HIMACHAL PRADESH TECHNICAL UNIVERSITY
HAMIRPUR

Syllabus

for

B.Tech ME

(3rd to 8th Semester)

As per National Education Policy (NEP-2020)

(w.e.f. the Academic Year 2024-2025)

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Semester-III

Sr. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	HS	IKS-311	Indian Knowledge System	2	0	0		2	40	60	100
2	PC	MEPC-311	Engineering Mechanics	3	1	0		4	40	60	100
3	PC	MEPC-312	Engineering Thermodynamics	3	0	0		3	40	60	100
4	PC	MEPC-313	Fluid Mechanics	3	1	0		4	40	60	100
5	PC	MEPC-314	Manufacturing Technology	3	0	0		3	40	60	100
6	PC	MEPC-315	Mechanical Measurement	3	0	0		3	40	60	100
Labs:										
1	PC	MEPC-313P	Fluid Mechanics Lab	0	0	2		1	30	20	50
2	PC	MEPC-314P	Manufacturing Practice Lab	0	0	2		1	30	20	50
3	PC	MEPC-315P	Mechanical Measurement Lab	0	0	2		1	30	20	50
Total				**17**	**2**	**6**		**22**			**750**

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Semester - III

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IKS-311 Indian Knowledge System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Exam	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions for question paper setter:
Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E will have short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Objectives:

- *To equip the students with the knowledge and understanding related to Indian knowledge systems, origin, evolution and the approaches used in ancient and modern times.*
- *To promote the youths to do research in the various fields of Bhāratīya knowledge system.*

Unit-I:
Bhāratīya Civilization and Development of Knowledge System: Genesis of the Bharatbhumi and Civilization, Discovery of the Saraswatī River, The Saraswatī-Sindhu Civilization, Traditional Knowledge System, The Ancient Education System, Brief Introduction of the Takṣaśilā University, The Nālandā University, Knowledge Export from Bharata.
Unit-II:
Art, Literature and Scholars: Natraja- A Masterpiece of Bhartiya Art, Introduction to Vedas and Vedic Literature, Life and Works of Agastya,Vālmīki, Patañjali, Vedvyāsa, Loapmudra, Maitreyi, Gārgī, Caraka, Suśruta, Kaṇāda, Kauṭīlya, Pāṇini, Āryabhaṭa, Varahmihira, Bhāskarācārya.
Unit-III:
Engineering Science and Technology: Engineering, Science and Technology in the Vedic Age, Post-Vedic Period, History of Mathematics in Bharata, Concepts of Zero, History and Culture of Astronomy in India, Kerala School of Astronomy and Mathematics.
Unit-IV:
Cultural Heritage and Indian Traditional Practices: Temple Architecture in Ancient India, Fairs and Festivals, Yoga, Āyurveda, Integrated Approach to Healthcare, Agriculture in Ancient India, Approaches and Strategies to the Protection and Conservation of Environment.

Course Outcomes (COs): After the completion of the course, the student will be able to:

1. Understand and appreciate the rich heritage that resides in our traditions.
2. Improve mindfulness and more maturity leading to effective process of learning.

Text Books:

- Bhag Chand Chauhan, IKS: The Knowledge of Bharata, Garuda Prakashan, 2023.
- Pradeep Kohle et al. Pride of India- A Glimpse of India's Scientific Heritage edited by Sanskrit Bharati, 2006.
- Suresh Soni, India's Glorious Scientific Tradition, Ocean Books Pvt. Ltd., 2010.
- Sibaji Raha, et al., History of Science in India Volume-1, Part-I, Part-II, Volume VIII, National Academy of Sciences, India and The Ramkrishna Mission Institute of Culture, Kolkata, 2014.

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MEPC-311 Engineering Mechanics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Exam	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions for question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E will have short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Unit-I:

Introduction to Engineering Mechanics: Basic concepts, Laws of motion, Principle of transmissibility of forces; Resultants of force system: Parallelogram law, Forces and components, Resultant of coplanar concurrent forces, Components of forces in space; Moment of force - Principal of moment, Coplanar applications, Couple, Resultant of any force system.

Equilibrium of Rigid Bodies: Free body diagram, Types of supports, Equations of equilibrium, Stable equilibrium, Moments and couples, Moment of a force about a point and about an axis, Equilibrium of planer and spatial rigid body systems.

