Course Outcome (COs) of ME Department	
Department of Mechanical Engineering	
3ME-201	**Advanced Engineering mathematiME Year of study: 2020-21**
CO1	Apply a range of mathematical theorems and methods to solve routine and complex analytic and applied problems
CO2	Analyze data necessary for the solution of engineering problems
CO3	Examine the effectiveness of proposed solutions to identified engineering problems.
3ME-102	**Technical Communication Year of study: 2020-21**
CO1	Demonstrate critical and innovative thinking.
CO2	Display competence in oral, written, and visual communication.
CO3	Show an understanding of opportunities in the field of communication.
CO4	Respond effectively to cultural communication differences.
CO5	Demonstrate positive group communication exchanges.
CO6	Communicate ethically.
3ME3-04	**Engineering Mechanics Year of study: 2020-21**
CO1	Determine the resultant force and moment for a given force system.
CO2	Determine the centroid and moment of area.
CO3	Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
CO4	Apply basic knowledge of mathematics and physics to solve real-world problems
CO5	Use scalar and vector analytical techniques for analyzing forces in statically determinate structures.
3ME4-05	**Engineering Thermodynamics Year of study: 2020-21**
CO1	Explain the basic principles and applications of the thermodynamics to the various real life systems.
CO2	Describe fundamental laws of thermodynamics.
CO3	Apply the concepts such as Entropy, Energy Balance also the calculations of heat, work and other important thermodynamic properties for various ideal gas processes.
CO4	Estimate performance of various thermodynamic gas power cycles and gas refrigeration cycle and availability in each case.
3ME4-06	**Material Science Engineering Year of study: 2020-21**
CO1	Apply core concepts in Materials Science to solve engineering problems.
CO2	Interpret about material fundamental and material processing.
CO3	Distinguish the defects in crystal and its effect on crystal properties
CO4	Figure out the different mechanical properties of material by studying different destructive and non- destructive testing.
CO5	Articulate and utilize corrosion prevention strategies and estimate corrosion behavior of materials and components
CO6	Gain knowledge of Transformation diagrams, polymers, alloys, Ferrous , Non-ferrous metal etc.
3ME4-07	**Mechanics of Solids Year of study: 2020-21**
CO1	Understand statically determinate and indeterminate problems.
CO2	Determine the resistance and deformation in member subjected to axial, flexural and torsional loads.
CO3	Evaluate principal stresses, strains and apply the concept of failure theories for design.
CO4	Analyze and design thin, thick cylinders and springs.

3ME4-21	**Mechine Drawing Practice Year of study: 2020-21**
CO1	Learn the basic concepts and to draw the views of section of solids, orthographic projections and threaded fasteners.
CO2	Create assembly and get the detailed drawing of machine components.
CO3	Represent tolerances and the levels of surface finish of machine elements.
CO4	Develop the ability to apply Limits, Fits, and Dimensional Tolerances, as well as Geometric Tolerances to components and assemblies on Engineering Drawings.
CO5	Develop an ability to create 2D drawings from 3D models.
3ME4-22	**Material Testing Lab Year of study: 2020-21**
CO1	Learn the principles of materials science and engineering through lab investigation.
CO2	Learn the basic skills required to properly use materials science Instrument.
CO3	Analyze mechanical properties of materials.
CO4	Perform Rockwell hardness tester for measurement of hardness.
CO5	Analyze impact test, fatigue test and bending test.
3ME4-23	**Basic Mechanical Engineering Lab Year of study: 2020-21**
CO1	Do hands on assembling and disassembling of SI & CI Engine.
CO2	Do hands on assembling and disassembling of bicycle & sewing machine.
CO3	Understand working principles & classification of boilers and their accessories.
CO4	Understand working principles & classification of pumps.
3ME4-24	**MATLAB Year of study: 2020-21**
CO1	Use MATLAB effectively to analyze and visualize data.
CO2	Apply numeric techniques and computer simulations to solve engineering-related problems.
CO3	Apply a top-down, modular, and systematic approach to design, write, test, and debug sequential MATLAB programs to achieve computational objectives.
