LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS & EXAMINATIONS [LR-24]
(w.e.f. Academic Year 2026-27)
B.E. V-Semester

S. No.	Course Code	Category	Course Title	Scheme of Instruction				Scheme of Examination			Credits
				L	T	P/D	Contact Hours/Week	Maximum Marks CIE	Maximum Marks SEE	Duration in Hours	
Theory Course											
1	U24ME501	PCC	Mechanics of Fluids and Hydraulic Machinery	3	-	-	3	40	60	3	3
2	U24ME502	PCC	Dynamics of Machines	3	-	-	3	40	60	3	3
3	U24ME503	PCC	Design of Machine Elements	3	-	-	3	40	60	3	3
4	U24ME504	PCC	Total Quality Management	3	-	-	3	40	60	3	3
5	-	PEC	Professional Elective Course-I	3	-	-	3	40	60	3	3
Practical/ Laboratory Course											
6	U24ME5L1	PCC	Mechanics of Fluids and Hydraulic Machinery Lab	-	-	3	3	25	50	3	1.5
7	U24ME5L2	PCC	Dynamics of Machines Lab	-	-	3	3	25	50	3	1.5
Internship											
8	U24ME5P1	PROJ	Internship-1 (During Vacations after IV Semester)	-	-	2	2	50	-	-	1
Total				**15**	**-**	**8**	**23**	**300**	**400**	**21**	**19**

L: Lecture (Hrs/Wk/Sem) **T**: Tutorial (Hrs/Wk/Sem) **P**: Practical **D**: Drawing (Hrs/Wk/Sem)

Professional Elective Course-I		
1.	U24ME505	Non-destructive Testing
2.	U24ME506	Composite Materials
3.	U24ME507	Production and Operations Management
4.	U24ME508	Renewable Energy Resources
5.	U24ME509	Reliability Engineering

CIE: Continuous Internal Evaluation
ESC: Engineering Science Course
OEC: Open Elective Course
ME: Mechanical Engineering
SEE: Semester End Examination
PCC: Professional Core Courses
PEC: Professional Elective Courses
PROJ: Project

Note:
1. Each contact hour is a Clock Hour.
2. The duration of the practical class is three hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Course Code	Course Title						Core/Elective
U24ME501	**Mechanics of Fluids and Hydraulic Machinery**						**Core**
Pre requisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Mathematics & Engineering Mechanics	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives

The objective of the course is to:

1. Know various fluid properties, concepts and methods of fluid measurement.
2. Understand the basic concepts and principle of fluid flow.
3. Study different equations of fluid motion and fluid dynamics.
4. Analyze different flow characteristics of laminar flows.
5. Understand the working principle of hydraulic turbines and pumps and their performance**.**

Course Outcomes

After completing the course, the student will be able to:

1. Illustrate the properties of fluids and classify the fluids.
2. Apply conservation laws to fluid flow problems in engineering applications and examine the stability of a floating bodies.
3. Apply Euler's Equation of motion and Bernoulli's equation for flow measuring devices and hydraulic machines.
4. Illustrate the working of Hydraulic machines.
5. Analyze the performance of various types of Hydraulic pumps and turbines.

UNIT–I

Basic Concepts and Properties of Fluid: Definition, distinction between solid and fluid, Properties of fluids, density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension, units and dimensions. **Fluid statics:** Concept of fluid static pressure, absolute and gauge pressures, pressure measurements by manometers and pressure gauges.

UNIT-II

Fluid Kinematics: Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform & non-uniform, laminar & turbulent, rotational &irrotational flows-equation of continuity for one dimensional flow and three-dimensional flows.

Fluid Dynamics: Equations of motion, Euler's equation along a streamline, Bernoulli's equation, applications. Venturi meter, Orifice meter, Pitot tube.

UNIT-III

Flow through pipes: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.

Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency,flow over radial vanes.

UNIT-IV

Hydraulic Turbines: Definitions and Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-workingproportions, work done, efficiencies, hydraulic design –draft tube theory- functions and efficiency.

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT-V

Hydraulic Pumps: Definition and classifications, Centrifugal pump: classifications, working principles, velocity triangles, specific speed, efficiency and performance curves.**Reciprocating pump:** classification, working principles, indicator diagram, performance curves, cavitation in pumps.

Suggested Readings:

1. Fluid Mechanics and Hydraulics Machine, Bansal, R.K.,, Laxmi publications(P) Ltd.Delhi (5^{th} edition),1995.
2. Hydraulic and Fluid Mechanics, Modi & Seth –standard book house, 2002.
3. Fluid Mechanics and Fluid Power Engineering, Kumar D.S., S.K. Kataria &Sons.
4. Introduction to fluid mechanics and fluid machines, Som, S.K.,and Biswas,G., Tata Mc Graw-Hill, ^{2nd} edition,2004.
5. Fluid Mechanics, White, F.M., Tata Mc Graw-Hill, 5^{th} Edition, New Delhi, 2003.

Course Code	Course Title						Core / Elective
U24ME502	Dynamics of Machines						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Mechanics of Solids	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Introduce some of the components mainly used in IC Engines and make analysis of various forcesinvolved. Understand the gyroscopic couple and its effect on vehicles in motion.
2. Know the working principles and characteristics of typical governors, as also the function of flywheels.
3. Compute frictional torque in clutches and understand the working of brakes and dynamometers.
4. Know the concept of unbalancing rotating and reciprocating masses in single and multi-cylinder in lineand radial engines and understand the phenomena of free vibration, including the effect of damping forsingle, DOF systems.
5. Determine natural frequencies of undammed, damped and forced vibrating systems of one, two andfreedom systems.

Course Outcomes:

After completing the course, the student will be able to:

1. Analyse static and dynamic forces in slider crank and other mechanisms; determine the magnitude ofgyroscopic couple and its effect on vehicles in motion
2. Evaluate the performance of various types of governors and design flywheels considering speed andenergy fluctuation.
3. Determine frictional torque in clutches and understand the working of brakes and dynamometers.
4. Analyse problems of balancing in rotating and reciprocating machinery.
5. Evaluate the natural frequencies of single and two degree of freedom systems in free and forced vibration mode, also considering the effect of damping

Unit-I

Static and Dynamic Force Analysis: Static force analysis of planar mechanisms – Analytical Method Dynamic Force Analysis – D'Alembert's principle, Dynamic Analysis of 4-link mechanism, Slider Crank Mechanism.

Precession: Gyroscopes, effect of precession, motion on the stability of moving vehicles such as motor car, motor cycle, aeroplanes and ships.

Unit-II

Governors: Working principle of governor, Classification & types of governors, analysis of Watt, Porter, Proell and Hartnell governors. Characteristics of governors: Controlling Force, Stability, Isochronism, Sensitivity, Power and Effort of governors.

Turning Moment Diagram and Flywheels: Engine Force Analysis – Piston Effort, Crank Effort, etc, Turning moment diagram –fluctuation of energy – flywheels and their design – crank effort and torque diagrams.

Unit-III

Friction: pivots and collars – uniform pressure, uniform wear – friction circle and friction axis: lubricated surfaces – boundary friction – film lubrication. Clutches – Types – Single plate, multi-plate and cone clutches

Brakes and Dynamometers: Simple block brakes, internal expanding brake, band brake of vehicle, Dynamometers – absorption and transmission types.

Unit-IV

Balancing Rotating Masses: Static balancing, dynamic balancing, balancing of several masses rotating in several planes,

Balancing of Reciprocating Masses: primary balancing shaking forces in single cylinder engine, partial balancing and its effects, secondary balancing, Balancing of locomotives, hammer blow, variation of traction effort and swaying couple

Unit-V

Vibrations: Vibrations of Single degree freedom system (axial, transverse and torsional), Whirling speed of shafts.

Damped Vibrations: Types of damping, Vibrations with viscous damping, damping factor and logarithmic decrement.

Torsional Vibrations: Two rotor, three rotor system, Natural frequencies of two degree freedomsystems, Modes of vibration approximate methods for determining natural frequencies: Dunkerley's method, Rayleigh's method.

Suggested Readings:

1. Theory of Machines, S.S. Rattan, Tata McGraw-Hill, 3rdEdition, 2009.
2. Theory of machines and Mechanisms, J. E. Shigley, McGraw Hill Publications, 2005.
3. Theory of Machines and Mechanisms- Rao & Dukkipati (Wiley)
4. The Theory of Machines, Thomas Bevan, CBS Publishers & Distributors, 2004.
5. Theory and Practice of Mechanical Vibrations, J.S. Rao and Gupta, Prentice Hall, 1984

Course Code	Course Title						Core / Elective
U24ME503	Design of Machine Elements						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Mechanics of Solids	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Understand the various steps involved in the Design Process.
2. Explain the principles involved in design of machine elements, subjected to different kinds of forces, fromthe considerations of strength, rigidity, functional and manufacturing requirements.
3. Understand and interpret different failure modes and application of appropriate criteria for design of machineelements.
4. Learn to use national and international standards, standard practices, standard data, catalogs, and standardcomponents used in design of machine elements.
5. Develop the capability to design elements like shafts, couplings, welded joints, screwed joints, and powerscrews.

