kinematic chain. Inversions of Four bar chain, Slider crank chain and Double slider crank chain, Hooke's joint, Introduction to Compliant mechanism.

Velocity and acceleration analysis: **[10 Hrs]**

Graphical methods - Relative velocity and acceleration methods, Corioli's component of acceleration, instantaneous centre of Rotation method,

Kinetics of slider crank mechanism: **[8 Hrs]**

Static and dynamic force analysis of slider crank mechanism, dynamically equivalent system, correction couple, Klein's construction, graphical and analytical method for determination of torque on crankshaft for IC engine.

Kinematics of Gears **[8 Hrs]**

Classification of gears, Types of gears, Spur gears - terminology, fundamental law of toothed gearing, involute and cycloidal profile, conjugate action, contact ratio, minimum number of teeth, interference and under cutting. Helical gears: Nomenclatures, center distance, force analysis.

Kinematics of cams and followers and governors **[8 Hrs]**

Types of cams and followers, types of follower motion, velocity and acceleration diagrams, profile of cam cams for various follower motions. Governor of different types, Sleeve displacement and speed relation of the governor.

Textbooks:

[1]	John Hannah and Stephens, R. C., "Mechanics of Machines: Advanced Theory and Examples", 1970, Hodder; Student international edition ISBN 0713132329 Edward Arnold London
[2]	Ballaney, P., "Theory if Machines and Mechanisms", 2005, ISBN 9788174091222 Khanna Publications
[3]	S S Ratan, "Theory of Machines", Fifth edition, Tata McGraw Hill Publication Co. Ltd.
[4]	Bansal, R. K., "Theory of machines", Laxmi Publications Pvt. Ltd, New Delhi

Reference Books:

[1]	Bevan Thomas, "The Theory of Machines", 3rd edition, CBS publishing
[2]	Uicker Jr, J. J., Penock G. R. and Shigley, J. E., "Theory oif Machines and Mechanisms' 2003, Tata McGraw Hill
[3]	Ramamurthy, V., "Mechanisms of Machines", 3rd edition, ISBN 978-1842654569, Narosa Publishing House

List of Experiments

[1]	Determination of moment of inertia of rigid bodies by bifilar/trifilar suspension methods.
[2]	Compound pendulum.
[3]	Experimental verification of displacement relation for different shaft angles for single Hooke's joint.
[4]	To generate gear tooth profile and to study the effect of under cutting and rack shift using model.

[5]	To determine the characteristics curve of any two types of centrifugal governor and to find its coefficient of in-sensitiveness and stability.
[6]	Analytical determination of inertia forces in engine mechanisms.
[7]	Problem on Hooke's joint.
[8]	Graphical solution to problems on velocity acceleration in mechanism by relative velocity and acceleration method including problem with Corioli's component of acceleration.
[9]	Velocity by instantaneous centre method.
[10]	Klein's construction and inertia force analysis for slider cranks mechanisms.
[11]	To draw cam profile for various types of followers' motion.
[12]	Kinematics study of mechanism using CAD software

NUMERICAL METHODS AND PROGRAMMING LANGUAGE

Course Code	ME-24009		**Examination Scheme**			
Teaching Scheme	1-0-2-1		**Theory**	CIE: 100		
Credits	2		**Laboratory**	ISE: 50	ESE: 50	--

Course Outcomes: Students will be able to:

1. Use numerical methods in modern scientific computing.
2. Determine numerical solutions of nonlinear equations in a single variable.
3. Use numerical interpolation and obtain numerical solution to engineering problems using programming.
4. Estimate solution to problems using numerical integration and differentiation.

Numerical methods I: **[6 Hrs]**

Introduction to Numerical Methods: Difference between analytical and numerical approaches.
Error Approximations: Types of Errors: Absolute, Relative, Algorithmic, Truncation, Round-off Error, Error Propagation, Concept of convergence and relevance to numerical methods.
Roots of Equations: Bracketing and Open Methods.
Simultaneous Equations: Gauss-Elimination (with partial pivoting), Gauss-Seidel, Gauss-Jordan, Gauss-Jacobi, Thomas algorithm for Tri-diagonal Matrix.

