- **Department Name :- Mechanical Engineering**

- **UG Program Name :- B.Tech. Mechanical Engineering**

- **Vision and Mission :-**

  Vision:

  To be a centre of excellence in the field of Mechanical Engineering where quality education and research synergize.

  Mission:

  To transform the students of the department into highly motivated and ethical engineers, technologists, researchers and entrepreneurs who will contribute to uplift the society in collaboration with industry and academia.

Sr. No.	Program Outcomes
1.	Apply the knowledge of mathematics, science, engineering fundamentals, and mechanical engineering to the solution of complex engineering problems.
2.	Identify, formulate, review research literature, and analyze complex mechanical engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3.	Design solutions for complex mechanical engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4.	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5.	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex mechanical engineering activities with an understanding of the limitations.
6.	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7.	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8.	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9.	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10.	Communicate effectively on complex mechanical engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11.	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12.	Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

Sr. No.	Program Specific Outcomes
1.	Use Company standards, national and international standards like IS BS, SAE, ISO, ASTM etc for designing and manufacturing of mechanical components and systems.
2.	Engage professionally in industries or as an entrepreneur by applying manufacturing, design, thermal and management practices.

Semester	Course Name	Course Code	Course Outcome
Semester-III	Engineering Mathematics -III		Identify the type of differential equations (Ordinary / partial, order and degree, linear/ Nonlinear, homogeneous / non-homogeneous, with constant / variable coefficients etc.)
			Apply appropriate method of solution to the given differential equation.
			Apply the techniques of solution of higher order linear ordinary differential equation to solve specific engineering problems.
			Define and describe what Laplace transform and inverse Laplace transform of a function is and apply rules of Laplace and Inverse Laplace transforms to find transform given expressions using transform and inverse transform of standard functions.
			Explain and identify random variables, discriminate between discrete and continuous Random variables; Define and fit probability distributions for the given frequency Distributions for discrete and continuous random variables.
			Determine the real roots of algebraic and transcendental equations using various numerical methods.
		ME2011	Understand the applications of engineering thermodynamics in real life situations

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	Applied Thermodynamics		Develop fundamental understanding of applied thermodynamics in an engineering perspective and how to integrate it with other subjects in engineering practice.
			Demonstrate an understanding of the construction of thermodynamic property tables and the capability to determine changes in enthalpy, entropy and internal energy using a suitable equation of state.
			Understand the properties of pure substances
			Formulate, model, and solve problems involving systems and devices having various forms of energy exchange and energy conversion.
			Discuss thermodynamics in a logical and general way.
	Electrical Technology	ME 209	Explain the constructional features of D.C. motors.
			Apply the fundamental formulae learned.
			Describe the constructional features of 3 phase induction motors.
			Apply the formulae and do the calculations to find different parameters of 3 phase induction motors.
			Select the appropriate machines suitable for different applications.
			Explain electric power utilization for various electric drives, electric heading and electric welding.
	Fluid Mechanics	ME2051	Define, calculate and measure properties of fluid.
			Identify different types of flows & forces acting on fluid /by fluid.
			Apply basic fluid mechanics equations for different flow system.
			Estimate different energy losses in fluid flow.
			Explain & calculate forces acting on body submerged in fluid.
	Manufacturing Processes	ME2071	Select casting as manufacturing process suitable for the component manufacturing and its production volume
			Select suitable Engineering forming process for production of component of required specification
			Select suitable Joining process for the joining of the two components of required specification.
			Illustrate the plastic molding process.
	Environmental Science	SH2011	Avoid over exploitation of natural resources and follow the environmental ethics.
			Do the sustainable practices for sustainable development.
			Protect environment and prevent environmental pollution.