Course Outcomes:

After completing the course, the student will be able to:

1. Apply the fundamentals of design of machine elements, and behavior of members subjected to various typesof complex loads, and criteria of failure to satisfy the applications
2. Identify the principles involved in evaluating the shape and dimensions of a component, when subjected tovarious types of fatigue loading, and methods to reduce the stress concentration and
3. Design the shafts used in various industrial applications.
4. Map out and design the different Couplings used in different industrial applications.
5. Design the machine components joined by Riveted, Welded and bolted joints, and to analyze the differentways in which riveted and welded joints can fail.

UNIT-I

Introduction: Design Process, definition of design, phases of design, and review of engineering materials and their properties and manufacturing processes; use of codes and standards, selection of preferred sizes. Reviewof axial, bending, shear and torsion loading on machine components, combined loading, two- and threedimensional stresses, principal stresses, stress tensors.

Design for static strength: Factor of safety and service factor. Failure mode: definition and types. , Failure of brittle and ductile materials; even and uneven materials; Theories of failure- maximum normal stress theory, maximum shear stress theory, distortion energy theory, strain energy theory

UNIT-II

Fatigue loading: Introduction to fatigue failure, Mechanism of fatigue failure, types of fatigue loading,S-N Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit. Modifying factors: size effect, surface effect,

Stress concentration effects, Notch sensitivity, Soderberg and Goodman relationships, stresses due to combined loading, cumulative fatigue damage, and Miner's equation.

UNIT-III

Design of shafts: Torsion of shafts, solid and hollow shaft design with steady loading based on strength and rigidity, ASME and BIS codes for power transmission shafting, design of shafts subjected to combined bending,torsion and axial loading. Design of shafts subjected to fluctuating loads

Design of keys and couplings: Keys: Types of keys and their applications, design considerations in parallel andtapered sunk keys, Design of square and rectangular sunk keys. Couplings: Rigid and flexible coupling-types and applications, design of Flange coupling, and Bush and Pin type coupling.

UNIT-IV

Design of Permanent Joints: Types of permanent joints-Riveted and Welded Joints.

Riveted joints: Types of rivets, rivet materials, Caulking and fullering, analysis of riveted joints, jointefficiency, failures of riveted joints, boiler joints, riveted brackets.

Welded joints: Types, strength of butt and fillet welds, eccentrically loaded welded joints

UNIT-V

Design of Temporary Joints: Types of temporary joints- cotter joints, knuckle joint and fasteners. Design ofCotter and Knuckle Joint.

Threaded Fasteners: Stresses in threaded fasteners, effect of initial tension, design of threaded fasteners understatic, dynamic and impact loads, design of eccentrically loaded bolted joints

Suggested Readings:

1. Design of Machine Elements, V. B. Bhandari, Tata McGraw-Hill Publ, 3rd Edn. 2010.
2. Mechanical Engineering Design, J.E. Shigley & Charles R. Mischke Tata McGraw-Hill.,6th ed.2010.
3. Machine Design, P. Kannaiah, Sci-Tech Publ., 2009.
4. Machine Design, P.C. Sharma & D.K. Aggarwal, S.K. Kataria & Sons, 10th edn, 2003
5. Design Data Book, 2nd edition", V. B. Bhandari, Tata McGraw-Hill Publ, 2019

Course Code	Course Title						Core / Elective
U24ME504	Total Quality Management						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Provide a comprehensive understanding of the evolution and fundamental concepts of quality management in organizations.
2. Develop knowledge of quality planning, quality by design, and cost implications related to quality and failure.
3. Familiarize students with leadership roles, team dynamics, and employee involvement in achieving quality excellence.
4. Introduce key quality management tools and philosophies such as PDCA cycle, Juran Trilogy, and contributions of quality pioneers.
5. Enable understanding of Total Quality Management (TQM) implementation, quality culture, and global quality standards and awards.

Course Outcomes:

After completing the course, the student will be able to:

1. Explain the principles, evolution, and importance of quality management in improving organizational performance.
2. Apply quality planning techniques and evaluate cost of quality to enhance business efficiency.
3. Analyze the role of leadership, teamwork, and employee empowerment in continuous quality improvement.
4. Utilize quality tools and frameworks such as PDCA cycle, statistical tolerance, and customer satisfaction metrics in real-world scenarios.
5. Evaluate TQM practices, quality culture, and international quality awards to implement effective quality systems in organizations.

UNIT-I

Evolution of Quality-Historical Perspective, Seven Tools of Quality Control, Basic Concepts of Quality, Vision, Mission and Objectives of an Organization, Corporate Structure in an Organization and Role of Quality. Quality Planning, Quality by Design, Quality Costs and Cost of Failure, Waste Control, How Quality Benefits Business.

UNIT-II

Quality and Competitiveness in Business, Zero Defects and Continuous Improvement, Role of Leadership and Commitment in Quality Deployment, Team Building, Motivation and Rewards, Total Employee Empowerment, Quality Functions-Measurement, Inspection, Testing, Calibration and Assurance.

UNIT-III

Design Control and Conformity, Tolerance and Variability, PDCA Cycle, Juran Trilogy, Crosby‘s 10 points and Deming‘s14Points Customers Requirements, Customer-Supplier and Chain Links, Establishing Customer Focus-Customer, Satisfaction, Measurement and Customer Retention.

UNIT-IV

Product Liability, Total Quality Concepts and CWQC, Difference in Western and Japanese Approach of TQM, Basic Philosophy and Fundamental Models of TQM, Total Quality and Ethics, Six Sigma Fundamentals.

UNIT-V

Internal Politics and Total Quality Management, Quality Culture, Education and Training Implementing Total Quality Management- An Integrated System Approach Total Preventive Maintenance. Self-Assessment, International/National Quality Awards: Malcolm Baldridge Award, Deming Prize, European Award, Rajeev Gandhi Award, CII Exim Award, Jamna Lal Bajaj Award, Golden Peacock Award.

Suggested Reading:

1. Total Quality Management by N.V.R.Naidu, G. Rajendra New Age International, First Edition, Jan2006.
2. Total Quality Management by R.S Naagarazan, New Age international,3e,2015.
3. Quality Control & Application by B. L.Hanson &P. M. Ghare, Prentice Hall of India,2004.
4. Total Quality Management by V.S Bagad Technical Publications, First Edition, Jan 2008.
5. Total Quality Management by S. Rajaram Dreamtech Press, First Edition, Jan 2008.

Course Code	Course Title						Core / Elective
U24ME505	Non-Destructive Testing						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Need, basic concepts and technologies of Non-Destructive Testing (NDT).
2. Security precautions from Radiography, protection from radiation and measurement of radiation received by personnel.
3. Technology of acoustic emission (AE), the associated instrumentation and applications.
4. Technologies like neutron radiography; laser induced ultrasonics, surface analysis and Thermography.
5. Merits and demerits of the different NDT Technologies.
6. Latest research and developments in NDT.

Course Outcomes:

After completing the course, the student will be able to:

1. Apply knowledge of different NDT techniques.
2. Analyse liquid penetrates inspection and magnetic particle inspection.
3. Interpret radiographs, utilize the various principles of radiography for different components of different shapes
4. Elaborate the knowledge of acoustic emission for NDT and the instrumentation used for NDT
5. Summarize knowledge of latest research, developments and trends in NDT

Unit-I

Liquid Penetrate inspection: Principle of penetrate inspection, characteristics of a penetrate, water washable system, post emulsification system, solvent removable system, surface preparation and cleaning, penetrate application, development, advantages, limitations, and applications.

Magnetic Particle Inspection: Principle, magnetization methods, continuous and residual methods, sensitivities, demagnetization, Advantages, Limitations, and Applications.

Unit-II

Eddy Current Testing: Principle, lift-off factor, and edge effect, skin effect, inspection frequency, coil arrangements, inspection probes, types of circuits, reference pieces, phase analysis, display methods and applications

Unit-III

Ultrasonic Testing: Generation of ultra sound, Characteristics of an ultrasonic beam, sound Waves at interfaces, sound attenuation, display systems, probe construction, type of display, inspection techniques, identification of defects, immersion testing, sensitivity and calibration. Reference standards, surface conditions, applications

UNIT-IV

Radiography: Principle and uses of radiography, limitation principle, radiation sources, production of X-rays, X-ray spectra, attenuation of radiation, shadow formation enlargement and distortion, radiographic film and paper, inspection of simple and complex shapes, radiation hazard, protection against radiation.

Unit-V

Acoustic Emission: physical principles, sources of emission, instrumentation and applications.

Other NDT Techniques*:* Neuron radiography, laser induced ultrasonics, surface analysis, and thermography.