CO4	Design and document computer programs and analyses in a careful and complete manner so as to effectively communicate results, to facilitate evaluation.
CO5	Create and control simple plot and user-interface graphics objects in MATLAB.
4ME2-01	**Data Analytics Year of study: 2020-21**
CO1	Apply Univariate & Multivariate statistics for data analysis
CO2	Perform Linear, Multiple & Logistic Regression
CO3	Demonstrate an understanding of dimensionality reduction techniques & Time Series analysis as well as its applications for data analytics
4ME1-03	**Managerial Economics and Financial Accounting Year of study: 2020-21**
CO1	Understand the roles of managers in firms
CO2	Understand the internal and external decisions to be made by managers
CO3	Analyze the demand and supply conditions and assess the position of a company

CO4	Design competition strategies, including costing, pricing, product differentiation, and market environment according to the natures of products and the structures of the markets.
CO5	Analyze real-world business problems with a systematic theoretical framework.
CO6	Make optimal business decisions by integrating the concepts of economics, mathematics and statistics.
4ME3-04	**Digital Electronics Year of study: 2020-21**
CO1	Have a thorough understanding of the fundamental concepts and techniques used in digital electronics.
CO2	Understand and examine the structure of various number systems and its application in digital design.
CO3	Understand, analyze and design various combinational and sequential circuits.
CO4	Identify basic requirements for a design application and propose a cost effective solution.
CO5	Identify and prevent various hazards and timing problems in a digital design.
CO6	Develop skill to build, and troubleshoot digital circuits
4ME4-05	**Fluid Mechanics & Machines Year of study: 2020-21**
CO1	Understand basic knowledge of the definition and the fundamental concepts of fluid mechanics including continuum, velocity field, surface tension, flow visualization etc.
CO2	Apply the basic equation of fluid statics to determine forces on planer and curved surfaces that are submerged in a static fluid.
CO3	Use conservation laws in integral form and apply them to determine forces and moments on surfaces of various shapes and simple machines
CO4	Use Euler's and Bernoulli's equations and the conservation of mass to determine velocities, pressures, and accelerations for incompressible and in viscid fluids
CO5	Design simple pipe systems to deliver fluids under specified conditions and also the loosed during the flow of the fluid.
CO6	Understand the mechanics of viscous flow about immersed boundaries, as it relates to flow separation, profile drag, drag coefficients and the determination of drag forces.
4ME4-06	**Manufacturing Processes Year of study: 2020-21**
CO1	Select materials, types and allowances of patterns used in casting and analyze the components of moulds.
CO2	Design core, core print and gating system in metal casting processes
CO3	Understand arc, gas, solid state and resistance welding processes.
CO4	Develop process-maps for metal forming processes using plasticity principles
CO5	Identify the effect of process variables to manufacture defect free products.
4ME4-07	**Theory of Machines Year of study: 2020-21**
CO1	Understand the principles of kinematic pairs, chains and their classification, DOF, inversions, equivalent chains and planar mechanisms.
CO2	Analyze the planar mechanisms for position, velocity and acceleration.
CO3	Synthesize planar four bar and slider crank mechanisms for specified kinematic conditions.
CO4	Evaluate gear tooth geometry and select appropriate gears for the required applications.
CO5	Design cams and followers for specified motion profiles.
4ME3-21	**Digital Electronics Lab Year of study: 2020-21**
CO1	Distinguish between analog and digital systems.
CO2	Identify the various digital ICs and understand their operation.
CO3	Apply Boolean laws and K-map to simplify the digital circuits.

CO4	Understand the function of elementary digital circuits under real and simulated environment.
4ME4-22	**Fluid Mechanics Lab Year of study: 2020-21**
CO1	Conduct experiments for a given purpose.
CO2	Analyze experimental data and develop empirical equations.
CO3	Verify the basic principles and equations of fluid mechanics.
4ME4-23	**Production practice-I Year of study: 2020-21**
CO1	Learn about material removal in various modern manufacturing processes.
CO2	Gaining knowledge of Foundry and Welding, etc.
CO3	Analyze the processes and evaluate the role of each process parameter during machining of various advanced materials.