Unit-II:

Friction: Introduction, Theory of friction, Angle of friction, Laws of friction, Static and dynamic friction, Motion of bodies: Angle of repose, Angle of friction, Cone of friction, Motion on inclined rough surface, Lifting machines: Wedge, Screw, Screw-Jack, and Differential screw jack.

Centroid and Moment of Inertia: Centroid of plane, curve, area, volume and composite bodies, Moment of inertia of plane area, Parallel axes theorem, Perpendicular axes theorems, Principal moment inertia, Mass moment of inertia of circular ring, Disc, Cylinder, Sphere and Cone about their axis of symmetry.

Unit-III:

Structural Analysis: Plane truss, Space truss, Difference between truss and frame, Types of trusses, Analysis of plane truss – Method of sections, Method of joints, Graphical method.

Beams: Types of beams, Statically determinate beams, Shear force and Bending Moment in beams, Shear Force and Bending Moment diagram, Relationship between Shear force and Bending Moment.

Unit-IV:

Kinematics of Rigid body: Introduction, Plane Motion of Rigid Body - Rectilinear and curvilinear translation, fixed axis rotation and general plane motion; Relative Velocity; Problems.

Kinetics of Rigid Body: Introduction, Force, Mass and Acceleration, Equations of motion, Work and Energy, Impulse and Momentum, D' Alembert's Principles and Dynamic Equilibrium; Problems.

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Course Outcomes (COs): After the completion of the course, the student will be able to:

1. Remember and understand the basic laws of engineering mechanics to effectively solve engineering problems.
2. Understand and apply the concepts of friction forces, the working of lifting machines, the centre of gravity, and the moment of inertia.
3. Apply the principles of mechanics to draw shear force and bending moment diagrams for various structural elements.
4. Analyze truss structures to determine internal forces and ensure structural integrity.
5. Evaluate the motion of rigid bodies using kinematic principles.
6. Create solutions by formulating the concepts of kinetics as they apply to bodies in motion.

Text Books:

- K.L. Kumar, "Engineering Mechanics", Tata McGraw Hill.
- Timoshenko &Young, "Engineering Mechanics", 4th ed, Tata McGraw Hill.

Reference Books:

- Shames and Rao, "Engineering Mechanics: Statics and Dynamics", Pearson.
- Beer & Johnston, "Vector Mechanics for Engineers", Tata Mc Graw Hill.
- Meriam, "Statics and Dynamics", John Wiley & Sons.
- R.C Hibbler, "Statics and Dynamics", Pearson.

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MEPC-312 Engineering Thermodynamics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Exam	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions for question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E will have short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory questionfrom section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus. Use of steam table and Moiller chart is allowed during the examinations.

Unit-I:
Fundamental Concepts: Macroscopic and microscopic viewpoints, Systems and control volumes, Properties of system, Continuum, State and equilibrium, Processes and cycles, Temperature and Zeroth law of thermodynamics, Heat and thermodynamics, Concept of work. **First Law of Thermodynamics:** Statement, Heat and work calculations, Application of first law to non-flow and flow systems, Steady flow energy equation as applied to- boiler, condenser, throttle, nozzle, turbine, and compressor, PMM1.
Unit-II:
Second Law of Thermodynamics: Thermal energy reservoirs, Heat engine, Refrigerator, Heat pump, Statements and their equivalence, PMM2, Carnot cycle and Principles, Thermodynamic temperature scale. **Entropy:** Clausius inequality, Entropy, Principle of entropy increase, First and second law combined, Entropy changes for perfect gas during reversible processes, Available and unavailable energy.
Unit-III:
Property Relations: Maxwell relations, Clausius-Clapeyron equation, Volume expansivity and isothermal compressibility, Mayer relation, Joule-Thomson coefficient. **Properties of Steam:** Phase transformation, Dryness fraction, Property diagrams, Steam tables, Mollier chart, First law applied to steam processes.
Unit-IV:
Power Cycles: Ideal Rankine cycle, Otto, Diesel, Dual cycles, Thermal efficiency, Mean effective pressures of air standard basis, Comparison of cycles.

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Course Outcomes (COs): After the completion of the course, the student will be able to:

1. Demonstrate understanding of basic concepts of thermodynamics.
2. Differentiate between quality and quantity of energy, heat and work, enthalpy and entropy etc.
3. Indicate the importance of phase change diagrams of pure substance.
4. Analyze the performance of vapour power cycle.
5. Evaluate the performance of air standard cycles.
6. Apply the laws of thermodynamics to various real life systems.