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			Apply their knowledge and skills to solve their environment related problems.
			Understand the importance and sensitivity of Environment
	Applied Thermodynamics Lab ME2511	ME2511	Work efficiently in a group, integrating skills and knowledge to make decisions in the performance of tasks, adopting a responsible and organized attitude to work and a willingness to learn.
			Apply the basic concepts of Thermodynamics to carry out professional engineering activities in the field of power plants.
			Conduct the test for determining lubricant properties like redwood viscosity, aniline point, flash & fire point, cloud & pour point, carbon residue, grease penetration number dropping point etc.
	Computer Programming C++	ME2531	Divide the problem into objects & build the Object Oriented Program
			Elaborate the concept of Function and Operator Overloading
			Modify/Extend the program by using Inheritance
			Increase the speed of program by proper memory management using Pointers, Constructor & Destructor
			Handle different file operations
			Write programme to draw simple geometric shapes
	Fluid Mechanics and Electrical Technology Lab	ME259	Measure Pressure, Discharge and head of Fluid.
			Measure and calculate Head loss of fluid.
			Calibrate discharge measuring instruments in Hydraulics.
			Perform different tests on D.C.shunt motor & calculate related parameters.
			Perform different tests on 3 phase induction motor & calculate related parameters.
	Machine Drawing Lab	ME2551	Recognize the significance and draw BIS conventions, types of section and welding symbols.
			Identify & draw the proportionate dimension and free hand sketches of various engineering components.
			Prepare details & assembly drawing from given detail drawings.
			Prepare the manufacturing drawing.
			Identify appropriate limits, fits , tolerances, tolerances of form & position, surface finish symbols for given

Semester	Course Name	Course Code	Course Outcome
			machine components & incorporate the same in the orthographic drawing of given machine component.
			Identify & draw the curves of interpenetration.
	Mini Project (Environmental Science) ME261	ME261	Demonstrate effect of variables such as voltage, current on welding process.
			Produce given joint by MIG welding process.
			Produce welding run on S.S. by TIG welding.
			Produce welding run on Aluminium by TIG welding.
			Produce given job with proper external taper and V threading within dimensional tolerances.
	Workshop Practice –III	ME2571	evaluate the solutions from the perspective of sustainable development
			apply their knowledge and skills to solve their Environmental related problems
			Participate effectively in the own and cross disciplinary groups
			Provide solutions to Environmental problems related to Mechanical Engineering Field
			Identity the environmental related problems in the field of Mechanical Engineering
Semester-IV	Mechanics of Deformable Bodies	ME212	Understand the different modes of failure and the stresses developed
			Find the principal stress and principal plane for plane stress system and Derive & apply the torsion, flexure and Euler's formula for determinate shafts.
			Evaluate and apply the shear force and bending moment by different techniques.
			Derive bending stress distribution and shear stress distribution for various cross sections of beam.
			Find the deflection of beams by double integration method and moment area method.
			Analyse axially loaded column and derive & use strain energy method.
	Fluid & Turbo Machinery	ME2041	Explain construction and working of different types of turbines, centrifugal pump & compressors
			Evaluate different efficiencies; power developed and discharge requirement of turbine.
			Sketch velocity triangles & estimate performance of pumps.
			Explain concept of model testing for performance of turbomachines.

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			Compute different efficiencies of reciprocating & rotary compressor
			Select proper fluid & turbo Machine for various operation
	Material Science	ME2061	Deduce mechanical properties from crystal structures of material.
			Draw equilibrium diagram for different alloy systems using cooling curves.
			Calculate the amount of phases present in any alloy using Lever arm principle.
			Tabulate different phases, temperatures and transformations on Fe-Fe3C diagram.
			Explain TTT and CCT diagrams for steel and effect of various alloying elements on these diagrams.
			Illustrate different transformations during heat treatment of steel.
			Explain and discriminate different heat treatment processes based on their applications
			Illustrate different heat treatment furnaces and controlled atmospheres.
			Prepare flow chart for different components made by powder metallurgy
			Explain different destructive and Non-destructive testing methods.
	Machine Tools and Processes	ME214	Illustrate machine tools like lathe, capstan & turret lathe etc.
			Identify the main parts of machine tools like drilling & boring machine.
			Demonstrate various mechanisms used on the capstan & turret lathes.
			Prepare tooling layout for capstan & turret lathe.
			Explain shaping, planning, milling, grinding & broaching machines with neat sketch.
			Distinguish shaping & planning processes.
			Explain non-conventional machining methods.
			Describe plastic processing methods with neat sketches.
			Discuss ceramic processing methods.
	Kinematics of Machines	ME2101	Identify Kinematic pair, kinematic chains, mechanisms and inversions
			Draw the velocity and acceleration diagram of a given mechanism.
			Interpret the results obtained by velocity and acceleration analysis by different methods.
			Derive SVAJ functions to fulfil cam design specifications.
			Illustrate the use of flywheel and governor.
			Analyze the controlling force and stability of governor.

