

## Department of Mechanical Engineering

### 2<sup>nd</sup> Year 3<sup>rd</sup> Semester

<b>BS-M301: Mathematics III</b>	
CO1	Know the methodologies to solve partial differential equations.
CO2	Solve field problems in engineering involving partial differential equations.
CO3	Formulate and solve problems involving random variables.
CO4	Apply statistical methods for analyzing experimental data.

<b>BS-BIO301: Biology</b>	
CO1	Describe about the biological observations of 18 <sup>th</sup> century and highlight the underlying criteria of biology, such as morphological, biochemical and ecological.
CO2	Understand the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring and identify DNA as a genetic material in the molecular basis of information transfer.
CO3	Know about the structure and functioning of biomolecules.
CO4	Apply thermodynamic principles to biological systems and understand microorganisms.

<b>ES-ECE301: Basic Electronics Engineering</b>	
CO1	Understand the principles of semiconductor devices and their applications.
CO2	Design an application using operational amplifier.
CO3	Understand the working of timing circuits, oscillator, logic gates, flip flop as a building block of digital systems.
CO4	Learn the basics of Electronic communication system.

<b>ES-ME301: Engineering Mechanics</b>	
CO1	Develop ability to model and analysis of mechanical engineering systems using vectoral representation of forces and moments.
CO2	Know the basis of centroid and center of gravity.
CO3	Understand the basic dynamics concept: force, momentum, work, power and energy.
CO4	Demonstrate the kinetics of rigid bodies and the concept of vibration.

<b>PC-ME301: Thermodynamics</b>	
CO1	Apply energy balance to systems and control volumes, in situations involving heat and work interactions.
CO2	Evaluate changes in thermodynamic properties of substances.
CO3	Determine the performance of energy conversion devices.
CO4	Differentiate between high grade and low grade energies.

**PC-ME302: Manufacturing Processes**

CO1	Explain the process of making patterns, preparation of sand mould, various special casting processes and casting defects.
CO2	Describe different metal forming techniques, their applications and difficulties.
CO3	Understand machining operations, cutting tool geometry and basic of CNC machining.
CO4	Know the principles of different joining processes.

**PC-ME391: Practice of Manufacturing Processes**

CO1	Perform machining operations on lathe, milling machine, shaper and drilling machine.
CO2	Prepare pattern and mould for sand casting.
CO3	Execute forging and sheet metal operations.
CO4	Perform joining and fitting operations.

## 2<sup>nd</sup> Year 4<sup>th</sup> Semester

<b>ES-ME401: Materials Engineering</b>	
CO1	Identify crystal structures for various materials and understand the defects in such structures.
CO2	Quantify mechanical properties and demonstrate failure in materials.
CO3	Evaluate the state of the phases present in a material and its effect.
CO4	Understand the methods to tailor material properties of ferrous and non-ferrous materials.

<b>PC-ME401: Applied Thermodynamics</b>	
CO1	Understand the operation of various practical power cycles.
CO2	Analyze various heat cycles and psychrometry.
CO3	Evaluate energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors.
CO4	Demonstrate the phenomenon occurring in high speed compressible flow.

<b>PC-ME402: Fluid Mechanics &amp; Fluid Machines</b>	
CO1	Understand the mass and moment conservation laws for fluid flows and their applications.
CO2	Study the velocity and pressure variations in various types of simple flows.
CO3	Analyze mathematically various simple flow situations.
CO4	Evaluate the performance of pumps and turbines.

<b>PC-ME403: Strength of Materials</b>	
CO1	Understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads.
CO2	Analyze the elastic deformation occurring in various simple geometries for different types of loading.
CO3	Understand the development of internal forces and resistance mechanism for one dimensional and two-dimensional structural elements.
CO4	Understand the behavior of torsion, stresses and deformation in shafts and helical springs.

<b>PC-ME404: Metrology &amp; Instrumentation</b>	
CO1	Understand the working of linear, angular measuring and working of optical measuring instruments and fundamentals of limits and limit gauges.
CO2	Understand the basic idea of various methods for measurement of screw thread and surface finish parameters, advanced measuring devices and machine tool metrology.
CO3	Overview of mechanical measurement systems and principle of instruments for motion and dimension measurement.
CO4	Understand the working principle and applications of devices for measurement of force and torque; strain and stress and temperature.