Text Books:

- PK. Nag, "*Engineering Thermodynamics*", TMH.
- Yunus A. Cengel and Michael A. Boles, "*Thermodynamics: An Engineering Approach*", TMH.

Reference Books:

- Van Wylen, Sonntag, "*Engineering Thermodynamics*", John Wiley.
- Mahesh M. Rathore, "*Thermal Engineering*", TMH.
- Michael J. Moran & Howard N. Shapiro, "*Fundamentals of Engineering Thermodynamics*", John Wiley & Sons.
- Merle C. Potter and Craig W. Somerton, "*Schaum's Outline of Thermodynamics for Engineers*", TMH.

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MEPC-313 Fluid Mechanics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Exam	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions for question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E will have short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Unit-I:

Introduction: Definition of fluid, Newton's law of viscosity, Units and dimensions, Physical properties of fluids, Control volume, Continuity equation and momentum equation, Incompressible flow, Bernoulli's equation and its applications.

Fluid Statics: Definition of body and surface forces, Pascal's law, Basic hydrostatic equation, Forces on surfaces due to hydrostatic pressure, Buoyancy and Archimedes principle, Meta center, Stability of floating and submerged bodies and manometers.

Unit-II:

Fluid Kinematics: Different approaches, Reynolds transport theorem, Flow visualization, Types of flow, Strain rate, stream line, streak line, path lines and stream tubes, Continuity equation in Cartesian coordinates in 3D forms, Velocity and acceleration of fluid particles, Velocity potential function and stream function.

Fluid Dynamics: Momentum equation, Navier Stoke equation, Development of Euler's equation, Bernoulli's equation and application, Steady and unsteady flow through orifice, Orifice placed in pipe, Venturimeter, Flow over triangular and rectangular notches, Pitot tube.

Unit-III:

Laminar Flow: Viscous/Laminar flow – Plane Poiseuille flow and Coutte flow, Laminar flow through circular pipes, Loss of head and power absorbed in viscous flow.

Turbulent Flow: Reynolds experiment, Frictional losses in pipe flow, Shear stress in turbulent flow, Major and minor losses (Darcy's and Chezy's equation), Flow through siphon pipes, Branching pipes and equivalent pipe.

Unit-IV:

Boundary Layer Flows: Concept of boundary layer and definition of boundary layer thickness, Displacement, momentum and energy thickness, Laminar and turbulent boundary layers, Laminar sub layer, Von Karman Momentum Integral equation for boundary layers, Analysis of laminar and turbulent boundary layers, Drag, Boundary layer separation and methods to control it, Streamlined and bluff bodies.

Dimensional Analysis: Buckingham's Pi theorem, Non – dimensional numbers and their application, Similitude, Scale effects.

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Course Outcomes (COs): After the completion of the course, the student will be able to:

1. Apply basic laws and properties associated with the fluid.
2. Apply the equations of fluid statics to evaluate forces acting on different sections submerged in water.
3. Interpret the various flow and function types utilised in fluid kinematics.
4. Illustrate the principles used in fluid dynamics in various situation of fluid flow.
5. Understand the concept of boundary layer and analyse its effect in laminar and turbulent flow.
6. Evaluate the dimensional analysis to predict physical parameters that influence the flow in fluid mechanics.

Text Books:

- S.K. Som, *"Introduction to Fluid Mechanics and Machines"*, TMH.
- P.N. Modi, and S.M. Seth, *"Hydraulics and Fluid Mechanics including Hydraulic Machines"*, Standard Book House, Naisarak, Delhi.

Reference Books:

- F.M. White, *"Fluid Mechanics"*, TMH.
- Cengel and Cimbala, *"Fluid Mechanics"*, TMH.
- D.S.Kumar, *"Fluid Mechanics and Fluid Power Engineering"*, S.K. Kataria and Sons.
- Irving Shames, *"Mechanics of Fluids"*.

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MEPC-314 Manufacturing Technology							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Exam	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions for question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E will have short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Unit-I:

Introduction: Manufacturing and manufacturing processes, Classification of manufacturing processes **Metal Casting Processes:** Introduction, Basic steps in casting processes, Advantages and Limitations, Sand mold making procedure, Patterns and Cores. Pattern materials, Pattern allowances, Types of pattern, Colour coding, Moulding material, Moulding sand composition, and preparation, Sand properties and testing type of sand moulds. Types of cores, core prints, chaplets, chills. Gating systems and Casting Defects, Gates and gating systems, Risers, Melting practice, Cupola, Charge calculations.