Numerical methods II: **[6 Hrs]**

Numerical Integration: Trapezoidal rule, Simpson's 1/3rd Rule, Simpson's 3/8th Rule, Gauss Quadrature (2-point and 3-point method).
Double Integration: Using Trapezoidal rule and Simpson's 1/3rd Rule.
Ordinary Differential Equations (ODE): Taylor series method, Euler Method, Runge-Kutta fourth order, Simultaneous equations using Runge-Kutta second-order method.
Partial Differential Equations (PDE): Finite Difference Methods - Introduction to finite difference method, Simple Laplace method, Parabolic explicit solution, Elliptic explicit solution.,

Curve fitting and Regression analysis: **[6 Hrs]**

Interpolation: Approximation by Forward, Backward, Central, and Divided Difference Formulae, Interpolation using Newton's Formulae, Lagrange's Method, Spline Interpolation, Hermite and Stirling Formulae.
Curve Fitting: Least Square Technique (Straight line, Power equation, Exponential equation, Quadratic equation).
Regression using Machine Learning Algorithms: Linear Regression, Logistic Regression, Polynomial Regression, Support Vector Regression, Regression Trees (Decision tree, Random Forest), Ridge Regression, Lasso Regression.
Clustering and Neural Networks: K-Means, K-Nearest Neighbor (KNN), Artificial Neural Networks.

Textbooks:

[1]	Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, 7th Edition, McGraw-Hill Education, 2015.
[2]	Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, 4th Edition, McGraw-Hill Education, 2018.
[3]	S. S. Sastry, Introductory Methods of Numerical Analysis, 5th Edition, PHI Learning, 2012.
[4]	Rajaraman, Computer Oriented Numerical Methods, Revised Edition, PHI Learning.
[5]	T. Veerarajan, T. Ramachandran, Theory and Problems in Numerical Methods, Revised Edition, McGraw-Hill Education.

Reference Books:

[1]	William H. Press, Saul A. Tenkolsky, William T. Vetterling, Brian P. Flannery, *Numerical Recipes: The Art of Scientific Computing*, 3rd Edition, Cambridge University Press, 2007.
[2]	Aurélien Géron, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems*, 2nd Edition, O'Reilly Media, 2019.
[3]	Alex Smola, S.V.N. Vishwanathan, *Introduction to Machine Learning*, 2nd Edition, Cambridge University Press, 2020.

[4]	Rudolph Russell, *Machine Learning: Step-by-Step Guide to Implement Machine Learning Algorithms with Python*, Open-source publication.
[5]	E. Balagurusamy, *Numerical Methods*, 2nd Edition, McGraw-Hill Education, 2020.

Indian Language: Sanskrit						
Course Code	*<tbd>*		**Examination Scheme**			
Teaching Scheme	2-0-0-0		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	2		**Laboratory**	CIE: --	ESE: --	--

Course Outcomes: Students will be able to:

1. Familiarize themselves with the basic grammatical categories of Sanskrit.
2. Form simple sentences in Sanskrit.
3. Understand and extract the meaning of the prescribed Sanskrit scientific texts.
4. Co-relates the significance of scientific literature with modern knowledge.

Unit 1	**[7 Hrs]**

Introduction to the Sanskrit phonology, Sandhi- Guṇa, Vṛddhi, Yaṇ, Savarṇadīrgha, Introduction to persons, numbers and the present tense. Introduction to Kāraka and Vibhaktis- 1. Prathamā - Dvitīyā 2. Tṛ tīyā - Caturthī

Unit 2	**[7 Hrs]**

Introduction to the past tense and the imperative and potential moods Introduction to Kāraka and Vibhaktis- 1. Pañcamī 2. Śaṣṭhī 3. Saptamī Introduction to Samāsa

Unit 3	**[7 Hrs]**

Janapadaniveśa - Kauṭilīya Arthaśāstra + Rasaratnasamuccaya

Unit 4	**[7 Hrs]**

Chapter 1 of the Līlāvatī (up to square roots)

Reference Books:

[1]	V. S. Apte, The student’s Sanskrit to English dictionary, 2015. Motilal Banarasidass.
[2]	A. Macdonell, A Sanskrit English dictionary, 1893, Oxford press.
[3]	V. S. Apte, The student’s English to Sanskrit dictionary, 2014. Motilal Banarasidass
[4]	Samskṛ t- Śabdadhātu- Rūpāvali, Navneet publications.
[5]	R. D. Desai, Sanskrit pravesha, 2017, Continental prakashan.
[6]	Madhav Deshpande, Samskṛ tsubodhinī, 2007, University of Michigan. Hrs. 7 7 7 7
[7]	Shankar Lal Hari Shankar, RasaRatnaSamucchaya of Vagbhatacharya, 2019, Khemraj Shrikrushnadas Prakashan.
[8]	Web Sanskrit Dictionary based on ``The Practical Sanskrit-English Dictionary'' by Vaman Shivaram Apte. - http://www.aa.tufs.ac.jp/~tjun/sktdic/
[9]	Colebrook, English translation of the Līlāvatī, (with notes by Banerjee), 1893, Thacker spink and co.
[10]	Līlāvatī, Khemraj Shrikrushnadas, 1908, Shri Venkateshvar steam press Mumbai.
[11]	R. Shamasastry, Kautilya's Arthashastra, 1915, Bangalore: Government Press.
[12]	R. Shamasastry, editor: Ashok Kumar Shukla - with Sanskrit Text, Kautilya's Arthashastra, 1915, Bangalore: Government Press

Indian Language: Pali						
Course Code	*<tbd>*		**Examination Scheme**			
Teaching Scheme	2-0-0-0		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	2		**Laboratory**	CIE: --	ESE: --	--

Course Outcomes: Students will be able to:

1. Students will become acquainted with some literary specimens of Pali literature in prose and poetry.
2. Through this literature they will learn ancient Indian moral, humanitarian and scientific values.
3. They will develop an interest in the Pali language and literature.
4. They will learn to appreciate the Indian literary heritage.

Introduction to Pali:	**[7 Hrs]**
What is Pali? Its origin and homeland; Pali Literature: Early Phase, Commentarial Phase and Post commentarial Phase	
Introduction to Grammar:	**[7 Hrs]**
Alphabets, Pronunciation, Phonetic variation; Noun, Verb and Sentence formation	
Selected Prose:	**[7 Hrs]**
Nakkhattajātaka, Vīmaṃsakasutta, Kālāmasutta, Vitakkasaṇṭhānasutta	
Selected Poetry:	**7 Hrs**
Selected portion from Dhammapada, Puṇṇikātherī, Kumbhajātaka with pronunciation and recitation	

Reference Books:

[1]	B. Mahadevan, Bhat Vinayak and Nagendra Pavan R.N., 'Introduction to Indian Knowledge Systems: Concepts and Applications'
[2]	Dharmapal 'Indian Science and Technology'
[3]	Kapil Kapoor, Singh Avdhesh Kumar, 'Indian Knowledge Systems'
[4]	Chattopadhyaya, Debiprasad, History of science and technology in ancient India: the beginnings, Firma KLM Pvt. Ltd. 1986.
[5]	Irfan Habib (ed.), People's History of India – Vol 20: Technology in Medieval India, c. 650–1750, Aligarh Historians Society and Tulika Books, 2016.
[6]	Jan Gonda, A History of Indian Literature, Otto Harrassowitz, Wiesbaden, 1975.
[7]	L. Gopal and V. C. Shrivastava, History of Agriculture in India (Upto 1200 A. D.), Concept Publishing, New Delhi, 2008.
[8]	Pushkar Sohoni, Introduction to the History of Architecture in India, IISER, Pune, 2020.
[9]	Surendranath Dasgupta, A History of Indian Philosophy, Cambridge University press, 1922.
[10]	Radhavallabh Tripathi, Vāda in theory and practice: studies in debates, dialogues and discussions in Indian intellectual discourses, IIAS, Shimla, 2016.
[11]	Thanu Padmanabhan (ed.), Astronomy in India: A Historical Perspective, Indian National Science Academy, Springer, New Delhi. 2014.

PRINCIPLES OF ENTREPRENEURSHIP						
Course Code	HS-24001		**Examination Scheme**			
Teaching Scheme	1-0-0-0		**Theory**	CIE:100		
Credits	1		**Laboratory**	CIE: --	ESE: --	--

Course Outcomes: Students will be able to:

1. To enable the students to understand the concept of Entrepreneurship and to learn the professional behavior expected of an entrepreneur.
2. To identify significant changes and trends which create business opportunities and to analyze the environment for potential business opportunities.
3. To provide conceptual exposure on converting idea to a successful entrepreneurial firm.

Entrepreneurship: **[3 Hrs]**

Meaning of entrepreneurship – Types of Entrepreneurships – Traits of entrepreneurship – Factors promoting entrepreneurship- Barriers to entrepreneurship- the entrepreneurial culture- Stages in entrepreneurial process – Women entrepreneurship and economic development- SHG.