CO4	Solve the various problems for the given profiles to be imparted on the work specimens.
4ME4-24	**Theory of Machine Lab Year of study: 2020-21**
CO1	Get the practical knowledge about various mechanisms.
CO2	Learn about applications of various mechanisms.
CO3	Go through and observe the various experiments/working of different mechanism like cam-follower mechanism, four bar chain, steering mechanism etc.
5ME3-01	**Mechatronics Year of study: 2020-21**
CO1	Model, analyze and control engineering systems.
CO2	Identify sensors, transducers and actuators to monitor and control the behavior of a process or product.
CO3	Develop PLC programs for a given task.
CO4	Evaluate the performance of mechatronic systems.
5ME4-02	**Heat Transfer Year of study: 2020-21**
CO1	Understand the basic modes of heat transfer.
CO2	Compute temperature distribution in steady-state and unsteady-state heat conduction.
CO3	Understand and analyse heat transfer through extended surfaces.
CO4	Interpret and analyze forced and free convection heat transfer.
CO5	Understand the principles of radiation heat transfer and basics of mass transfer
CO6	Design heat exchangers using LMTD and NTU methods
5ME4-03	**Manufacturing Technology Year of study: 2020-21**
CO1	Understand the cutting tool geometry, mechanism of chip formation and mechanics of orthogonal cutting.
CO2	To gain knowledge of grinding and different methods of grinding.
CO3	To learn about concept of tool life etc.
5ME4-04	**Design of Machine Element-I Year of study: 2020-21**
CO1	Understand the fundamental scientific principles of mechanical design (stress, strain, material properties, failure theories, fatigue phenomena, fracture mechanics) and their importance and use in design analysis

CO2	Develop practical experience with the function, design and analysis of actual machine components including prediction of their life and failure
CO3	Practice systematic approaches to mechanical design and analysis procedures
CO4	Understand component behavior subjected to loads and identify the failure criteria.
CO5	Design a machine component using theories of failure.
CO6	Design keys, cotters, couplings and joints.
5ME4-05	**Principles of Management Year of study: 2020-21**
CO1	Recognize the role of a manager and how it relates to the organization's mission.
CO2	Define management, its four basic functions and skills.
CO3	Know critical management theories and philosophies and how to apply them.
CO4	Recognize the concept of social responsiveness and its benefits.
CO5	Recognize the part communication plays in the management function.
CO6	Identify the stages of team development and the skills a team must acquire to become effective.
5ME5-11	**Steam Engineering Year of study: 2020-21**
CO1	Understand working of boilers including water tube, fire tube and high pressure boilers and determine efficiencies.
CO2	Analyze the flow of steam through nozzles.
CO3	Evaluate the performance of steam turbines.
CO4	Study of regenerative feed heating cycles and reheating of steam etc.
5ME5-12	**Automobile Engineering Year of study: 2020-21**
CO1	Understand the basic lay-out of an automobile.
CO2	Understand the operation of engine cooling, lubrication, ignition, electrical and air conditioning systems.
CO3	Understand the principles of transmission, suspension, steering and braking systems.
CO4	Understand automotive electronics.
CO5	Study latest developments in automobiles.
5ME5-13	**Non-Destructive & Evaluation Techniques Year of study: 2020-21**
CO1	Understand importance of NDT in quality assurance.
CO2	Gain knowledge about various NDT methods.
CO3	Differentiate different types of NDT methods.
CO4	Learn about ultrasonic testing, electro-magnetic methods, x-ray radiography processes etc.
5ME3-21	**Mechatronics Lab Year of study: 2020-21**
CO1	Identification of key elements of mechatronics system and its representation in terms of block diagram
CO2	Understanding the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O
CO3	Interfacing of Sensors, Actuators using appropriate DAQ micro-controller
CO4	Time and Frequency domain analysis of system model (for control application)
CO5	PID control implementation on real time systems
CO6	Development of PLC ladder programming and implementation of real life system.

5ME4-22	Heat Transfer Lab Year of study: 2020-21
CO1	Determine Thermal Conductivity.