Casting Cleaning and Casting Defects: Fettling, Defects in castings and their remedies, Methods of testing of castings for their soundness. **Special Casting Processes:** Shell molding, Precision investment casting, Permanent mold casting, Die casting, Centrifugal casting, and Continuous casting.

Unit-II:

Metal Forming Processes: Introduction to forming, Nature of plastic deformation, Hot working and cold working. Principles of rolling, Roll passes, Roll pass sequences. **Forging:** Forging operations, Smith forging, Drop forging, Press forging, Forging defects.

Extrusion and Other Processes: Extrusion principle, Hot extrusion, Cold extrusion, Wire drawing, Swaging, Tube making, **Sheet Metal Operation:** Press tool operations, Shearing action, Drawing dies, Spinning, Punching, Piercing, Bending, Stretch forming, Embossing and Coining.

Unit-III:

Welding and Welding Defects: Introduction to Welding, Gas and Arc Welding, Classification: Oxyacetylene welding equipment and techniques. Electric arc welding: Electrodes, Tungsten inert gas welding (TIG), Metal inert gas welding (MIG), Submerged arc welding (SAW), Resistance welding: Principle & types, Welding defects and remedies.

Other Joining Processes: Thermit welding, Electro slag welding, Electron beam welding, Forge welding, Friction welding, Diffusion welding, Brazing and soldering, Mechanical joining, Joining Plastic.

Unit-IV:

Plastic Manufacturing Processes: Classification of plastic materials, Manufacturing of plastic products,

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Casting, Compression moulding, Transfer moulding, Injection Moulding, Extrusion, calendering, Blow moulding, Forming shaping methods, Laminating methods, Reinforced plastic moulding.

Powder Metallurgy: Introduction, Operation in powder metallurgy, Production of metal powders, Properties of metal powder, blending of metal powders, Compaction of metal powders, Sintering and secondary operation, Application of powder metallurgy.

Course Outcomes (COs): After the completion of the course, the student will be able to:

1. Demonstrate an understanding of non-chip forming processes such as casting, forging, welding, etc.
2. Explain the various plastic manufacturing processes.
3. Understand basics of powder metallurgy.
4. Select appropriate production processes for a specific application.
5. Recommend materials in a manufacturing process based on their properties.
6. Apply appropriate manufacturing techniques for economic production.

Text Books:

- *Materials and Manufacturing Processes* – Kalpak Jain-Pearson Publication.
- *Manufacturing Science* – Ghosh A., Malik A.K. Affiliated East-West Press Pvt. Ltd., New Delhi.

Reference Books:

- *Production Technology*: R.K.Jain, Khanna Publishers.
- *Manufacturing Technology*: Vol I &Vol II, P.N.Rao, Tata McGraw Hill.
- *Manufacturing Technology*: R.K. Rajput, Laxmi Publications.
- *Welding and Welding Technology*: Richard L.Little, Tata McGraw Hill.
- *Principle of Metal casting*- Rosenthal, Tata McGraw Hill.
- *Manufacturing Processes and Systems:* Ostwald Phillip F., Munoz Jairo, John Wiley & Sons (Asia) Pvt. Ltd.

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MEPC-315 Mechanical Measurement							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Exam	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions for question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Unit-I:

General Concept: Need and classification of measurements and instruments, Basic and auxiliary functional elements of a measurement system, Mechanical versus electrical/electronic instruments, Primary, secondary and Working standards.

Static and Dynamic Characteristics of Instruments: Range and span, Accuracy and precision, Calibration, Hysteresis and dead zone, Sensitivity and linearity, Threshold and resolution: speed of response, lag, fidelity and dynamic error, dead time and dead zone. Zero, first and second order systems and their response to step, Ramp and sinusoidal input signals. Error in measurement: sources of errors, systematic and random errors: statistical analysis of test data.

Unit-II:

Functional Elements: Review of electro-mechanical sensors and transducers – variable resistance, Inductance and capacitive pickups, Photo cells and piezo-electric transducers, and application of these elements for measurement of position/displacement, speed/velocity/acceleration, force and liquid level etc.