Suggested Reading:

1. Barry Hull & Vernon John, _*Non-Destructive Testing*" , 1988.
2. Non-Destructive examination and quality control, ASM International, Vol.17, 9th edition 1989
3. J. Prasad and C.G.K. Nair, Non-Destructive Test and evaluation of materials, Tata McGraw-Hill Education, 2nd edition 2011
4. B. Raj, T. Jayakumar and M. Thavasimuth, Practical Non-Destructive Testing, Alpha Science International Limited, 3rd edition 2002
5. T. Rangachari, J. Prasad and B.N.S. Murthy, Treatise on Non-Destructive Testing and Evaluation, Navbharath enterprises, Vol.3, 1983.

Course Code	Course Title						Core / Elective
U24ME506	Composite Materials						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Metallurgy and Material Science	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Discuss the basic structure of composites
2. Define Elastic constants and Hygro-thermal stresses
3. Identify stress-strain relations in composites
4. Describe the behavior and Design with composites
5. Demonstrate the basic equations of plate bending

Course Outcomes:

After completing the course, the student will be able to:

1. Demonstrate knowledge of composites and their structure
2. Predict the Elastic constants and Hygrothermal stresses
3. Analyse the stress - strain relationship in composites
4. Summarise and apply the Design procedure and the failure criteria.
5. Formulate Plate bending equations for various Boundary conditions of composite plates.

Unit-I

Introduction: Fibres, Matrix materials, interfaces, polymer matrix composites, metal matrixcomposites, ceramic matrix composite, carbon fibre composites.

Unit-II:

Micromechanics of Composites: Mechanical Properties: Prediction of Elastic constant, micromechanical approach, Halpin-Tsai equations, Transverse stresses. Thermal properties: Hygrothermal stresses, mechanics of load transfer from matrix to fibre.

Unit-III

Macromechanics of Composites: Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation, inter-laminar stresses and edge effects. Simplified composite beam solutions. Bending of laminated beams.

Unit-IV

Strength, fracture, fatigue and design: Tensile and compressive strength of unidirectional fibre composites, fracture modes in composites: Single and multiple fracture, de-bonding, fibre pullout and de- lamination failure, fatigue of laminate composites, Effect of variability of fibre strength. Strength of an orthotropic lamina: Max stress theory, max strain criteria, maximum work (Tsai-Hill) criterion, quadratic interaction criteria. Designing with composite materials.

Unit-V

Analysis of plates and shells: Plate equilibrium equations, Bending of composite plates, Levy and Navier solution for plates of composite material. Analysis of composite cylindrical shells under axially symmetric loads.

Suggested Readings:

1. Mechanics of Composite Materials, Jones, R.M., Mc-Graw Hill Co., 1967.
2. The Analysis of Laminated Composite Structures, Calcote, L.R., Van Nostrand, 1969.
3. Experimental Mechanics of Fibre Reinforced Composite Materials, Whitney. I.M., Daniel, R.B. Pipes, Prentice Hall, 1984.
4. Stress Analysis of Fibre-Reinforced Composite Materials, Hyer. M.W., McGraw Hill Co., 1998.
5. Principles of Composite Material Mechanics, Ronald Gibson, TMH, 1994.

Course Code	Course Title						Core / Elective
U24ME507	Production and Operation Management						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Understand the concept of Production & Operations Management.
2. Understand role of work study and work measurement in Industry.
3. Learn use of fore casting and various methods of it.
4. Understand importance Aggregate planning, Materials Requirement Planning for Industry.
5. Understand Project Management approaches in completion of Project.

Course Outcomes:

After completing the course, the student will be able to:

1. Analyse various types of Production Systems, develop suitable layout for a given plant.
2. Develop various methods for work study and apply suitable Recording techniques. Develop standard procedures and time for the operations.
3. Explain necessity of Forecasting and various methods of it. Develop suitable quantitative forecasting technique for the given past data. Compare accuracy of models in connection with forecast errors.
4. Interpret Aggregate planning & Mater scheduling, Materials Requirement Planning Processes and develop quantitative models for Material requirement and resources based on time span.
5. Elaborate the usages of PERT/CPM techniques for a given project and develop suitable quantitative model for the project in successful competition by identifying the time constraints for start and end of process activities.

Unit-I

Production & Operations Management: Introduction, Types of production Systems. Job shop, Batch, Flow shop. Plant location and layout: Factors affecting plant location, Break even analysis, plant layout objectives, Types of layouts, merits and demerits.

Unit-II:

Work Study: Introduction to method study, Steps in method study, Recording techniques- Flow process chart, String diagram, Therbligs, Principles of motion economy. Work measurement: Stop watch time study, Standard time calculation. Work sampling- procedure, applications, advantages and disadvantages, Wages and incentives, types of incentive plans.

Unit-III

Forecasting: Introduction, Forecasting objectives and uses, demand patterns, Qualitative models Market survey, Delphi Tech, Quantitative models, Moving average, Weighted moving average, Simple exponential smoothing, trend adjusted exponential smoothing, Least square method, Simple regression, multiple regression. Forecast errors: Mean absolute Deviation (MAD), Mean Square Error (MSE), Mean Forecast Error (MFE), Mean absolute percentage error(MAPE).

Unit-IV

Aggregate Planning and Master Scheduling: Introduction, objectives of aggregate planning, Cost in aggregate planning, Strategies in aggregate planning, Master production scheduling. Materials Requirement Planning MRP 1: Importance of MRP, MRP system inputs and outputs, MRP calculations Manufacturing Resource Planning MRP2 & Enterprise Resource Planning(ERP): Features of ERP packages like SAP, People soft etc.,

Unit-V

Project Management: Project management: Network fundamentals. Fulkerson's rule. Earliest and latest times. Determination of ES and EF in the forward path. LS and LF in backward path. Determination of critical path. Free float, independent float, Total float, Program evaluation and review technique, crashing of network.

Suggested Reading:

1. Joseph Monk, Operations Management, TMH Publishers, New Delhi,2004.
2. Buffa Elwood S, Modern Production/Operations Management, John Wiley Publishers, Singapore, 2002.
3. Everett E Adam, Jrand Ronald J. Ebert, Production and Operations Management Concepts, Models and Behaviour,5thEd.1998, (EEE), Prentice Hall of India (P) Ltd., New Delhi.
4. PanneerSelvamR,— Operations Research‖, Second Edition, PHI Learning Pvt. Ltd. New Delhi, 2006.
5. S.D.Sharma,—Operations Research‖, Kedarnnath, Ramnath

Course Code	Course Title						Core / Elective
U24ME508	Renewable Energy Resources						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
Basic Electrical Engineering	L	T	D	P			
	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Understand the concept of various forms of Renewable energy resources and Non-Renewable energyresources.
2. Outline division aspects and utilization of renewable energy sources for both domestics and industrialapplications.
3. Identify Wind energy as alternate form of energy and to know how it can be tapped
4. Make the students understand the advantages and disadvantages of different renewable energy resources
5. Know the concepts of thermo and bio-chemical process along with novel technologies to conversion of biomass to Bio fuel.

Course Outcomes:

After completing the course, the student will be able to:

1. Summarize the renewable and non-renewable sources of energy
2. Acquire the knowledge of various components, principle of operation and present scenario of different conventional and non-conventional sources.
3. Explain the use of solar energy and the various components used in the energy production with respect to applications
4. Design wind turbine blades and know about applications of wind energy for water pumping and electricity generation
5. Relate the concept of Biomass energy resources and their classification, types of biogas Plants-applications and summarize the knowledge of Ocean energy, tidal energy, and geothermal energy.

Unit-I

Introduction: Classification of Energy Resources, Conventional Energy Resources, Non-Conventional Energy Resources, Alternative Energy Resources, World energy status, Current energy scenario in India, Environmental aspects of energy utilization, Energy and sustainable development. Energy policies in India

Unit-II

Solar energy: solar energy basic concepts, Solar cells, Solar collectors, Solar Thermal Applications-Heating, Cooling, Distillation, Desalination, Drying, Cooking, Solar pumping, Solar photo voltaic systems. Solar PV Applications, Government schemes and policies.

Unit-III

Wind energy: Principles of wind energy conversion systems - Nature of wind - Power in the Wind-Basic components of WECS -Classification of WECS -Site selection considerations - Advantages and disadvantages of WECS -Wind energy collectors -Wind electric generating and control systems - Applications of Wind energy -Environmental aspects.

UNIT-IV

Energy from the Oceans: Ocean Thermal Electric Conversion (OTEC) methods - Principles of tidal power generation -Advantages and limitations of tidal power generation -Ocean waves - Wave energy conversion devices -Advantages and disadvantages of wave energy - Geo-thermal Energy - Types of Geo-thermal Energy Systems - Applications of Geo-thermal Energy.

Unit-V

Energy from Biomass: Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation - Thermal gasification of biomass -Biomass gasifiers. Bio fuels- Bioethanol, Biobutanol, Biodiesel production.