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			Analyze the gear system used in engineering applications.
	Kinematics of Machines and Material Science Lab	ME2521	Determine M.I of irregular shape bodies experimentally.
			Design mechanism to fulfil motion generation.
			Determine the positions, velocities and acceleration of links of mechanism.
			Generate Involute gear tooth profile.
			Illustrate stress strain diagram for mild steel
			Use Rockwell Hardness testing machine to measure hardness of material
			Test materials for their impact strength.
			Judge mechanical properties from microstructure of steel and cast iron
			Compare various heat treatment processes of steel
	Workshop Practice – IV	ME2541	Demonstrate effect of variables such as speed, feed and depth of cut on machining process.
			Produce given job with proper taper fitting and within dimensional tolerances $\pm$ 0.2 mm on diameter and $\pm$ 0.5 mm on length.
			Produce given job with proper V threading fitting and within dimensional tolerances $\pm$ 0.2 mm on diameter and $\pm$ 0.5 mm on length.
			Produce given job of square threading of given specification.
	Fluid and Turbo Machinery Lab	ME2561	Conduct trial &Calculate performance parameters of turbine, centrifugal pumps and reciprocating pump, reciprocating compressor & blower.
			Draw & compare performance characteristics curves with their theoretical nature in case of Pelton wheel, Fransis turbine, Kaplan turbine, centrifugal pumps and reciprocating compressor.
			Explain construction & working of gear pump, vane blower, Hydraulic accumulator, intensifier, hydraulic ram.
	CAD Modelling and Drafting ME	ME2581	Creating sketches of simple machine parts and components
			Construction of simple machine parts and components
			Creating mechanical assemblies of parts.
			Generations of drawing views, editing and modification of drawing views and adding dimensions text to the drawings.
			Creating of surface features and different style tools.
	Professional Skills Development – I	SH2511	Prepare professional image perception as reality.
			Develop personality traits.
			Strategize and develop skill to build self-esteem and positive attitude
			Imbibe integrity and ethics.
			Broaden think tanks on entrepreneurial skills.

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			Apply English as a language for specific purposes.
Semester V	Dynamics of Machinery	ME3011	Identify and investigate the stability of spinning bodies due to gyroscopic effect.
			Apply the theoretical knowledge to balance the rotary and reciprocating systems.
			Apply different principles to convert physical vibratory system into a mathematical model.
			Recognize the suitable method for minimizing or elimination the vibration from the system.
			Identify the effect of external excitation on the system and effect of dampers to control the system vibration.
			Recognize the whirling speed conditions of shaft and methods to eliminate it.
	Heat and Mass transfer	ME3031	Differentiate the modes of heat transfer with appropriate governing laws and explain importance of thermal conductivity, heat transfer coefficient etc.
			Derive the general heat conduction equations in Cartesian coordinate system, critical radius insulation of cylinder and sphere, and solve steady state one dimensional heat conduction problem.
			Derive expression heat transfer from pin fin for different condition and calculate heat transfer, efficiency, effectiveness of pin fin Also Solve unsteady state problem
			State and explain different laws, terms related to radiation heat transfer and determine heat exchange between two bodies.
			Explain hydrodynamic, thermal boundary layer and analyze forced and natural convection problem by dimensional analysis procedure and solve problem based on it.
			Analyze heat exchanger by LMTD and NTU method and solve problem based on it, also explain the phenomena like boiling, condensation, mass transfer.
	Design of Machine Components	ME3051	Select engineering materials and proper theory of elastic failure while designing the component.
			Design simple mechanical components, bolted and welded joints at transverse and eccentric loading conditions.
			Design the shaft on strength and rigidity basis and the keys.
			Deign the spring and select the proper type of spring as per application.
			Design the Power screw.
			Design flywheel and flat belt, V belt as per the standard manufacturer's
		ME3071	List various elements of feedback control system