Strain Gauges: Resistances strain gauges, Gauge factor, Bonded and unbonded gauges, Surface preparation and bonding technique, Signal conditioning and bridge circuits, Temperature compensation, Application of strain gauges for direct, bending and torsional loads.

Unit-III:

Pressure and Flow Measurement: Bourdon tube, Diaphragm and bellows, Vacuum measurement – McLeod gauge, Thermal conductivity gauge and ionisation gauge, Dead weight gauge tester. Electromagnetic flux meters, Ultra-sonic flow meters and Hot wire anemometer: Flow visualisation technique.

Temperature Measurement: Thermal expansion methods – bimetallic thermometers, Liquid-in-glass thermometer and filled-in-system thermometers, Thermo-electric sensors-common thermocouples, reference junction considerations, Special materials and configurations: metal resistance thermometers and thermistors, Optical and radiation pyrometers, calibration, standards.

Unit-IV:

Speed, Force, Torque and Shaft Lower Measurement: Mechanical tachometers, Vibration and Tachometer and Stroboscope, Proving ring, Hydraulic and pneumatic load cells, Torque on rotating shafts, Absorption, Transmission and Driving dynamometers.

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Course Outcomes (COs): After the completion of the course, the student will be able to:

1. Explain working principle of various measuring instruments.
2. Understand the output from different systems.
3. Identify and select proper measuring instruments for specific application.
4. Understand calibration methodology and error analysis related to measuring instruments.
5. Develop various methods to minimize errors based on characteristics.
6. Formulate mathematical model and analyze system/process for standard input responses.

Text Books:

- Ernest O. Doebelin, "*Measurement system: Application and Design*", McGraw Hill Higher Education.
- D.S. Kumar, "*Mechanical Measurement and Control*", Metropolitan Book Co. Pvt. Ltd., New Delhi.
- Thomas G Beckwith, Roy D Marangoni, John H. Lienhard V, "*Mechanical Measurements*", Pearson Education India.

Reference Books:

- J.P. Holman, "*Experimental Methods for Engineers*", McGraw Hill Education.
- Benjamin C. Kuo, Farid Golnaraghi, "*Automatic Control System*", Wiley.

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MEPC-313P Fluid Mechanics Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Exam	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Guidelines: The following is the list of experiments/ jobs. Minimum 08 numbers of practical's are to be performed from following list. The additional experiments may be performed by the respective institution depending on availability of time on academic schedule and the available infrastructure.

List of Experiments:

1. To determine the meta-centric height of a floating body.
2. To visualize two-dimensional flow (streamline flows) around and through models.
3. To visualize streamlines in flow around various bodies including sink source and potential flow analogy.
4. To visualize forced vortex, free vortex and determine rotational speed.
5. To show the velocity and pressure variation with radius in a forced vertex flow.
6. To determine the coefficient of discharge of venturimeter /orifice meter, pitot tube.
7. To determine the coefficient of discharge of Notch (V and Rectangular types).
8. To find critical Reynolds number for a pipe flow.
9. To determine the friction factor for the pipes.
10. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
11. To design and plan a system installation of valves and fittings, piping elements and system as per process schematic.
12. To determine the pressure distribution around and calculate lift/drag on an aerofoil using wind tunnel apparatus.
13. To study flow separation, vortex formation and demonstration of Karman vortices.
14. To study the effect of water hammer and pressure surge in pipes.

Course Outcomes (COs): After the completion of the course, the student will be able to:

1. Develop skills in accurately measuring fluid properties such as pressure, velocity, flow rate, and viscosity, and analyzing experimental data to draw valid conclusions.
2. Understand fundamental principles of fluid behavior through hands-on experiments.
3. Acquire familiarity with a range of equipment and apparatus used in fluid mechanics experiments, including understanding their operational principles and limitations.
4. Demonstrate knowledge of safety protocols specific to fluid mechanics laboratories, including proper handling of fluids, equipment setup, and emergency procedures.
5. Communicate experimental procedures, results, and conclusions effectively through structured lab reports, including graphical representations, calculations, and discussions of sources of error.
6. Collaborate effectively with peers in conducting experiments, sharing responsibilities, and discussing findings to enhance understanding and learning outcomes.

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MEPC-314P Manufacturing Practice Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Exam	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Guidelines: The following is the list of experiments/ jobs. Minimum 08 numbers of practical's are to be performed from following list. The additional experiments may be performed by the respective institution depending on availability of time on academic schedule and the available infrastructure.

