Bachelor of Technology (Mechanical Engineering)

Program Outcomes (POs)

- **PO 1** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **PO 2** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO 3** Design solutions for complex 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.
- **PO 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.
- **PO 5** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- **PO 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.
- **PO 7** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO 8** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO 9** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO 10** Communicate effectively on complex 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.
- **PO11** 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 and in multidisciplinary environments, to manage projects, identify business opportunities & sources of finance.
- **PO12** 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.

Program Specific Outcomes (PSOs)

- **PSO 01** Apply knowledge of design, thermal, materials and manufacturing to solve complex problems in mechanical engineering and allied areas.
- **PSO 02** Create and implement new ideas on product/process design and development with the help of modern CAD/CAM/CAE tools while ensuring best engineering practices.

Course outcomes
Batch: 2017-2021

Semester	Course Code	Course Name	Course Outcomes
1	17BS1 MA01	Applied Engineering Mathematic s-I	CO1:Determine the power series expansion of the function with the help of mean value theorems
			CO2:Analyze the multivariable function for extreme values
			CO3:Apply multiple integrals to find area, surface area and volume
			CO4:Employ the method of reduction formulae to find surface area and volumes of evolution
			CO5:Solve first and higher order ordinary differential equations
			CO6:Model a physical phenomenon into a mathematical equation
	17BSC PY02	Applied Physics	CO1:Understand the role of physics in Engineering field
			CO2:Analyze the applications of physics for engineering problems
			CO3:Demonstrate the problem-solving ability to identify the solutions
			CO4:Construct the quantum model to explain the behaviour of a system at microscopic level
			CO5:Apply the properties of lasers to improve the optical fibre communication
	17HSS C06	Sociology and Elements of Indian History for Engineers	CO1:Understand the fundamental concepts of Sociology and History
			CO2:Apply the sociological concepts with new technologies for overall growth
			CO3:Analyze the theoretical concepts and to reflect on them in contemporary social life
			CO4:Evaluate the knowledge of social change into developments of the society
	17BSC PY02L	Physics Lab	CO1:Demonstrate the working knowledge of optical, electrical and electronics experiments
			CO2:Illustrate the procedure to conduct the experiments and correlate their results
			CO3:Compare moduli of elasticity of given materials
			CO4:Interpret the diffraction of light to determine the wavelength of incident laser
			CO5:Examine the Fermi energy of a conductor and semiconductor
			CO6:Construct simple circuits to verify I-V characteristics of a diode, Stefan's constant, Planck's constant, Dielectric constant and frequency response of resonance circuit
		Applied	CO1:Apply double and triple integrals to find surface area and volume of solids
			CO2:Employ differentiation on vector point functions

2	17BS2 MA01	Engineering Mathematic s-II	CO3:Analyze line, surface and volume integrals using vector point functions
			CO4:Apply Laplace Transforms to solve ordinary differential equations
			CO5:Analyze the solution of system of linear differential equations using Eigen value and Eigen vectors
			CO6:Test for consistency and solve system of linear equations
	17BSC CH02	Applied Chemistry	CO1:Have knowledge of basics of Nanomaterials and their application
			CO2:Understand the concepts of Fuels, corrosion and their importance in the engineering

			CO3:Ability to understand different types of pollutions and analysis of pollutants
			CO4:Interpret the replacement of conventional materials by polymers for domestic and industrial applications
			CO5:Have a knowledge of electrochemistry and Ability to analyse & design of energy storage devices
	17HSS 07	Communicatve English	CO1:Explore new ideas in areas like presentations, group discussions and conversations
			CO2:Transform their pronunciation of English with basic understanding of phonetics
			CO3:Express fluently in flawless English with proper understanding of grammar and syntax
			CO4:Develop command in their language which would build their confidence
			CO5:Identify the salient features of literary texts to produce creative thinking and imaginative writing
	17BSC CH02L	Chemistry Lab	CO1:Analyse the physical principle involved in the various instruments
			CO2:Relate the principles of the experiments to new application
			CO3:Perform different types of titrations in volumetric analysis
			CO4:Exhibit skills in performing experiments based on theoretical fundamentals
			CO5:Study and apply basic chemistry laboratory techniques for small/large scale water analysis and purification
			CO6:Improve cognitive skills in accordance with current engineering and technology developments
	17ESC	ENGINEERIN G	CO1:Indicate the basic entities and perspective of a technical drawing as per the BIS standards
			CO2:Construct the projection of points in various angles of projections manually and with SolidEdge