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	Control Engineering		Representation of control systems mathematically and by block diagrams.
			Construct direct and inverse analogue for mechanical and electrical system.
			Solve problems on linearization of nonlinear function.
			Draw steady state curves for control system.
			Reduce given block diagram using block diagram algebra.
			Apply various mathematical tools to express control systems and analyze response to various input conditions.
			Check stability of the system using Routh's stability criteria.
			Prepare root locus for given system function.
			Use various programming methods for state space representation of the
			Explain the mechanism of metal cutting.
			Analyze the effect of various parameters such as process variables, cutting tool materials etc. on the performance of machining.
	Manufacturing Engineering	ME3091	Identify and recognize the importance of the various elements of tool geometry of single and multipoint cutting tools.
			Explain the design principles common to jigs and fixtures.
			Design jig for given component.
			Design fixture for given component.
			Design press tool for cutting press working operations
			Design press tool for forming press working operations.
	Workshop Practice – V	ME3511	Demonstrate effect of variables such as speed, feed and depth of cut on machining process
			Produce given job with proper taper fitting and within dimensional tolerances $\pm$ 0.1 mm on diameter and $\pm$ 0.2 mm on length. (Job A)
			Produce bearing diameter on job a maintaining fit H7g6.
			Produce Gear Teeth - Job B on Milling Machine as per specifications.
			Produce Job C to fit Job A with proper threading fitting on Turret.
			Prepare process sheet for all Jobs
	Dynamics of Machinery Lab	ME3531	To identify and investigate the stability of spinning bodies due to gyroscopic effect.
			To apply the theoretical knowledge to balance the rotary and reciprocating systems.
			To determine natural frequency, damped frequency and resonant frequency of any vibratory system.

Semester	Course Name	Course Code	Course Outcome
			To recognize the whirling speed conditions of shaft and methods to eliminate it.
			To determine natural frequencies and mode shapes of vibratory system with two degree of freedom.
	Heat and Mass Transfer Lab	ME3551	Calculate thermal conductivity of metal and insulating powder experimentally, and compare it with standard
			Compare theoretical and experimental values of heat transfer from composite wall.
			Calculate the fin efficiency for short and insulated tip fin experimentally
			Calculate heat transfer coefficient in natural and forced convection experimentally, compare it with standard correlation.
			Calculate emissivity , Stefen Boltzman constant experimentally and compare it with standard
			Calculate effectiveness of Heat Exchanger (parallel flow and counter flow arrangement)
	Professional Skills Development – II	SH3511	To describe the importance, for industry and the community, of ethical conduct.
			To be provided the skills with which to recognize and resolve ethical issues while working.
			To be able to enhance awareness and critical self-examination of one's own values, and to appreciate the relevance of personal values in the /workplace.
			To be able to apply engineering ethics to their workplace.
			To be able to apply and evaluate the behaviour / working of organizations based on normative ethical framework.
Semester VI	Machine Design	ME3021	Design machine components under fluctuating loads
			Draw and use Soderberg's and Goodman Diagram.
			Design components considering creep and fracture criteria
			Design spur and helical gears under beam strength and wear strength.
			Apply principles of interaction of materials processing and design.
			Design / select rolling contact and sliding contact bearing.
	Internal Combustion Engines	ME3061	Classify engines and define different performance parameters of the engine.
			Analyze and differentiate between theoretical air standard, theoretical fuel air and actual cycles.
			Calculate the required air-fuel ratio under different operating conditions.
			Outline the requirements of fuel systems of SI and CI engines.