Developing Successful Business Ideas **[3 Hrs]**

Recognizing opportunities – trend analysis – generating ideas – Brainstorming, Focus Groups, Surveys, Customer advisory boards, Day in the life research – Encouraging focal point for ideas and creativity at a firm level-Protecting ideas from being lost or stolen – Patents and IPR.

Opportunity Identification and Evaluation **[3 Hrs]**

Opportunity identification and product/service selection – Generation and screening the project ideas – Market analysis, technical analysis, Cost benefit analysis and network analysis- Project formulation – Assessment of project feasibility- Dealing with basic and initial problems of setting up of Enterprises.

Business Planning Process **3 Hrs**

Business Planning Process Meaning of business plan- Business plan process- Advantages of business planning preparing a model project report for starting a new venture (Team-based project work)

Funding Sources of Finance **3 Hrs**

Funding Sources of Finance- Venture capital- Venture capital process- Business angles Commercial banks- Government Grants and Schemes.

Textbooks:

[1]	Reddy, Entrepreneurship: Text & Cases - Cengage, New Delhi.
[2]	Kuratko/rao, Entrepreneurship: a south asian perpective.- Cengage, New Delhi.
[3]	Leach/Melicher, Entrepreneurial Finance – Cengage., New Delhi.
[4]	K.Sundar – Entrepreneurship Development – Vijay Nicole Imprints private Limited
[5]	Khanka S.S., Entrepreneurial Development, S.Chand & Co. Ltd., New Delhi, 2001.
[6]	Sangeeta Sharma, Entrepreneurship Development, PHI Learning Pvt. Ltd., 2016.

Reference Books:

[1]	Barringer, B., Entrepreneurship: Successfully Launching New Ventures, 3rd Edition, Pearson, 2011.
[2]	Bessant, J., and Tidd, J., Innovation and Entrepreneurship, 2nd Edition, John Wiley &Sons, 2011.
[3]	Desai, V., Small Scale Industries and Entrepreneurship, Himalaya Publishing House, 2011.
[4]	Donald, F.K., Entrepreneurship- Theory, Process and Practice, 9th Edition, Cengage Learning, 2014.

Constitution of India & Universal Human Values						
Course Code	<tbd>		**Examination Scheme**			
Teaching Scheme	1-0-0-0		**Theory**	CIE:100		
Credits	1		**Laboratory**	CIE: --	ESE: --	--

Course Outcomes: Students will be able to:

1. Understand the basis of Law, the concept 'Constitution' and the interpretation of the Preamble.
2. Define the basis of governance of the nation and the fundamental rights. Illustrate the functioning of the Union and the State Executive.
3. Outlines the aspects that allow the use of rights to fulfill one's duties as a responsible citizen.
4. Analyze the moral and ethical character needed for a professional engineer.

Unit 1	**[3 Hrs]**

Introduction to The Constitution of India, understanding its objects. Preamble to the constitution of India. Understanding the concept 'Rule of Law', Human Rights and Fundamental Rights.

Unit 2	**[3 Hrs]**

Fundamental rights under Part-III, Exercise of the Rights, limitations, and important cases. Fundamental duties & their significance. Relevance of Directive principles of State Policy.

Unit 3	**[3 Hrs]**

Legislative, Executive & Judiciary (Union and State Level) Prerogative Writs. Electoral procedure in India

Unit 4	**3 Hrs**

Constitutional Provisions for Scheduled Castes, Scheduled Tribes, & Backward classes. Constitutional Provisions for Women & Children; Emergency Provisions. Amendment procedure and few important Constitutional Amendments

Unit 4	**3 Hrs**

Relationship between Law and Ethics, Professional Ethics for Engineers Universal Human Values

Resource Books:

[1]	Introduction to the Constitution of India by Durga Das Basu (Students Edn.) Prentice – Hall EEE, 19th/20th Edn.
[2]	Suresh, J. & Raghavan, B.S. (2016). Human Values and Professional Ethics. S. Chand & Company Pvt. Ltd. New Delhi.
[3]	Engineering Ethics by Charles E.Haries, Michael. S.Pritchard and Michael J.Robins Thompson Asia,
[4]	An Introduction to Constitution of India by M.V. Pylee, Vikas Publishing. Gogate, S. B. (2011). Human Values & Professional Ethics. Vikas Publishing House Pvt. Ltd. New Delhi.