<b>MC481: Environmental Science</b>	
CO1	Gain knowledge about environment and ecosystem.
CO2	Understand the natural resource, its importance and environmental impacts of human activities on natural resource.
CO3	Gain knowledge about the conservation of biodiversity and its importance.
CO4	Acquire awareness about problems of environmental pollution, its impact on human and ecosystem and control measures.

<b>PC-ME491: Practice of Manufacturing Processes and Systems Laboratory</b>	
CO1	Perform experiments on hydraulics/pneumatics and electronics systems.
CO2	Take measurement using standard gauges.
CO3	Select and use different measuring instruments and accessories as per requirement.
CO4	Understand the scope for errors and remedies during taking measurement of specimens.

<b>PC-ME492: Machine Drawing I</b>	
CO1	Draw and recognize standard engineering symbols.
CO2	Draw and analyze orthographic projection.
CO3	Draw and analyze isometric projection.
CO4	Draw and analyze assembly design.

### 3<sup>rd</sup> Year 5<sup>th</sup> Semester

<b>PC-ME501: Heat Transfer</b>	
CO1	Understand the three basic modes of heat transfer namely conduction, convection and radiation and analyze problems involving any of the three modes of heat transfer.
CO2	Analyze the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer.
CO3	Describe film wise & drop wise condensation, pool & flow boiling and analyze heat exchanger using LMTD and NTU approaches.
CO4	Analyze diffusion and convective mass transfer occurring in different applications.

<b>PC-ME502: Solid Mechanics</b>	
CO1	Understand the concept of tensors, stress and strain in Cartesian coordinate.
CO2	Learn different methods to formulate and solve stress-strain problems.
CO3	Demonstrate governing equations for stress and strain in cylindrical and spherical coordinates and axisymmetric problems.
CO4	Apply the problem solving knowledge to practical applications.

<b>PC-ME503: Kinematics and Theory of Machines</b>	
CO1	Understand the kinematics and rigid- body dynamics of kinematically driven machine components.
CO2	Understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link.
CO3	Understand the kinematics of power transmitting devices.
CO4	Understand the concept of vibration, effect of balancing and mechanism of stability.

<b>HM-HU501: Humanities I (Effective Technical Communication)</b>	
CO1	Understand the dynamics of Verbal and Non Verbal aspects of technical communication.
CO2	Practice multi-step writing process to plan, draft, and revise reports, correspondence, and presentations.
CO3	Know the ethical aspects of engineering and explain social and professional etiquettes.
CO4	Plan self-development and practice self-assessment to function on multi-disciplinary teams.

<b>MC ME501: Essence of Indian Knowledge Tradition</b>	
CO1	Understand the concept of Traditional knowledge and its importance
CO2	Know the need and importance of protecting traditional knowledge.
CO3	Know the various enactments related to the protection of traditional knowledge.
CO4	Understand the concepts of Intellectual property to protect the traditional knowledge.

<b>PC-ME591:Mechanical EngineeringLaboratory (Thermal) I</b>	
CO1	Analyze fluid flow through pipe and different flow meters.
CO2	Analyze performance characteristics of hydraulic machines.
CO3	Analyze fuel characterizations, performance of IC engines and vapor compression system.
CO4	Analyze thermal properties of a specimen.

<b>PC-ME592:Machine Drawing-II</b>	
CO1	Understand and apply the knowledge of machine drawing as a system of communication in which ideas are expressed clearly and all information fully conveyed.
CO2	Understand the design a system, component or process to meet desired needs within, realistic constraints such as manufacturability, economic, environmental, safety & sustainability etc.
CO3	Represent a part drawing and assembly drawing.
CO4	Identify, formulates, analyzes and solve engineering problems in optimum time.

<b>PW-ME581:Project-I</b>	
CO1	Learn project management skills.
CO2	Apply theoretical knowledge into practical solutions.
CO3	Identify and resolve problems through critical thinking and decision-making capabilities.
CO4	Learn to communicate effectively and develop teamwork approach.