CO2	Determine Stefan Boltzmann Constant.
CO3	Estimate heat transfer coefficient.
CO4	Measure heat transfer coefficient in free convection
CO5	To Study and Compare LMTD and Effectiveness
CO6	Analyze rates of heat transfer for different materials
5ME4-23	**Production Engineering Lab Year of study: 2020-21**
CO1	Perform Linear and Angular measurements.
CO2	Understand the concept of Slip gauges.
CO3	Perform tests to measures gear tooth profiles and screw threads.
CO4	To measure flatness and surface defects in the given test specimen
CO5	Force measurements during turning, drilling and milling operations.
5ME4-24	**Machine Design Practice-I Year of study: 2020-21**
CO1	Understand the problem and draw the design specifications.
CO2	Solve problems related to fits and tolerances.
CO3	Understand component behavior subjected to loads and identify the failure criteria.
CO4	Design beams, cotters and knuckle etc.
6ME3-01	**Measurement & Metrology Year of study: 2020-21**
CO1	Explain the basics of standards of measurement, limits, fits
CO2	Identify the uses of gauges and comparators.
CO3	Understand the significance of measurement system, errors.
CO4	Interpret measurement of field variables like force, torque
CO5	Comprehend the fundamentals of thermocouple and strain.
6ME4-02	**Computer Integrated Manufacturing System Year of study: 2020-21**
CO1	Gain advanced knowledge in manufacturing tools, solutions to industrial applications; Identify, formulate and solve mechanical engineering problems related to Computer integrated manufacturing environment.
CO2	Design a system, components, or process and meet specific objectives keeping in view the economical approaches, availability of materials and manufacturability with increased life.
CO3	Acquire knowledge of CAD-CAM engineering and be able to discriminate, evaluate, analyze and integrate existing and new knowledge.
CO4	Develop habit of individual critical thinking in analyzing a complex problem in the computer aided designing, manufacturing and optimization.
CO5	Write CNC part programs using CADEM simulation package for simulation of machining operations such as Turning, Drilling & Milling.
CO6	Understand & write programs for Flexible Manufacturing Systems & Robotics.
6ME4-03	**Vibration Engineering Year of study: 2020-21**
CO1	Understand the causes and effects of vibration in mechanical systems.
CO2	Develop schematic models for physical systems and formulate governing equations of motion.
CO3	Understand the role of damping, stiffness and inertia in mechanical systems

CO4	Analyze rotating and reciprocating systems and compute critical speeds.
CO5	Analyze and design machine supporting structures, vibration isolators and absorbers.
6ME4-04	**Design of Machine Element-II Year of study: 2020-21**
CO1	Understand the concepts of principal stresses, theories of failure, stress concentration and fatigue loading.
CO2	Design shafts, couplings and gears.
CO3	Analyze the pressure distribution and design journal bearings.
CO4	Design belts, springs, brakes, clutches and engine parts.
6ME4-05	**Quality Management Year of study: 2020-21**
CO1	Understand the role of statistical tools in quality improvement.
CO2	Understand the different types of variability, rational subgroups, and how a control chart is used to detect assignable causes.
CO3	Construct and interpret control charts for variables such as x-bar, r, s, and individuals charts.
CO4	Construct the sampling plan and OC curve etc.
6ME5-11	**Refrigeration & Air Conditioning Year of study: 2020-21**
CO1	Understand the principles and applications of refrigeration systems.
CO2	Understand vapour compression refrigeration system and identify methods for performance improvement.
CO3	Study the working principles of air, vapour absorption, thermoelectric and steam-jet refrigeration systems.
CO4	Analyze air-conditioning processes using the principles of psychrometry.
CO5	Evaluate cooling and heating loads in an air-conditioning system.
6ME5-12	**Non-Conventional Machining Methods Year of study: 2020-21**
CO1	Understand the need of Non Traditional Machining Processes and able to Classify various processes
CO2	Recognize the role of mechanical energy in non-traditional machining processes.
CO3	Apply the knowledge on machining electrically conductive material through electrical energy in non-traditional machining processes.