Suggested Readings:

1. Non-Conventional Sources of Energy, Rai G.D, Khandala Publishers, New Delhi, 1999.
2. Power Plant Technology, M.M.El-Wakil, McGraw Hill, 1984.
3. Solar Energy, Sukhatme S.P., Tata McGraw Hill, 1984
4. Renewable Energy Engineering and Technology, Kishore V V N, Teri Press, New Delhi,2012.
5. Wind Energy Conversion Systems, Freris. L.L., Prentice Hall, UK, 1990.

Course Code	Course Title						Core / Elective
U24ME509	Reliability Engineering						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
-	L	T	D	P			
	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Understand the fundamental concepts, terminology, and mathematical models of reliability engineering.
2. Analyze the reliability and availability of engineering systems using appropriate reliability analysis techniques.
3. Apply reliability testing, failure analysis, and life-testing methods for engineering applications.
4. Evaluate product reliability and predict system life using statistical reliability models and industry standards.
5. Understand reliability management practices, maintenance strategies, and design approaches for improving system performance and safety.

Course Outcomes:

After completing the course, the student will be able to:

1. Explain the fundamental concepts, failure mechanisms, and mathematical models used in reliability engineering.
2. Analyze the reliability and availability of engineering systems using Reliability Block Diagrams (RBD), FMECA, Fault Tree Analysis (FTA), and Markov models.
3. Apply reliability testing techniques and failure analysis methods to assess engineering system performance.
4. Estimate product reliability and predict system life using statistical distributions and reliability prediction methods.
5. Evaluate reliability management, reliability-centered maintenance (RCM), and design-for-reliability techniques to improve system reliability and safety.

Unit 1:

Introduction: Basic definitions: Reliability, Availability, Serviceability, Failure rate, Reliability Mathematics, Failure distribution - constant failure rate model, Time dependent failure rate models and its types, Bath tub curve. case study or Videos on Human Reliability, Software Reliability.

Unit II:

System Reliability: Reliability Block Diagram - Series, Parallel & combined series parallel configurations; redundant-active and passive types, Failure Mode, Effects and Criticality Analysis (FMECA), Failure Reporting, Analysis and Corrective Action System (FRACAS), Fault Tree Analysis (FTA), System state analysis-Markov Model, Availability, Downtime

Unit III:

Reliability testing: Failures and types of failures; Intrinsic & extrinsic failures; Failure cascade; Failure mode; Failure rate, MTTF, MTBF, Accelerated life testing (ALT) - Qualitative ALT, Quantitative ALT & its types, AF, Samples

Unit IV:

Reliability estimation and life Prediction: Types of Failure data – Data censoring, Parametric and Non Parametric distribution, Probability density function, Exponential, Normal, lognormal & weibull distributions, weibull Goodness of fit distributions, Electronics reliability prediction-p arts count, parts stress method, MIL standard, Naval
Surface Warfare Center (NSWC).

Unit V:

Reliability Management: Design for Reliability, Relationship between Reliability and Safety factor, Stress-Strength interference theory, Reliability growth testing, Reliability centered maintenance (RCM), Spares planning.

Suggested Readings:

1. Kailash C. Kapur, Michael Pecht, Reliability Engineering, John Wiley & Sons, 2014.
2. Srinath L.S, “Reliability Engineering”, Affiliated East-West Press Pvt Ltd, New Delhi, 1998.
3. Modarres, “Reliability and Risk analysis”, Marshal Dekker Inc.1993.
4. John Davidson, “The Reliability of Mechanical system” published by the Institution of Mechanical Engineers, London, 1988.
5. Smith C.O. “Introduction to Reliability in Design”, McGraw Hill, London, 1976.
6. Charles E. Ebeling, “An introduction to Reliability and Maintainability engineering”, TMH, 2004

Course Code	Course Title						Core/Elective
U24ME5L1	**Mechanics of Fluids and Hydraulic Machinery Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Material Testing Lab	-	-	-	3	25	50	1.5

Course Objectives

The objective of the course is to:

1. Understand the working of pumps of different kinds and their behaviour.
2. Understand the concept of different kinds of turbines and their behaviour.
3. Gain theory knowledge of working of various flow measuring devices and their utility inindustry.

Course Outcomes

After completing this course, the student will be able to:

1. Illustrate the working of Hydraulic machines.
2. Apply the Bernoulli‟s principle in flow measurement used in hydraulic machines.
3. Analyze working principles of hydraulic pumps and turbines.
4. Evaluate the theoretical concepts and apply them in the functioning of hydraulic machines
5. Estimate the performance of pumps and turbines.

List of Experiments:

1. Verification of Bernoulli's Theorems.
2. To determine coefficient of discharge of venturi meter
3. To determine coefficient of discharge of orifice meter
4. Determination of friction factor for a given pipe line.
5. Impact of Jets on Vanes
6. Performance and characteristic curves of Reciprocating pump
7. Performance and characteristic curves of Single Stage Centrifugal Pump.
8. Performance Test on Multi Stage Centrifugal Pump.
9. Performance and characteristic curves of Pelton Wheel
10. Performance and characteristic curves of Francis Turbine
11. Performance and characteristic curves of Kaplan Turbine
12. Calibration of contracted rectangular notch and v-notch.
13. Calibration of Pitot Tube and Determination of Flow Velocity

Note: At least 10 experiments must be conducted in the semester.

Course Code	Course Title						Core / Elective
U24ME5L2	Dynamics of Machines Lab						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
Material Testing	L	T	D	P			
	-	-	-	3	25	50	1.5

Course Objectives:

The objective of the course is to:

1. Understand the effects and importance of kinematic and dynamic analysis of mechanisms.
2. Study the gyroscope, governors and cams.
3. Understand static and dynamic balance.
4. Understand effects and analysis of Single degree freedom vibration systems.

Course Outcomes:

After completing the course, the student will be able to:

1. Estimate the Gyroscopic couple and its effect on a Precessing rotating member.
2. Evaluate performance characteristics of centrifugal governors.
3. Determine the magnitude, location and orientation of a balancing mass required to balance the unbalance rotating system and verify the static and dynamic balancing.
4. Analyze the cam profile for motion characteristics.
5. Determine the time period and natural frequencies of simple and compound pendulum.

List of Experiments:

1. To determine time period and natural frequency of a simple pendulum.
2. To determine time period and natural frequency of a compound pendulum.
3. Undamped torsional vibrations of single and double rotor system.
4. Free vibration of simply supported / cantilever beam.
5. Damped and undamped torsional vibrations of single rotor system.
6. Find the motion of the follower for the given profile of the cam.
7. To Study the gyroscopic effects and estimation of gyroscopic couple on a rotating disc.
8. To Study the controlling force curves on Watt governor.
9. To determine the effect of varying mass on the centre of sleeve in porter governor.

10. To determine time period, amplitude and frequency of undamped free longitudinal vibration of single degree spring mass systems.
11. The balance masses statically and dynamically for single rotating mass systems.
12. To determine the critical speed of a given shaft for different n-conditions.
13. Dunkerley Method to Find Fundamental Frequencies.

Note: At least 10 experiments must be conducted in the semester.

Course Code	Course Title						Core / Elective
U24ME5P1	Internship-I						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	50	-	1

Course Objectives:

The objective of the course is to:

1. Produce an accurate record of work performed during the Internship/Co-op
2. Apply engineering knowledge to a problem in industry
3. Produce a technical report
4. Discuss work in a team environment, if relevant to the project
5. Conduct herself/himself responsibly, safely, and ethically in a professional environment

Course Outcomes:

After completing the course, the student will be able to:

1. Design/develop a small and simple product in hardware or software.
2. Complete the task or realize a pre specified target, with limited scope, rather than taking up a complex task and leave it.
3. Learn to find alternate viable solutions for a given problem.
4. Evaluate these alternatives with reference to pre specified criteria.
5. Implement the selected solution and document the same.

Internship is introduced as part of the curricula of encouraging students to work on problems of interest to industries. A batch upto five students will be attached to a person from the Government or Private Organizations/Computer Industry/Software Companies/R&D Organization for a period of 4 weeks. This will be during the summer vacation following the completion of the II-year Course. One faculty coordinator will also be attached to the group of 3 students to monitor the progress and to interact with the industry co- ordinate (person from industry). The course schedule will depend on the specific internship/training experience. The typical time per topic will vary depending on the internship

1. Overview of company/project, its vision and missions.
2. Safety training and disaster management.
3. Discussions with project teams
4. Background research, review of documents, scientific papers and its implementation.
5. Planning, designing, and reviewing the planned work

6. Executing the plans
7. Documenting progress, experiments, and other technical documentation
8. Further team discussions to discuss results
9. Final report writing and presentation

After the completion of the project, each student will be required to:
1. Submit a brief technical report on the project executed and
2. Present the work through a seminar talk (to be organized by the Department)

Note: Students have to undergo summer internship of 4 weeks at the end of semester IV and credits will be awarded after evaluation in V semester.

LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS & EXAMINATIONS [LR-24]
(w.e.f. Academic Year 2026-27)
B.E. VI-Semester

S. No.	Course Code	Category	Course Title	Scheme of Instruction				Scheme of Examination			Credits
				L	T	P/D	Contact Hours/Week	Maximum Marks CIE	Maximum Marks SEE	Duration in Hours	
Theory Course											
1	U24ME601	PCC	Metal Cutting and Machine Tools	3	-	-	3	40	60	3	3
2	U24ME602	PCC	Machine Design	3	-	-	3	40	60	3	3
3	U24ME603	PCC	Heat Transfer	3	-	-	3	40	60	3	3
4	U24ME604	PCC	CAD/ CAM	3	-	-	3	40	60	3	3
5	-	PEC	Professional Elective Course- II	3	-	-	3	40	60	3	3
6	-	OEC	Open Elective Course-I	3	-	-	3	40	60	3	3
Practical/ Laboratory Course											
7	U24ME6L1	PCC	Metal Cutting and Machine Tools Lab	-	-	3	3	25	50	3	1.5
8	U24ME6L2	PCC	Heat Transfer Lab	-	-	3	3	25	50	3	1.5
Project											
9	U24ME6P1	PROJ	Mini Project	-	-	4	4	50	50	-	2
Total				**18**	**-**	**10**	**28**	**340**	**510**	**24**	**23**

L: Lecture (Hrs/Wk/Sem) **T**: Tutorial (Hrs/Wk/Sem) **P**: Practical **D**: Drawing (Hrs/Wk/Sem)

Professional Elective Course-II		
1.	U24ME605	Automobile Engineering
2.	U24ME606	Control Systems
3.	U24ME607	Flexible Manufacturing System
4.	U24ME608	Robotics
5.	U24ME609	Drone Technology

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
PCC: Professional Core Courses **OEC**: Open Elective Courses
EN: English **ME**: Mechanical Engineering
HSMC: Humanities & Social Sciences Including Management Courses **PROJ:** Project

Note:
1. Each contact hour is a Clock Hour.
2. The duration of the practical class is three hours, however it can be extended wherever necessary, to enable the student to complete the experiment.
3. At the end of VI semester students should undergo summer Industrial Internship of four-week duration-Credits for Summer Internship will be awarded in VII semester.

Course Code	Course Title						Core / Elective
U24ME601	Metal Cutting and Machine Tools						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Metallurgy and Material Science	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Learn the geometry and mechanics of metal cutting for turning, drilling milling and tool materials.
2. Understand the heat distribution, tool wear and tool life.
3. Know the various machining processes such as lathe, drilling, milling, boring, broaching, grinding etc.
4. Know various types of work and tool holding devices for conventional machining.
5. Understand the basics of Unconventional Machining processes.

Course Outcomes:

After completing the course, the student will be able to:

1. Develop the relations for shear angle, shear strain, forces and temperatures associated with orthogonal cutting.
2. Select the cutting fluids, tool materials and coatings to control the tool wear and temperature.
3. Evaluate the tool life and economics of machining for maximum production and minimum cost.
4. Select the appropriate machine tool and tool & work holding devices for machining of components.
5. Illustrate the various finishing techniques and unconventional machining processes.

Unit-I

Basic chip formation process. Tool geometry: Nomenclature of single point cutting tool by ASA,ORS and NRS. Geometry of drills, Milling cutters and broaches. Recommended Tool angles. Chip formation: Types of chips, BUE, Chip breakers. Machining: Orthogonal and oblique cutting, Mechanics of Orthogonal Cutting: Merchant‟s analysis, Friction. Shear angle: Shear angle Solutions of Merchant and Lee & Shafer. Cutting tool materials: High carbon steel, HSS, Carbides, Ceramics, Coated carbides, Cermets, HPC, cBN & Diamond.

Unit-II

Measurement of Cutting Forces: Lathe tool dynamometers, Drilling, Milling and Grinding Dynamometers. Thermal aspects of metal cutting: Sources of heat and heat distribution, various methods of measurement of temperature, Cutting fluids and applications. Tool wear, Tool life & Machinability: Types of wear, mechanism of tool wear, Tool life & Machinability. Effects of process parameters on Tool life, Taylor's tool life equation. Economics of machining: Tool life for maximum production, minimum cost.

Unit-III

Constructional features and specifications of machine tools: Various operations on Lathe, Types of

Lathes and special attachments on a Centre Lathe. Drilling, Milling operations. Indexing methods.Shaper, planer and slotter and their differences. Quick return mechanisms, Automatic feed devices. Jig Boring machines- Differences between horizontal and vertical jig boring machines. Principles of Broaching.

UNIT-IV

Abrasive Processes: Grinding machines. Types of grinding, Abrasives and bonds used for grinding wheels. Specification and selection of wheels. Lapping, Honing, Polishing, Buffing, Super finishing and burnishing. Screws and gear manufacturing: Screw making by tapping, Chasers, Thread rolling, Thread milling, Thread grinding. Gear shaping, Gear hobbing, Gear shaving and grinding.

Unit-V

Jigs and Fixtures: Design principles for location and clamping. Tool holding and work holding devices. Quick clamping devices. Types of Jigs and fixtures. Unconventional machining: Principles of working and applications of USM, AJM, WJM, EDM, ECM,LBM , EBM and PAM.

Suggested Readings:

1. Metal Cutting Theory and Practice, A. Bhattacharyya, New Central Book Agency (P) Ltd., 2006.
2. Fundamentals of Metal Machining and Machine Tools / Geoffrey Boothroyd / McGraw Hill.
3. Manufacturing Technology – Metal Culling & Machine Tools", P.N. Rao,Vol. 2, Tata McGraw HillEducation Pvt. Ltd, 2010.
4. Machine Tool Practices/ Kibbe, Johne. Neely, T. White, Rolando O. Meyer/ Pearson
5. Manufacturing Science, Amitabha Ghosh and Ashok Kumar Mallik, Affiliated East-West Press Pvt. Ltd., 2nd Edition, 2010.

Course Code	Course Title						Core / Elective
U24ME602	Machine Design						Core
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Design of Machine Elements	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Understand various elements involved in a mechanical system.
2. Analyze various forces acting on the elements of a mechanical system and design them using appropriate techniques, codes, and standards
3. Select transmission elements like gears, belts, pulleys, bearings from the manufacturers' catalogue
4. Design a mechanical system integrating machine elements
5. Produce assembly and working drawings of various mechanical systems involving machineelements like belts, pulleys, gears, springs, bearings

Course Outcomes:

After completing the course, the student will be able to:

1. Demonstrate the design, development and use of Different types of Springs and apply design principles for the design of mechanical systems involving belts, pulleys, and wire rope.
2. Apply design concepts of hydrodynamic bearings for different applications and select anti friction bearings for different applications using the manufacturers, catalogue
3. Apply the knowledge of design, selection of material, shape and standard parameters of fins for piston, to withstand the buckling, tension and compressive loads for piston and connecting rod.
4. Analyze and differentiate the of curved beams and straight beams in terms of load distribution across the section of different shaped elements
5. Demonstrate the basic knowledge in the designing, choosing the best materials for Spur gear, helical gear, worm gears for different operating temperature, speed and number of operating hours.

UNIT-I

Springs: Types of springs, spring materials, stresses in helical coil springs of circular and non- circular cross sections. Tension and compression springs, concentric springs; springs under fluctuating loads. **Leaf Springs:** Stresses in leaf springs, equalized stresses, and nipping of leaf springs. Introduction to torsion and Belleville springs.

UNIT-II

Belts: Materials of construction of flat and V belts, power rating of belts, concept of slip and creep, initial tension, effect of centrifugal tension, maximum power condition. Selection of flat and V belts-

length & cross section from manufacturers' catalogues. Construction and application of timing belts.
Wire ropes: Construction of wire ropes, stresses in wire ropes, and selection of wire ropes.

UNIT-III

Bearings: Classification of Bearings. Viscosity of Lubricants Theory of Hydrostatic and Hydrodynamic lubrication
Sliding contact bearings: Types of Journal bearings – Lubrication – Bearing Modulus – Full and partial bearings – Clearance ratio – Heat dissipation of bearings, bearing materials – journal bearing design.
Rolling contact bearings: Ball and roller bearings – Static load – dynamic load – equivalent radial load – design and selection of ball & roller bearings

UNIT-IV

Engine Parts: Connecting Rod: Thrust in connecting rod – stress due to whipping action onconnecting rod ends –Pistons, Forces acting on piston – Construction, Design and proportions of piston.