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			Explain the stages of combustion in SI and CI engines and differentiate between detonation and knocking.
			Prepare heat balance sheet and Show the distinct operating characteristics of different IC engines.
			Justify the need of alternative fuels and compare with the standard emission norms.
	Metrology and Quality Control	ME3081	Recognize the importance of Metrology and take the linear measurement by using instruments
			Evaluate the limits fits and tolerances for the component Design The limit gauge by using Taylors Principle
			Examine surface finish and use measurement techniques for surface finish measurement
			Describe screw thread terminology, measure screw thread dimensions and detect errors in screw thread measurements
			Describe the principle and working of CMM
			Discuss the measurement system analysis
			Explain Quality Control concepts and analyze by using X bar chart and R and P
			Describe the advance quality tools used in the industry such as PPAP,APQP,FMEA
	Engineering Management	ME3101	Recognize the factors that influence industrial and business environment and visualize their effect on business
			perceive the factors required to develop a business framework
			justify importance of business excellence models on world class business development
			elaborate different business growth strategies
			Appraise the scope and objectives of functional areas of business and their integration
			Apply engineering economics principles for evaluation of business
			Identify several ways in which financial accounting information is used to make business decisions
			Identify appropriate sources of finance and financial institutions
	PE I Biomechanics	ME3121	Apply mechanics of material in medicine.
			Apply principles of dynamics in circulatory system by using biological properties
			Model anatomical systems in to mechanical system and perform force analysis
			Select appropriate bio-materials based on functional requirement
			Investigate bio-mechanical aspects of accidents
			Discuss use of several bio-instruments
			Describe Material handling system.

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	PE I Material Handling Equipment Design	ME3141	Select suitable material handling system for different applications.
			Design Hoists, Cranes and their components
			Design of load lifting attachments
			Choose the systems and Equipments used for Material Storage
			Review of Material Handling / Warehouse Automation and Safety considerations
	PE I World Class Manufacturing	ME3201	Illustrate relevance and basics of World Class Manufacturing.
			Relate factors of competitiveness and performance measures based on which, global manufacturing success is bench marked.
			Explain the different systems and tools for world class manufacturing
			Discuss the role of human resource in world class manufacturing strategy formulation
			Design and develop a roadmap to achieve world class manufacturing status.
			Describe the role of total quality management in taking a firm to the world class level.
	PE I Recycling and Regeneration Technology	ME3221	Recycle the waste properly and use it as resource.
			Design the system for overall recycle process.
			Describe various processes to recover the energy from waste
			Explain the process of recovering industrial resources from waste effluents
			Explain identification, collection and separation method for recover various materials, plastics from waste
	Machine design Lab	ME3521	Design spur and helical gears under beam strength and wear strength criteria.
			Apply principles of interaction of materials processing and design.
			Select rolling contact bearing.
			Prepare production Drawing using AutoCAD / CATIA, etc.
	Advanced Machining Lab.	ME3541	Write and explain CNC program.
			Describe CNC Turning and Milling Machines.
			Simulate Taper Turning, Step Turning and Threading CNC Programs.
			Simulate CNC Milling Program for surface finishing, drilling and threading.
			Demonstrate CNC EDM Machine.
			Enter program into CNC Machine, perform Set-up operation and execute it
		ME3561	Recognize the various parts, systems of IC engine, and disassemble an IC engine.

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	IC Engine lab		Perform various tests on different engines; plot various operating characteristics and compare it with standards.
			Demonstrate and differentiate between fuel system of SI and CI engines.
	Metrology, Quality Control, and Measurement lab	ME3581	Use Vernier Calliper, Vernier Height Gauge, and Micrometer, V-block for accurate linear and angular Measurement
			Demonstrate and use the tool makers Microscope for the measurement of screw thread terminology
			Measure the flatness and straightness using Auto collinometer
			Measurement of screw thread parameter using floating carriage micrometer.
			construct the X bar, R chart, P chart to check the process capability
			Use load cell for measurement of Force.
			Select suitable tachometer for speed measurement.
			Discriminate temperature measuring devices using different criteria's.
			Conduct calibration of thermocouple.
			Conduct an experiment on dead weight pressure gauge tester.
	Mini Project-II/ EPICS project	ME3601	Identify real-life problems faced by local community related to mechanical engineering and identify the areas for innovation.
			Conduct literature review related to identified problem.
			Acquire the requisite skills to deal with social issues through innovative and sustainable solutions considering technical, safety and environmental issues.
			Show ability to participate in team discussions and share responsibilities while carrying out the project work / assignments.
			Develop communication, analytical thinking and decision making skills to become more effective and creative leaders.
			Write technical report and give oral presentation.
	Field Training	ME3621	Demonstrate the use, interpretation and application of an appropriate international engineering standard in a specific situation.
			Analyze a given engineering problem, identify an appropriate problem solving methodology, implement the methodology and propose a meaningful solution.
			Apply prior acquired knowledge in problem solving.
			Recognize various modelling, analysis and validation techniques, manufacturing tools and processes,