### 3<sup>rd</sup> Year 6<sup>th</sup> Semester

<b>PC-ME601:Manufacturing Technology</b>	
CO1	Describe machines and related tools for manufacturing various components.
CO2	Understand the relationship between process and system in manufacturing domain.
CO3	Perform experiment on CNC machine.
CO4	Demonstrate rapid prototyping methods.

<b>PC-ME602:Design of Machine Elements</b>	
CO1	Remember different codes and standards for design with different materials.
CO2	Analyze failure in engineering products.
CO3	Demonstrate and analyze design criteria for different joints.
CO4	Evaluate design aspects of power transmission apparatus.

<b>PE-ME601/2A:Internal Combustion Engines and Gas Turbines</b>	
CO1	Describe the fundamental concepts, working principle and combustion phenomena of IC engine.
CO2	Explain the characteristics of different fuels and their combustion cycles.
CO3	Evaluate the performance of IC engines.
CO4	Illustrate the working principle of gas turbine, Jet propulsive engines and Rockets.

<b>PE-ME601/2G:Mechatronics</b>	
CO1	Model and analyze mechatronic systems for an engineering application.
CO2	Identify sensors, transducers and actuators to monitor and control the behavior of process or product.
CO3	Develop PLC programs for an engineering application.
CO4	Evaluate the performance of mechatronic systems.

<b>PE-ME601/2I:Material Handling</b>	
CO1	Demonstrate unit load calculation and selecting specification of some material handling system.
CO2	Illustrate constructional features of different material handling systems.
CO3	Describe the working principles and safety of various material handling systems.
CO4	Select a specific material handling system as per the required application.

<b>HM-HU601:Humanities II (OperationsResearch)</b>	
CO1	Apply linear programming tools for optimal utilization of resources in various types of industries.
CO2	Solve project management problems for optimizing cost and time.
CO3	Understand sequencing, inventory management and the concept of replacement.
CO4	Make decision in different situations and forecast demands.

<b>MC601:Constitution of India</b>	
CO1	Understand fundamental duties, integrity, ethics and responsibilities of engineers and develop legal literacy.
CO2	Demonstrate the structure and policies of state and central executives.
CO3	Understand electoral process and the powers and functions of Municipalities, Panchayats and Co-operative Societies.
CO4	Develop knowledge on special provisions and human rights.

<b>PC-ME691:Mechanical Engineering Laboratory(Design) II</b>	
CO1	Measure mechanical properties of materials.
CO2	Compare mechanical properties with logical explanation.
CO3	Illustrate motions of different kinematic pairs.
CO4	Characterize the dynamic behavior of mechanical system.

<b>PW-ME681:Project-II</b>	
CO1	Learn project management skills.
CO2	Apply theoretical knowledge to make innovative machine or product.
CO3	Identify and resolve problems through critical thinking and decision-making capabilities.
CO4	Learn to communicate effectively and develop teamwork approach.



## 4<sup>th</sup> Year 7<sup>th</sup> Semester

<b>PC-ME701:Advanced Manufacturing Technology</b>	
CO1	Differentiate the various non-traditional machining processes.
CO2	Demonstrate the principle of different non-traditional machining processes.
CO3	Understand the effect of process parameters for different non-traditional machining processes.
CO4	Demonstrate micromachining technology.

<b>PE-ME701/2A:Automobile Engineering</b>	
CO1	Understand the basic lay-out of an automobile.
CO2	Explain the operation of engine cooling, lubrication, ignition, electrical and air conditioning systems.
CO3	Illustrate the principles of transmission, suspension, steering and braking systems.
CO4	Demonstrate automotive electronics and latest developments in automobiles.

<b>PE-ME701/2E:Selection and Testing of Materials</b>	
CO1	Select materials for engineering applications.
CO2	Identify different material properties
CO3	Identify suitable testing technique to inspect industrial component.
CO4	Use different techniques and know their applications and limitations

<b>PE-ME701/2H:Advanced Welding Technology</b>	
CO1	Understand different types of welding processes used for different materials.
CO2	Demonstrate basic mechanism of different welding processes.
CO3	Evaluate the influencing factors for different welding processes.
CO4	Understand welding defects and various tests to judge soundness of the weld joint.