UNIT-V

Gear drives: Classification of gears, materials for gears, standard systems of gear tooth, lubrication of gears, and gear tooth failure modes.
Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, design for strength, dynamic load and wear.
Helical Gears: Definitions, transverse and normal module, formative number of teeth, design based on strength, dynamic load and wear
Bevel Gears: Definitions, formative number of teeth, design based on strength, dynamic load and wear

Suggested Readings :

1. Design of Machine Elements, V. B. Bhandari, Tata McGraw-Hill Publ, 3rd Edn. 2010.
2. Mechanical Engineering Design, J.E. Shigley & Charles R. Mischke, Tata McGraw-Hill.,6th ed.2010.
3. Machine Design, P. Kannaiah, Sci-Tech Publ., 2009.
4. Machine Design, P.C. Sharma & D.K. Aggarwal, S.K. Kataria & Sons, 10th edn, 2003
5. Design Data Book, V. B. Bhandari, 2nd edition, ", Tata McGraw-Hill Publ, 2019

Course-Code	Course Title						Core/ Elective
U24ME603	Heat Transfer						Core
Prerequisites	Contact Hour per Week				CIE	SEE	Credit
	L	T	D	P			
Thermodynamics	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Develop the fundamental principles and laws of heat transfer and to explore the implications ofthese principles for system behavior.
2. Formulate the models necessary to study, analyse and design heat transfer systems through theapplication of these principles.
3. Develop the problem-solving skills essential to good engineering practice of heat transfer inreal-world applications.

Course Outcomes:

After completing the course, the student will be able to:

1. Illustrate the basic modes of heat transfer with its associated laws in simple geometries.
2. Solve the problems of steady state and transient heat conduction with simple and multi-layer geometries. Analyze heat transfer coefficients for free and forced convection, considering boundary layers.
3. Develop relationships for radiation exchange between (Opaque, Diffuse, Gray) Surfaces in an enclosure.
4. Familiarize with time dependent heat transfer and compute convective heat transfer coefficients in forced, natural convection.
5. Analyse heat exchanger performance by using the methods of Log Mean Temperature Difference (LMTD).

UNIT-I

Heat transfer fundamentals; Basic heat transfer mechanisms (conduction, convection and radiation), Conduction: General conduction equation on cartesian coordinates, Cylinders and spheres. One dimensional steady state conduction through plane walls, hollow cylinders and spheres with and without heat generation. Thermal resistance network, Boundary Conditions, Effect of variable thermal conductivity for one-dimensional steady-state conduction in a planewall.

UNIT-II

Fins: Heat transfer analysis of a body with negligible internal temperature gradients, fins efficiency and effectiveness. Lumped system analysis within the body with negligible internal temperature

gradients. Transient heat transfer analysis of an infinite slab with specified temperature and connective boundary conditions.

UNIT-III

Convection: Physical mechanism of convection, Buckingham pi-theorem and use of dimensional analysis in free and forced convection, Physical significance of different dimensionless numbers. Concept of velocity boundary layer, thermal boundary layer. Reynolds analogy, Chilton-Colburn analogy for turbulent flow over flat surfaces. Calculation of heat transfer for flow over plates, cylinders and in pipes in free and forced convection using empirical formulae.

UNIT-IV

Radiation: Absorptivity, Reflectivity, and Transmissivity, Concept of a blackbody, Emissivity, the Planck Distribution law, Wien's Displacement Law, Stefan-Boltzmann, Kirchhoff's Law. The View factor, View factor relations, View Factors between Infinitely Long Surfaces: The Crossed- Strings Method, Radiation exchange between Opaque, Diffuse, Gray Surfaces in an enclosure.

UNIT-V

Heat Exchangers: Heat exchanger types, overall heat transfer coefficient. Heat exchanger analysis: Use of the Log Mean Temperature Difference (Parallel-Flow, Counter-Flow), the Effectiveness–NTU Method. Heat Exchanger Design and Performance Calculations (LMTD, ε-NTU methods), Selection of heat exchangers. Boiling: Pool boiling regimes, nucleate pool boiling, and critical heat flux for nucleate pool boiling, minimum heat flux. Conduction Process.

Suggested Readings :

1. Heat Transfer, Holman, J.P., McGraw Hill Publication, New Delhi, 2010.
2. Heat and Mass Transfer, Rajput, R.K., S. Chand & Company Ltd, New Delhi, 2004.
3. Heat and Mass Transfer, Yadav, R., Sanjay. and Rajay.,Central Publishing House, Allahabad, 2004
4. Fundamentals of Engineering Heat and Mass Transfer, Sachdeva,R.C, New Age International (P) Ltd Publishers, New Delhi,
5. A course in Heat and Mass Transfer, Arora, S.C. and Domkandwar., DhanpatRai& Sons, New Delhi, 2004.

Course Code	Course Title						Core / Elective
U24ME604	CAD/CAM						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Metal Cutting and Machine Tools	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Introduce the concepts of CAD and advanced modeling techniques
2. Help the student in understanding advanced manufacturing concepts like Group technology, flexible manufacturing systems, Computer aided Process Planning, and Computer aided quality control, Artificial Intelligence etc.
3. Help the students in understanding the functioning of computer numerical control machine tools and also in writing programs for operating these machines.
4. Understand the various assemblies and part design with CAD Software's.
5. Create awareness among students about the advanced Software's.

Course Outcomes:

After completing the course, the student will be able to:

1. Apply the fundamental applications of computer in design, manufacturing and geometric transformation techniques in CAD.
2. Develop mathematical Model for curves, surfaces, solid models and understand thefundamental concepts of Finite Element Analysis.
3. Develop CNC Part program for manufacturing components.
4. Differentiate the concepts of Machining Centre's, adaptive control and as well asfundamentals knowledge of robotics.
5. Analyze the working of various components of an modern manufacturing systems

UNIT-I

CAD Fundamentals, Product life cycle in conventional and computer-based manufacturing system, Hardware integration and networking. CAD Software: Definitions of system software and application software. Graphic Standards and Exchange Formats. CAD database and structure.

UNIT-II

Geometric modeling: 3-D wire frame modeling: wire frame entities and their definitions, Interpolation and approximation of curves, synthetic curves and curve fitting. Definitions of cubic, Bezier, and B- spline curves.

UNIT-III

Surface modeling: Definitions of basic surfaces, surface of revolution, blends, intersection, and Cubic, Bezier, B-spline surfaces. Solid Modeling: Solid entities, Boolean operations, B-rep and C-rep approaches. Feature based modeling: Concepts and applications, Assembly modeling.

UNIT-IV

Parametric Representation of Synthetic Surfaces: Hermite Bicubic surface, Bezier surface, BSplinesurface, COONs surface, Blending surface Sculptured surface, Surface manipulation Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D).

UNIT-V

Group Technology: Organization, G.T. layout, part classification and coding, CAPP: Variant and Generative approaches and their relative features. Computer Aided Quality Control: Computer in quality control, Contact and non-contact inspection, optical and non-optical computer aided testing, Experts systems. Artificial intelligence, CAD/CAM integration.

Suggested Readings:

1. CAD/CAM, theory and practice, Ibrahim Zeid, McGraw Hill Inc, N.Y.1991.
2. CAD/CAM, Grover, MP and Zimmers E.W., Prenctice Hall of India 1989.
3. Computer Aided Manufacturing, Rao P.N., Tiwari N.K., Kundra T.K., Tata McGraw Hill, New Delhi, 1993.
4. CAD/CAM/CIM, Radhakrishnan. P, Subramanyan. S, Raju. V, New Age international (P) Ltd., 2nd Edn., 2004.

Course Code	Course Title						Core / Elective
U24ME605	Automobile Engineering						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Thermodynamics	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. To provide fundamental knowledge of different types of automobiles, engine components, and fuel systems including conventional and modern technologies.
2. To develop understanding of lubrication, cooling, ignition, and electrical systems used in automobiles.
3. To familiarize students with steering mechanisms, suspension systems, and wheel dynamics for vehicle stability and control.
4. To introduce the construction and working of power transmission systems and braking systems in automobiles.
5. To impart knowledge on automobile maintenance, diagnostics, pollution control technologies, and recent emission standards.

Course Outcomes:

After completing the course, the student will be able to:

1. Identify and explain various types of automobiles, engine components, and fuel injection systems.
2. Analyze lubrication, cooling, ignition, and electrical systems for efficient vehicle performance.
3. Evaluate steering geometry, suspension systems, and tyre characteristics for improved vehicle handling and safety.
4. Describe and analyze power transmission and braking systems in modern automobiles.
5. Apply maintenance procedures, troubleshooting techniques, and emission control methods in compliance with current environmental norms.

Unit-I

Types of automobiles: Normal, Hybrid and Hydrogen fuel vehicles. Engine location and its components, chassis layout, crank shaft proportion, firing order, piston and piston rings, cylinder liners, valves and operation mechanism, inlet and exhaust manifolds, carburetion and fuel injection system, mechanical fuel injection system & electronic fuel injection system.

Unit-II

Lubricating systems: Wet sump, dry sump and petrol systems, and Cooling systems: Water pumps, radiators, thermostat control anti freezing compounds. Types of Ignition systems, modern ignition systems, types of batteries and charging systems, starting motors, lighting and electrical accessories, automobile air-conditioning.