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			management techniques, Professional ethics adopted at industries.
			Identify and communicate solution to problems (oral, visual, written) effectively.
			Device a project within a given time frame.
Semester VII	Industrial Engineering	ME4011	Recognize the position, scope and objectives of Industrial Engineering in organizations.
			Apply industrial engineering tools to improve the productivity
			Decide the plant location and design the appropriate type of layout and recommend Suitable material handling system.
			Use tools like capacity and aggregate planning to Plan and control production
			Design the inventory systems using appropriate applicable models
			Analyze the projects using various project management techniques
	Mechanical system design	ME4031	Select brake and clutch based on functional requirements of automobile transmission systems.
			Use of IS code for selection of pressure vessel.
			Design of IC Engine components.
			Select site for wind turbine and compute efficiency of wind turbine.
			List the different material handling equipment and design conveyor systems.
			Elaborate the significance of the stepped regulation in machine tools and design the machine tool gearbox.
	Mechatronics ME4021	ME4021_1	Demonstrate the importance of integration of Mechanical, Electronics, computers and control in the design of Mechatronics system.
			Describe/identify key elements of sensors and transducers and techniques of interfacing with PLC, Microprocessor, Microcontroller etc.
			Apply a systematic approach to the design process for Mechatronics systems. (Concurrent engineering).
			Create system modelling of basic models and analyze.
			Demonstrate the practical application of mechatronics systems in areas such as manufacturing, automobile systems and robotics.
			Develop the capacity to think creatively and independently about new design problems and challenges

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	Refrigeration and Air Conditioning	ME4041	Illustrate various refrigeration methods
			Analyze performance of refrigeration systems.
			Plot various refrigeration and air conditioning processes using charts and tables.
			Select suitable refrigerant for refrigeration and air-conditioning system.
			Design air conditioning system for various applications.
	PE II Mechanics of composite material	ME4171	Choose suitable composite materials based on field applications
			Explain different fabrication processes and perform cost comparison
			Explain characteristics of the reinforcement and comment on properties of composite
			Design sandwich structures as per the functional requirement
			Predict failure of composite laminates by selecting appropriate failure criteria
			Illustrate the use of advanced materials and their limitations
	PE II Cryogenics	ME4251	Discuss the properties of materials and cryogenic fluids at low temperature.
			Criticize cryogenic Liquefaction systems.
			Describe Cryogenic Refrigeration Systems OR Cry coolers.
			Calculate performance of gas separation systems
			Explain the methods of fluid storage, transfer and insulation of cryogens.
			Summarize the applications of low temperature engineering in various fields.
			Explain vacuum technology and various measurement systems used for temperature, pressure, mass flow rate, fluid level measurement.
	PE II New product design & development	ME4271	Identify the new product opportunities and sources of new product ideas.
			Understand the product life cycle and product design process.
			Integrate the customer and end-consumer needs into design process.
			Apply the concepts and tools like DFMA,VE and QFD in design process
			Assimilate the various product characteristics to design a novel product
			Participate in group work sessions and teams to become acquainted with the importance of teamwork