CO4	Understand the concept of machining the hard material using chemical energy and electrochemical energy.
CO5	Familiarity with various thermal energy based nontraditional machining processes.
6ME5-13	**Micro Electro Mechanical Systems Year of study: 2020-21**
CO1	Explain MEMS Technology, Present, Future and Challenges.
CO2	Explain micro sensors, micro-actuators, their types and applications.
CO3	Explain about fabrication processes for producing micro-sensors and actuators. They will also be able to apply Reliability, and Failure Analysis Testing.
6ME4-21	**Computer Integrated Manufacturing Lab Year of study: 2020-21**
CO1	Create the G-code program (with a standard computer post processor) of a work-piece on a standard numerically controlled machine tool with CNC controls.
CO2	Create basic and advanced CNC programs from imported CAD data using several CAM systems.
CO3	Use effectively CAD / CAM systems in order to produce the final NC code for the manufacturing of various mechanical parts and carry out exchange of data between CAD and CAM systems.
CO4	Compare the operation and programming of CNC machine tool using manual programming
CO5	Compare the operation and programming of CNC machine tool using CAM systems.

6ME4-22	**Vibration Engineering Lab Year of study: 2020-21**
CO1	Design on experiment to measure the periodic time of free-vibrations of single degree and multi degree of freedom system
CO2	Analyze the mechanical vibrations to determine the material properties of mechanical elements used
CO3	Understand the fundamental of vibration measurement in the real world.
6ME4-23	**Machine Design Practice – II Year of study: 2020-21**
CO1	Design mechanical components under fatigue loading.
CO2	Design helical compression, tension and torsional springs.
CO3	Design of bolts subjected to variable stresses.
CO4	Design of spur, bevel and helical gears.
6ME4-24	**Thermal Engineering Lab-1 Year of study: 2020-21**
CO1	Differentiate between SI & CI Engines.
CO2	Differentiate between 2-stroke & 4-stroke Engines
CO3	Understand theoretical and actual working cycles of SI & CI Engines.
CO4	Demonstrate steering system.
CO5	Demonstrate Ignition & Fuel Supply System.
7ME5-11	**IC Engine Year of study: 2020-21**
CO1	Understand working and performance of IC Engines through thermodynamic cycles.
CO2	Understand combustion phenomena in SI and CI engines and factors influencing combustion chamber design.
CO3	Outline emission formation mechanism of IC engines, its effects and the legislation standards.
CO4	Understand working principles of instrumentation used for engine performance and emission parameters.
CO5	Evaluate methods for improving the IC engine performance.
CO6	Understand the latest developments in IC Engines and alternate fuels
7ME5-12	**Operation Research Year of study: 2020-21**
CO1	Apply and analyze mathematical optimization functions to various applications
CO2	Recognize the importance and value of Operations Research and mathematical modeling in solving practical problems in industry by Linear programming problems
CO3	Understand the mathematical tools that are needed to formulate & solve transportation problems for optimization
CO4	Formulate & analyze a managerial decision problem into a mathematical model using game theory & investment analysis.
CO5	Use mathematical models to solve the inventory & replacement problems.
CO6	Understand queuing & sequencing models and apply them to real-life problems.
CO7	Use network models and techniques for effective decision making
7ME5-13	**Turbomachine Year of study: 2020-21**
CO1	Give examples of the main applications of turbo machines
CO2	Recognize typical designs of turbo machines
CO3	Explain the working principles of turbo machines and apply it to various types of machines
CO4	Determine the velocity triangles in turbo machinery stages operating at design and off-design conditions
CO5	Explain the working principles of Reciprocating pumps.

7PE6-60.1	**Pipeline Engineering Year of study: 2020-21**
CO1	Select pipe of proper size.
CO2	Select piping system components.
CO3	Design piping for a given system.
7CR6-60.2	**Plant, Equipment & Furnace Design Year of study: 2020-21**
CO1	Understand basics of process equipment design and important parameters of equipment design
CO2	Principle of design of simple supports (foundations) of various equipment.
CO3	Working of chimneys and operation of furnace.
CO4	Concept for furnace life and selection of refractories.