Unit-III

Steering systems: Linkage arrangements and its components modified Ackerman linkage, wheel alignment, caster and camber. Rack and pinion assembly – recent trends Wheel and tyres: Tyre construction, specification. Tyre wear and causes, wheel balancing, types of suspension system, independent suspension coil and leaf springs, torsion bar, shock absorbers.

Unit-IV

Power Train: Clutches, gear and gearbox manual, semi-automatic and automatic gearboxes. Torque converter, propeller shaft, universal coupling differential, four-wheel drive system.Brake systems: Description and operation of hydraulic brake, leading and trailing shoe layout, disc brakes, master cylinder, hand brake linkage, recent trends.

Unit-V

Maintenance: Pollution control, trouble shooting and servicing procedure overhauling, engine tune up, tools and equipment for repair and overhaul, testing equipment, pollution control technologies used for petrol and diesel engines, types and study of catalytic converters, Euro norms 2 & 3 and Bharat Norms – recent trends.

Suggested Reading:

1. Crouse & Anglin, 'Automotive Mechanics' Tata McGraw Hill, Publishing Co., Ltd., New Delhi, Tenth edition - 2004.
2. Kirpal Singh, ―Automobile Engineering‖, Vol I & II Standard Publishers, Delhi.
3. Joseph Heitner, _Automotive Mechanics, Affiliated East West Pvt., Ltd.,
4. C.P. Nakra, ―Basic Automobile Engineering‖, Dhanpat Rai Publishing Co.(P) Ltd., New Delhi, 2003

Course Code	Course Title						Core / Elective
U24ME606	Quality and Reliability Engineering						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Understand the fundamental concepts, principles, and mathematical modeling of control systems used in mechanical engineering.
2. Analyze the time-domain response and stability characteristics of linear control systems.
3. Evaluate the frequency response of control systems and apply stability and compensation techniques.
4. Develop knowledge of discrete-time control systems and assess their stability using Z-transform methods.
5. Understand state-space representation and analyze dynamic systems using state variable techniques.

Course Outcomes:

After completing the course, the student will be able to:

1. Explain the fundamentals of control systems, system components, transfer functions, and mathematical modeling techniques.
2. Analyze the time response and stability of control systems using standard performance criteria and stability methods.
3. Evaluate the frequency response characteristics of control systems using Bode, Nyquist, and Gain–Phase plots and design suitable compensation techniques.
4. Apply Z-transform techniques to analyze and determine the stability of discrete-time control systems.
5. Develop state-space models of linear systems and analyze their dynamic behavior using state variable methods.

Unit-I

Introduction: Classification of control systems. Examples of control systems with applications in Mechanical Engineering. Relationships of components and analogies. Performance characteristics of control system components. Hydraulic and pneumatic control systems. Methods of analysis using standard input functions. Laplace transformation, use of transfer functions.

Unit-II

Modeling in the time domain. Time Response: Response characteristics of systems Types of input. Transient response of first and second order system for step input. Time domain specification. Types of system, static error coefficients, error series, Routh-Hurwitz criterion of stability.

Unit-III

Modeling in the frequency domain. Frequency response analysis: The frequency response of a second order system, effect of numerator factors, zero factors in a transfer function. Bode plots, Gain-Phase plot, Nyquist criterion for stability, Gain Margin and Phase Margin, compensation techniques.

UNIT-IV

Discrete Control Analysis: The Z-transformation, digital control, advantages and disadvantages, Digital control system architecture. The discrete transfer function. Z-domain stability. Stability tests. Jury's stability criteria.

UNIT-V

State space representation: Concept of state. State variable, state models of linear time invariant systems, derivation of state model from transfer functions and differential equations.

Suggested Reading:

1. Katsuhiko Ogata, “Modern Control Engineering”, Prentice hall, 5th edition, 2010.
2. Norman S Nise, Control system engineering‟, Wiley publications, 6th edition, 2010.
3. Francis Raven H. "Automatic Control Engineering", Tata McGraw Hill, 5th Edition, 1995.
4. Peter Dransfield, "Engineering Systems and Automatic Control", Prentice Hall of India, 1974.
6. Gene F. Franklin, J. David Powell, Abbas Emamin Naini, "Feedback control of Dynamic
5. Systems", Pearson Education Pvt. Ltd., 4th Edition, 2004.

Course Code	Course Title						Core / Elective
U24ME607	Flexible Manufacturing Systems						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Manufacturing Processes	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Understand the Fundamentals of FMS, evolution, definition, need, objectives, components, merits, demerits, and applications of Flexible Manufacturing Systems (FMS), including flexibility in push and pull-type systems.
2. Learn about various FMS layout types—such as single line, dual line, loop, ladder, and robot-centered layouts—and understand their salient features and suitability for different manufacturing environments.
3. Study key processing stations in FMS including machining centers, turning centers, coordinate measuring machines (CMM), and washing/deburring stations, along with their roles and functionalities.
4. Gain knowledge of essential MHS components like conveyors, robots, Automated Guided Vehicles (AGVs), and Automated Storage and Retrieval Systems (ASRS) used in FMS.
5. Learn about tool management (including magazines, presetting, and monitoring), fault detection, and key functions like FMS configuration planning, routing, production planning, scheduling, and loading.

Course Outcomes:

After completing the course, the student will be able to:

1. Classify and distinguish FMS and other manufacturing systems including job-shop and mass production systems.
2. Explain processing stations and material handling systems used in FMS environments
3. Design and analyze FMS using simulation and analytical techniques.
4. Describe tool management in FMS.
5. Analyze the production management problems in planning, loading, scheduling, routing and breakdown in a typical FMS.

Unit-1

Understanding of FMS: Evolution of Manufacturing Systems, FMS: Definition, objective and Need, FMS: components, Merits, Demerits and Applications, Flexibility in Pull and Push type.

Unit-2

Classification of FMS Layout: FMS: Layouts and their Salient features, Single line, dual line, loop, ladder, robot centre type etc.

Unit-3

Salient features of processing stations: Processing stations- Machining Centers, Turning centre, Coordinate measuring machine (CMM), Washing/ Deburring station.

Unit-4

MHS; An introduction: Material Handling System Conveyor, Robots, Automated Guided Vehicle (AGV), Automated Storage Retrieval System (ASRS).

Unit-5

Management Technology: Tool Management, tool magazine, Tool preset, identification, Tool monitoring and fault detection, FMS: Configuration planning and routing, FMS: Production Planning and Control, FMS: Scheduling and loading.

Suggested Reading:

1. William W Luggen, “Flexible Manufacturing Cells and System” Prentice Hall of Inc New Jersey, 1991
2. Reza A Maleki “Flexible Manufacturing system” Prentice Hall of Inc New Jersey, 1991
3. John E Lenz “Flexible Manufacturing” marcel Dekker Inc New York, 1989.
4. Groover,M.P “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India Pvt.Ltd. New Delhi 2009

Course Code	Course Title						Core / Elective
U24ME608	Robotics						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Explain the fundamentals of robotic systems, including classifications, anatomy, sensors, and selection criteria based on applications.
2. Apply kinematic and dynamic modeling techniques for industrial robotic manipulators using mathematical and simulation tools.
3. Analyze and design motion trajectories and control systems for robotic applications.
4. Explore advanced topics in robotics, including vision systems and path planning techniques using modern technologies.
5. Evaluate and integrate robotics solutions in industrial manufacturing, material handling, and inspection processes.

Course Outcomes:

After completing the course, the student will be able to:

1. Explain the anatomy, classification, and selection of robots, sensors, and grippers for specific automation applications.
2. Formulate and solve direct and inverse kinematics problems for different robot configurations using transformation matrices.
3. Analyze robot dynamics using Lagrangian and Newton-Euler methods and demonstrate differential kinematics using simulation tools.
4. Develop and implement motion control strategies and trajectory planning using control architectures and robot programming techniques.
5. Assess and recommend appropriate robotic systems for real-world industrial applications such as welding, assembly, inspection, and material handling.

UNIT-I

Introduction: Multibody systems, Automation, Classification of robots, Anatomy, Sensors (velocity, proximity, touch, torque etc), Grippers, selection of Robot based on the Application. Demonstration of different types of Robots & tools using Robot Simulator Software like ROBODK.

UNIT-II

Kinematics: Manipulators Kinematics, Rotation Matrix, Homogenous Transformation Matrix, Direct and Inverse Kinematics for industrial robots for Position and orientation. Demonstrate FK and IK using simulation tools.

Differential Kinematics, statics and Dynamics: Jacobian, Lagrangian Formulation, Newton- Euler Formulation for RR & RP Manipulators. Demonstrate differential kinematics using simulation tools.

UNIT-III

Trajectory planning: Motion Control- Interaction control, Rigid Body mechanics. Demonstrate trajectory planning using simulation tools.

Control: architecture- position, path velocity and force control systems, computed torque control, Adaptive control, and Servo system for robot control.