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			and collaboration that is critical to new product success.
	Additive Manufacturing	ME4291	Recognize the Importance of AM technologies in Manufacturing
			Classify and select additive manufacturing processes for a given application.
			Design for manufacturing of AM and conduct Process Analysis
			Identify software issues related to additive manufacturing process.
			Identify the Different methods for Post-processing of AM parts
			Recognize the Applications of AM in Automobile, Aerospace, and Bio-medical etc.
	PE III CIMS	ME4311	Describe and classify computer integrated manufacturing systems (CIMS)
			Recognize socio-economic impact of CIMS
			Explain principle of operation of CNC machine
			Describe part family forming methods
			Perform quantitative analysis of Flexible Manufacturing Systems (FMS)
			Analyze various computer integrated planning and control techniques.
			Explain various computer aided quality control (CAQC) methods.
	Mechatronics Laboratory	ME4561	Demonstrate/select proper types of sensors/transducers for given task.
			Design signal conditioning circuits for various signal conditioning processes like signal level change, signal form change, filters, bridge circuits etc.
			Demonstrate ability of control and automation of simple devices such as motors, cylinders using PLC.
			Demonstrate the ability to create microcontroller programs and properly interface them to input and output devices.
	RAC Laboratory	ME4581	Examine various components of refrigeration and air conditioning systems.
			Estimate and compare the performance of various refrigeration systems.
		ME4671	Develop prototype of any engineering prototype by using 3-D printer
			Synthesize & Test composite

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	Advanced Testing Laboratory		Determine coefficient of friction or abrasive wear of any type of material.
			Measure SPL of any mechanical system
			Determine damping factor of simple engineering components
			Characterize any engineering material
			Synthesize and Characterize smart material
			Determine the composition of any metal
			Measure surface roughness of a machined component
			Measure cutting forces developed during machining operations
			Measure micro hardness of any material
	Software training I	ME4711	Use effectively modules of the software related to design, analysis and synthesis
			Develop solution for the Mechanical engineering problem using the software.
	Software Training II	ME4721	Use effectively modules of the software related to design, analysis and synthesis
			Develop solution for the Mechanical engineering problem using the software
	Capstone project phase I	ME4731	Convert an open ended problem statement into a statement of work or a set of design specifications
			Decompose problem/task into subtasks, prioritizes subtasks, and establishes a timetable and milestones by which progress may be evaluated
			Select and apply appropriate models, or simulations of the real world and analyzes output of models/simulations to provide information for decisions
			Collaborates with team members of diverse background and perspectives
			Collaborate with team members to achieve a common goal
Semester VIII	PE III Finite Element Method	ME4051	Apply various approximate methods to solve Linear differential equations appearing in the field of solid mechanics and heat transfer from the perspective of finite element analysis
			Select suitable element for a particular type of problem and comment on convergence requirement to obtain better accuracy
			Formulate the structural problems and illustrate the use of interpolation function to derive shape functions
			To develop stiffness matrix and also load vectors of problems related to elasticity and heat transfer.

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			Estimate primary field variable and use them to calculate secondary variables.
			Compare linear element with higher order element and comment on significance of using higher order element.
	PE III Experimental Mechanics	ME4071	Use polariscope for finding stresses in machine component.
			Analyze the photo elastic data by various methods.
			Determine the strains and stresses in photo elastic coating by using reflection polariscope.
			Use strain gauge for measurement of strains/stresses.
			Design strain gauge transducers.
	PE III Automobile Engineering	ME4091	Summarize different types of automobile power plants, vehicle layout and vehicle body.
			Estimate performance of automobile.
			Explain transmission system.
			Describe braking system.
			Explain steering and suspension system.
			Discuss different electronic and electrical system.
	PE III Industrial hydraulics & pneumatics	ME4111	Describe the structure and function of common hydraulic and pneumatic components such as cylinders, valves, pumps and motors.
			Model hydraulic components, pneumatic components and simple systems quantitatively.
			Create simple hydraulic and pneumatic circuit diagrams for different applications.
			Choose and dimension suitable hydraulic and pneumatic components for different applications.
			Analyze common hydraulic and pneumatic components such as cylinders, valves, pumps and motors.
			Construct simple hydraulic and pneumatic systems.
			Analyze simple hydraulic and pneumatic systems.
	PE III Computational techniques	ME4131	Obtain solution of linear simultaneous and nonlinear system.
			Use technique of interpolation and extrapolation.
			Solve complicated integral and differentiation problems.
			Develop a correlation for experimental data and estimate uncertainty.
			Apply techniques to find solution for ODE.
			Apply techniques to find solution of boundary value problems.
			Explain different fabrication processes and perform cost comparison
			Explain characteristics of the reinforcement and comment on properties of composite