7AG6-60.1	**Human Engineering & Safety Year of study: 2020-21**
CO1	Understand the importance of human factors and their application in system development.
CO2	Know the effect of visual, auditory and factual displays in human performance.
CO3	Understand the importance of optimum work-rest cycles in endurance.
CO4	Ideally design the work space in accordance to anthropometry.
CO5	Have the general understanding safety features and regulation acts in farm machinery
7ME4-21	**Finite Element Analysis Year of study: 2020-21**
CO1	Demonstrate the ability to create models for trusses, frames, plate structures, machine parts, and components using ANSYS general-purpose software.
CO2	Model multi-dimensional heat transfer problems using ANSYS
CO3	Demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation purposes
CO4	Develop a basic understanding of the limitations of the FE method and understand the possible error sources in its use.
7ME4-22	**Thermal Engineering Lab-II Year of study: 2020-21**
CO1	Conduct constant speed and variable speed tests on IC engines and interpret their performance.
CO2	Estimate energy distribution by conducting heat balance test on IC engines
CO3	Evaluate performance parameters of steam power plant.
CO4	Determine performance parameters of refrigeration and air-conditioning systems
CO5	Evaluate the performance of turbo machines.
7ME4-23	**Quality Control Lab Year of study: 2020-21**
CO1	Understand the role of statistical tools in quality improvement.
CO2	Understand the different types of variability, rational subgroups, and how a control chart is used to detect assignable causes.
CO3	Construct and interpret control charts for variables such as x-bar, r, s, and individuals charts.
CO4	Conduct the experiments related to probability distribution.
CO5	Solve the SQC problems using MINITAB software.
8ME5-11	**Hybrid and Electric Vehicle Year of study: 2020-21**
CO1	Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals

CO2	Explain plug – in hybrid electric vehicle architecture, design and component sizing and the power electronics devices used in hybrid electric vehicles.
CO3	Analyze various electric drives suitable for hybrid electric vehicles.
CO4	Discuss different energy storage technologies used for hybrid electric vehicles and their control.
CO5	Demonstrate different configurations of electric vehicles and its components, hybrid vehicle configuration by different techniques, sizing of components and design optimization and energy management.
8ME5-12	**Supply & Operations Management Year of study: 2020-21**
CO1	Demonstrate an understanding of fundamental operations concepts, key principles of its management, and relevant analysis approaches.
CO2	Demonstrate the ability to understand a real-world unstructured problem, and gather necessary information and data to formulate into a structured problem
CO3	Demonstrate ability to develop quantitative and qualitative analysis framework and solution methods, and appropriately implement them to obtain meaningful solutions
CO4	Demonstrate ability to identify strengths and weaknesses of alternative solutions and obtain relevant managerial insights.
8ME5-13	**Additive Manufacturing Year of study: 2020-21**
CO1	Demonstrate the knowledge of Additive Manufacturing and Rapid Prototyping technologies.
CO2	Describe different RP techniques.
CO3	Discuss fundamentals of Reverse Engineering.
8EC6-60.2	**Robotics and Control Year of study: 2020-21**
CO1	Design automatic manufacturing cells with robotic control using the principle behind robotic drive system, end effectors, sensor, machine vision robot kinematics and programming.
CO2	Explain the basic concepts of working of robot analyze the function of sensors in the robot
CO3	Write program to use a robot for a typical application
CO4	Use Robots in different applications
8AN6-60.1	**Finite Element Methods Year of study: 2020-21**
CO1	Recognize the significance and importance of finite element methods to the professional design engineer.
CO2	Provide a theoretical understanding on the fundamentals of finite element methods for small displacement linear elastic analysis
CO3	Provide experience on how to develop good models and how to interpret the numerical results in design.
8MI6-60.2	**Maintenance Management Year of study: 2020-21**
CO1	Maintenance management skill
CO2	Need of safety devices
CO3	Increase the productivity of the plant at minimal cost
CO4	Failure analysis of plant machineries
CO5	Concept of tribology, conditioning monitoring
CO6	Concept of maintainability and availability of mechanical components and systems.