UNIT-IV

Advanced Topics in Robotics: Motion Planning (Methods of Path planners), Robot Vision (Feature Detection & Matching, Motion Tracking, Machine Learning methods).

Robot programming: Programming of Robots and Vision System- overview of various programming Languages.

UNIT-V

Applications: Application of Robots in production systems- Application of robot in welding, machine tools, material handling, and assembly operations parts sorting and parts inspection, IoT Applications.

Suggested Reading:

1. Craig, J.J., Introduction to Robotics Mechanics and Control, Addison Wesley, 1999.
2. Saha, Subir Kumar, Introduction to robotics, Tata McGraw-Hill Education, 2014.
3. Spong, Mark W., Seth Hutchinson, and Mathukumalli Vidyasagar, Robot modeling and control, New York: Wiley, 2006.
4. Kevin M. Lynch, Frank C. Park, Modern Robotics: Mechanics, Planning, and Control, Cambridge University Press, 2017.

Course Code	Course Title						Core / Elective
U24ME609	Drone Technology						Elective
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Understand the fundamentals, classifications, and evolution of drone technology and its applications across various engineering domains.
2. Develop knowledge of drone design, components, fabrication, programming, and flight control systems.
3. Familiarize students with drone operation, flight management, sensors, and communication systems.
4. Explore the commercial, industrial, and entrepreneurial applications of drones in diverse sectors.
5. Understand drone safety regulations, aviation standards, and emerging trends in autonomous and swarm drone technologies.

Course Outcomes:

After completing the course, the student will be able to:

1. Explain the fundamentals, classifications, and operational principles of drone technology.
2. Identify drone components and demonstrate knowledge of drone assembly, programming, and flight stabilization techniques.
3. Operate and manage drone flight systems using appropriate control modes, sensors, and communication interfaces.
4. Evaluate the application of drones in agriculture, infrastructure inspection, logistics, photography, and other industrial sectors.
5. Interpret drone safety regulations, licensing requirements, and emerging developments in autonomous and swarm drone technologies.

UNIT I

Introduction to Drone Technology: Drone Concept - Vocabulary Terminology, History of Drone, Types of the Current Generation of Drones Based on their Method of Propulsion, Drone Technology Impact on the Businesses, Drone Business Through Entrepreneurship, Opportunities/Applications for Entrepreneurship and Employability.

UNIT II

Drone Design, Fabrication and Programming: Classifications of the UAV, Overview of the Main Drone Parts, Technical Characteristics of the Parts, Function of the Component Parts, assembling a Drone, The Energy Sources, Level of Autonomy, Drones Configurations, The Methods of Programming Drone, Download Program, Install Program on Computer Running Programs, Multi Rotor Stabilization, Flight Modes, Wifi Connection.

UNIT III

Drone Flying and Operation: Concept of Operation for Drone, Flight Modes, Operate a Small Drone in A Controlled Environment, Drone Controls Flight Operations, Management Tool, Sensors, Onboard Storage Capacity, Removable Storage Devices- Linked Mobile Devices And Applications.

UNIT IV

Drone Commercial Applications: Choosing A Drone Based on the Application, Drones in The Insurance Sector, Drones in Delivering Mail, Parcels and Other Cargo, Drones in Agriculture, Drones in Inspection of Transmission Lines and Power Distribution, Drones in Filming and Panoramic Picturing.

UNIT V

Future Drones and Safety: The Safety Risks, Guidelines to Fly Safely, Specific Aviation Regulation and Standardization Drone License, Miniaturization of Drones, Increasing Autonomy of Drones, The Use Of Drones in Swarms.

Suggested Reading:

1. Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation, D. Tal and J. Altschuld, John Wiley & Sons, 2021.
2. Make: Getting Started with Drones, T. Kilby and B. Kilby, Maker Media, 2016.
3. Drone University, J. Glover, Createspace Independent Publishing, 2016.
4. Mastering Drone Photography: Capture Stunning Aerial Photos and Videos with Your Drone, R. Harrington, Rocky Nook, 2017.
5. Drone Entrepreneurship: 30 Businesses You Can Start, D. John, Independently Published, 2018.

Course-Code	Course Title						Core/ Elective
U24ME6L1	Metal Cutting and Machine Tools Lab						Core
Prerequisites	Contact Hour per Week				CIE	SEE	Credit
	L	T	D	P			
Manufacturing Processes Lab	-	-	-	3	25	50	1.5

Course Objectives:

The objective of the course is to:

1. Provide hands-on experience in basic machining operations using conventional machine tools such as lathe, drilling, milling, and grinding machines.
2. Develop practical skills in producing components involving turning, threading, tapering, and surface finishing operations.
3. Familiarize students with different machining processes such as shaping, slotting, and planning for material removal.
4. Impart knowledge of tool geometry, cutting parameters, and their influence on machining performance and accuracy.
5. Introduce methods for inspection, testing, and maintenance of machine tools to ensure precision and quality in manufacturing.

Course Outcomes:

After completing the course, the student will be able to:

1. Demonstrate the need of machine alignment test for qualitative production.
2. Practice calibration principles for maintaining the required precision of instruments / tools.
3. Select and practice the methods of temperature measurement.
4. Select cutting tool materials and tool geometries along with appropriate cutting conditions for different work materials and grind the cutting tools to the required geometry.
5. Recognize and summarize the features and applications of various machine tools like Lathe, Milling, Drilling, Grinding, Shaping, Slotting etc.
6. Practice calibration principles for maintaining the required precision of instruments / tools

List of Experiments:

1. Typical exercises on lathe machine (Turning, Step Turning).
2. Typical exercises on lathe machine (Taper Turning and Knurling).
3. Thread cutting exercise on lathe machine as single start.
4. Machining of holes using Drilling and boring machines.
5. Typical exercises on shaper machine.
6. Typical exercises on cylindrical grinding machine.
7. Typical Exercise on milling machine.
8. Typical Exercise on slotting machine.
9. Typical Exercise on Planning machine.
10. Production of threads with taps and threading dies and milling cutters.

11. Grinding of Tool angles using Cylindrical / Surface Grinding.
12. Study of geometrical tests on lathe machine.

Note: At least 10 experiments must be conducted in the semester.

Course-Code	Course Title						Core/ Elective
U24ME6L2	Heat Transfer Lab						Core
Prerequisites	Contact Hour per Week				CIE	SEE	Credit
	L	T	D	P			
Thermal Engineering Lab	-	-	-	3	25	50	1.5

Course Objectives:

The objective of the course is to:

1. Conduct experiments to evaluate heat transfer rates in conduction, convection, and radiation systems.
2. Determine thermal conductivity, emissivity, and overall heat transfer coefficients from experimental data.
3. Analyze the performance of heat exchangers, fins, and convection systems under different operating conditions.
4. Interpret transient heat conduction and phase change phenomena such as boiling and condensation.
5. Apply experimental techniques, data analysis, and error estimation in heat transfer systems.

Course Outcomes:

After completing the course, the student will be able to:

1. Perform steady state conduction experiments to estimate thermal conductivity of differentmaterials.
2. Perform transient heat conduction experiment.
3. Estimate heat transfer coefficients in forced convection, free convection, condensation and correlate with theoretical values
4. Obtain variation of temperature along the length of the pin fin under forced andfree convection.
5. Perform radiation experiments: Determine surface emissivity of a test plate and Stefan-Boltzmann's constant and compare with theoretical value.

List of Experiments:

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer in forced convection apparatus.
8. Heat transfer in natural convection
9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.

11. Stefan Boltzman Apparatus.
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Film and Drop wise condensation apparatus

Note: At least 10 experiments must be conducted in the semester.

Course Code	Course Title					Core / Elective
U24ME6P1	Mini Project					Elective
Prerequisite	Contact Hours Per Week			CIE	SEE	Credits
	L	T	P			
-	-	-	4	50	50	2

Course Objectives:

The objective of the course is to:

1. Enhance practical and professional skills.
2. Familiarize tools and techniques of systematic literature survey and documentation
3. Expose the students to industry practices and team work.
4. Encourage students to work with innovative and entrepreneurial ideas and its implementation.
5. Make students evaluate different solutions based on economic and technical feasibility

Course Outcomes:

After completing the course, the student will be able to:

1. Formulate a specific problem and give valuable and economical solution
2. Develop model/models either theoretical/practical/numerical form
3. Solve, interpret/correlate the results and discussions
4. Conclude the results obtained
5. Write the documentation in standard format

Guidelines:

1. As part of the curriculum in the VI- semester of the programme each student shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
2. Four students will be allotted to one faculty supervisor for mentoring.
3. Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
4. Mini projects shall have inter-disciplinary/ industry relevance, which can be implemented practically.
5. The students can select a mathematical modelling based/Experimental investigations or Numerical modelling
6. All the investigations should be clearly stated and documented with the reasons/explanations/Justifications.
7. The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and reference
8. Project Review Committee: Supervisor and a minimum of two faculty members.