<b>OE-ME701A:Industrial Engineering</b>	
CO1	Describe productivity and various factors influencing productivity.
CO2	Understand different aspects of work system design and facilities design.
CO3	Explain production systems and their characteristics.
CO4	Apply the inventory management tools in managing inventory.

<b>OE-ME701D:Non-Conventional Energy Resources</b>	
CO1	Know about the energy scenario at present and the need of using renewable energy for sustainability.
CO2	Demonstrate different sources of non-conventional energy.
CO3	Understand the generation and storage of energy from non-conventional sources.
CO4	Illustrate the applications and limitations of different non-conventional energy resources.

<b>HM-HU701:Economics for Engineers</b>	
CO1	Understand economic decisions making criteria.
CO2	Know basic principles of engineering costs and estimation.
CO3	Illustrate the concept of depreciation and inflation.
CO4	Understand basic accounting principles.

<b>PC-ME791:Mechanical Engineering Laboratory III (Manufacturing)</b>	
CO1	Perform quantitative and qualitative analysis of conventional manufacturing processes.
CO2	Understand the working of a robot and its programming.
CO3	Perform programming on CNC machine.
CO4	Perform non-conventional machining and additive manufacturing.

<b>PW-ME781:Project-III</b>	
CO1	Learn project management skills.
CO2	Apply theoretical knowledge to design and formulate a machine or a product.
CO3	Identify and resolve problems through critical thinking and decision-making capabilities.
CO4	Learn to communicate effectively and develop teamwork approach.

## 4<sup>th</sup> Year 8<sup>th</sup> Semester

<b>PE-ME801/2B:Power Plant Engineering</b>	
CO1	Understand functions of the various components of power plant.
CO2	Illustrate the working of nuclear, thermal and gas based power plants.
CO3	Evaluate the design layout and working of hydroelectric power plants.
CO4	Estimate the feasibility and its implications on power generating units.

<b>PE-ME801/2E:Tribology</b>	
CO1	Acquire the fundamental knowledge in the field of Industrial tribology.
CO2	Demonstrate friction and wear mechanism in engineering components.
CO3	Describe different types of lubrication and their applications.
CO4	Understand basic concept of surface engineering.

<b>PE-ME801/2G:Micro and NanoManufacturing</b>	
CO1	Understand different micromachining and micro-manufacturing techniques.
CO2	Describe the application of different micromachining and micro-manufacturing techniques.
CO3	Comprehend nanotechnology by molecular or atomic manipulation.
CO4	Illustrate various application areas of some nanomaterials.

<b>OE-ME801/2A:Total Quality Management</b>	
CO1	Understand quality management philosophies, techniques, and frameworks.
CO2	Know various TQM Principles.
CO3	Apply tools and techniques of TQM in manufacturing and service sectors.
CO4	Understand the implications of quality management standards and systems.

<b>OE-ME801/2D:Industrial Pollution and Control</b>	
CO1	Know about the various types of pollution caused by the industries and their effects on the environment.
CO2	Know specifically about the causes, processes and control techniques of air pollution.
CO3	Know specifically about the causes, processes and control techniques of water pollution.
CO4	Know specifically about the causes, processes and control techniques of noise pollution.

<b>OE-ME801/2J:Cyber Security</b>	
CO1	Understand, appreciate, employ, design and implement appropriate security technologies and policies to protect computers and digital information.
CO2	Identify & Evaluate Information Security threats and vulnerabilities in Information Systems and apply security measures to real time scenarios.
CO3	Identify common trade-offs and compromises that are made in the design and development process

	of Information Systems.
CO4	Demonstrate the use of standards and cyber laws to enhance information security in the development process and infrastructure protection.

<b>PW-ME881:Project- IV</b>	
CO1	Learn project management skills.
CO2	Apply theoretical knowledge to fabricate and analyze newly developed machine or product.
CO3	Identify and resolve problems through critical thinking and decision-making capabilities.
CO4	Learn to communicate effectively and develop teamwork approach.

<b>PW-ME882:Comprehensive Viva-Voce</b>	
CO1	Understand area of strength and weakens in the mechanical engineering domain.
CO2	Enhance interview skills.
CO3	Recognize area of interest.
CO4	Prepare themselves for competitive exams.