Semester	Course Name	Course Code	Course Outcome
			Design sandwich structures as per the functional requirement
			Predict failure of composite laminates by selecting appropriate failure criteria
			Illustrate the use of advanced materials and their limitations
	New product design & development	ME4271	Identify the new product opportunities and sources of new product ideas.
			Understand the product life cycle and product design process.
			Integrate the customer and end-consumer needs into design process.
			Apply the concepts and tools like DFMA,VE and QFD in design process
			Assimilate the various product characteristics to design a novel product
			Participate in group work sessions and teams to become acquainted with the importance of teamwork and collaboration that is critical to new product success.
	ME4311 PE III CIMS	ME4311	Describe and classify computer integrated manufacturing systems (CIMS)
			Recognize socio-economic impact of CIMS
			Explain principle of operation of CNC machine
			Describe part family forming methods
			Perform quantitative analysis of Flexible Manufacturing Systems (FMS)
			Analyze various computer integrated planning and control techniques.
			Explain various computer aided quality control (CAQC) methods.
	Finite Element Method Laboratory	ME4551	Identify suitable element based on physics of the problem so that real world problems can be converted to finite element model with accurate approximation.
			Apply and select suitable boundary conditions and loading conditions depending upon the field applications such as structural or heat transfer problem.
			Analyze and suggest the critical load that can be taken by a mechanical member by using FEM software
			Write a computer program using MATLAB code for one and two dimensional problem
	Experimental Mechanics Laboratory	ME4571	Use of transmission polariscope for measurement of stresses in machine components.
			Apply reflection polariscope technique for measurement of strain/stress in photoelastic coating.
			Use strain gauge technique in various applications
		ME4591	Explain the structure of an automobile.

Semester	Course Name	Course Code	Course Outcome
	Automobile Engg Laboratory		Describe and Design transmission systems of an automobile.
			Demonstrate and select different types of an automobile system.
			Test wheel balancing and wheel alignment.
			Model any automobile system/component.
	Industrial hydraulics & pneumatics Laboratory	ME4611	Demonstrate various components of Hydraulics & Pneumatics System along with standard symbols.
			Design simple circuits & circuits for automation.
			Use software to design & simulate the fluid power circuits.
	Computational techniques Laboratory	ME4631	Obtain solution of linear simultaneous and nonlinear system.
			Use technique of interpolation and extrapolation.
			Solve complicated integral and differentiation problems.
			Develop a correlation for experimental data and estimate uncertainty.
			Apply techniques to find solution for ODE.
			Apply techniques to find solution of boundary value problems
	Tribology	ME4101	Recognize the laws of friction, mechanisms of friction and appreciate the various modes of wear.
			Evaluate hydrostatic and squeeze film lubrication.
			Design hydrodynamic thrust bearing
			Analyze elasto-hydrodynamic lubrication.
			Select gas lubricated bearings.
	Automation and robotics	ME4141	Recognize manufacturing automation and Advanced Automation Functions
			Perform quantitative analysis of transfer lines for its efficiency and effect of breakdowns.
			Perform quantitative analysis of Assembly lines for its efficiency and effect of defective components.
			Explain need, meaning and classification of robotics and its control systems.
			Explain robot end effectors and sensors.
			Develop robot programs.
			Perform robot economic analysis
	Production and operations mgmt	ME4181	Select appropriate production and operations strategies based on situation
			Estimate the demand using appropriate forecasting techniques.
			Plan the capacity based on the demand pattern and prepare the manufacturing schedule based on the production plan using various tools and techniques.

Semester	Course Name	Course Code	Course Outcome
			Apply the tools of lean and JIT manufacturing to manufacturing and service operations.
	Capstone Project Phase II	ME4741	Fabricate project or experimental setup or model and analyze output of model/ simulations to provide information's for decisions
			Perform feasibility analysis and uses result to choose candidate solution and evaluates quality of solutions to select the best one
			Produce usable documents of record regarding design process and design state
			Collaborates with team members of diverse background and perspectives
			Collaborate with team members to achieve common Goal