List of Experiments:

1. To make a pattern for a given casting gating system.
2. Prepare the mould and make the casting. Investigate the casting defects and suggest the remedial measures.
3. To prepare the aluminium metal matrix composites using permanent mould casting and study the physical, mechanical characteristics and microstructure using metallurgical microscope.
4. To prepare the aluminium metal matrix composites using centrifugal casting and study the physical, mechanical characteristics and microstructure using metallurgical microscope.
5. To study design for welding and make a component involving horizontal and vertical welding and study the welding defects and suggests their remedies.
6. To make a component involving horizontal/vertical welding and determine the weld quality using destructive testing such as tension test/ bend test/fracture toughness test.
7. To determine the weld quality using non-destructive testing such as liquid-penetrant/ultrasonic testing/magnetic particles/radiographic tests.
8. To study physical, mechanical characteristics and microstructure of the given specimen.
9. To study and demonstrate wire electrical discharge machining (w-EDM).
10. To study design for brazing, soldering and perform the soldering and brazing operations of metals.
11. To perform the MIG/TIG operation on metals.
12. To determining the strength of weld using UTM.
13. To study design for mechanical fastening and perform joining of sheet metal by riveting.
14. Development and manufacturing of complex sheet metal components such as funnel etc.

Course Outcomes (COs): After the completion of the course, the student will be able to:

1. Gain proficiency in using manufacturing tools and equipment.
2. Demonstrate knowledge and practice of safety protocols specific to manufacturing environments, including proper use of personal protective equipment (PPE) and adherence to ethical standards.
3. Learn about different materials used in manufacturing, their properties, selection criteria, and appropriate handling techniques.
4. Develop skills in ensuring precision and quality in manufacturing operations, including measurement techniques, tolerance analysis, and inspection procedures.
5. Document manufacturing processes, procedures, and results effectively through technical reports, including detailing experimental setups, data analysis, and conclusions.
6. Enhance professionalism in manufacturing practices, including teamwork, communication skills, and understanding of industry standards and practices.

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MEPC-315P Mechanical Measurement Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Exam	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Guidelines: The following is the list of experiments/ jobs. Minimum 08 numbers of practical's are to be performed from following list. The additional experiments may be performed by the respective institution depending on availability of time on academic schedule and the available infrastructure.

List of Experiments:

1. To study different types of gauges (Vernier caliper, Vernier Height gauge, Vernier depth gauge, Micrometer, Filler gauge, Go-nogo gauge, Plug gauge, Go-Nogo snap gauge).
2. To calibrate of linear measuring instruments by using slip gauges and calculation of percentage error.
3. To measure included angle of a given specimen using Sine Bar and Clinometers.
4. To measure diameter of small size hole using Tool Maker's Microscope.
5. To measure the pitch diameter of a screw thread by vertical Profile Projector.
6. To study working of various pressure measuring devices (Bourdon tube, U-tube and Inclined tube Manometer, Micro manometer).
7. To determine RPM and torque of a given motor using contact and non-contact techniques.
8. To determine velocity using hot-wire anemometer and vane anemometer.
9. To determine PIV and micro/nano PIV flow visualisation techniques.
10. To determine LDV and LIF flow visualisation techniques.
11. To calibrate RTD, thermocouple using temperature calibrator and temperature bath.
12. To calibrate pressure gauge using pressure calibrator.
13. To study viscoelastic behaviour of specimen using rheometer.
14. To perform tension/bending/torsion test each with strain gauge measuring points in full bridge circuit.

Course Outcomes (COs): After the completion of the course, the student will be able to:

1. Students should be able to demonstrate a comprehensive understanding of various measurement techniques used in mechanical engineering, including both traditional and modern methods.
2. Gain practical experience in using measurement instruments commonly used in mechanical engineering.
3. Develop the ability to perform measurements with a high degree of precision and accuracy, considering factors such as instrument limitations, environmental conditions, and calibration procedures.
4. Analyze measurement data critically, identify sources of error, and interpret results effectively to draw meaningful conclusions.
5. Acquire skills in documenting measurement procedures, recording data accurately, and presenting findings in a clear and structured manner, often through formal lab reports.
6. Collaborate effectively with peers in conducting experiments, sharing responsibilities, and contributing to group discussions and analyses.