	ME03	**GRAPHICS**	CO3:Construct the projection of lines and planes in first angle projection manually and with SolidEdge
			CO4:Construct the projection of solids in first angle projection manually and with SolidEdge
			CO5:Construct the projection of solids in isometric perspective manually and with SolidEdge
			CO6:Generate orthographic and isometric views through CAD software
	17EMSCME41L	**Workshop/ Manufacturing Practices**	CO1:Demonstrate knowledge on the basics of casting, forming, machining, Joining processes
			CO2:Discuss on the concepts and programming related to CNC machines
			CO3:Demonstrate skill on fitting with square joint and V joint
			CO4:Demonstrate skill on carpentry works with dove tail joint and lap joint
			CO5:Demonstrate skill on carpentry works with dove butt joint. lap joint and T joint
			CO6:Perform casting of simple components
	17ESCME04	**Basics of Mechanical Engineering**	CO1:Describe working of steam turbines, impulse and reaction turbines
			CO2:Demonstrate knowledge on machine tools and basic manufacturing processes
			CO3:Explain working of two stroke and Four stroke IC engine
			CO4:Discuss on the basics of refrigeration and air-conditioning systems

			CO5:Discuss on the working Principles of power transmitting elements. And related actuators
			CO6:Demonstrate knowledge on basics of manufacturing processes and machine tools
	17HSS C08	**Economics for Engineers**	CO1: Understand the basic concepts of ecological facets of environment.
			CO2: Identify different Components of ecosystem and their interactions and interrelationships
			CO3: Summarize the impacts of pollution on climate change.
			CO4: Gain knowledge on Environmental issues and environmental protection acts.
			CO5: discuss the economics of engineering activities
			CO6: Evaluate the different aspects of government policy
	17ME31	**Engineerin g Materials**	CO1:Understand the basic structure of materials and their associated defects
			CO2:Explain the microstructure and failure mechanisms in materials
			CO3:Predict the microstructure using phase diagram
			CO4:Familiarize with different types of ferrous, non-ferrous alloys and composite materials.

3			CO5:Appraise the properties and applications of recent advanced materials
			CO6:Select suitable material for various engineering applications.
	17ME 32	**Solid Mechanics**	CO1:Understand the basic concepts of stress, strain and deformations
			CO2:Determine equilibrium condition and bending stresses in beams using free body diagram, shear force diagram and bending moment diagram.
			CO3:Calculate the deflection of beams and torsional stresses under different types of loading
			CO4:Determine principal stresses and strains both analytically and graphically using Mohr's circle
			CO5:Apply theories of failure for columns and cylinders
			CO6:Estimate the strength of different loading members.
	17ME 33	**Fluid Mechanics**	CO1:Demonstrate knowledge on fundamental properties of fluid and pressure measurement.
			CO2:Determine the hydro static forces and kinematic characteristics of fluids.
			CO3:Apply Euler's equation & Bernoulli's Equation for flow measurement.
			CO4:Examine energy losses in pipe transitions
			CO5:Apply dimensional analysis to predict physical parameters that influence the flow in fluid mechanics.
			CO6:Solve one dimensional fluid flow problems
	17ME 31L	**Materials Testing Lab**	CO1:Prepare specimen for various metallographic examinations
			CO2:Perform dye penetration testing to identify cracks
			CO3:Determine the tensile, compression and torsion stresses under different loading conditions
			CO4:Estimate impact load of various materials using Charpy and Izod tests
			CO5:Determine hardness of different materials
			CO6:Conduct wear characterization tests for different materials
	17ME 33L	**Fluid Mechanics**	CO1:Determine the major and minor losses in the pipes under various conditions.
			CO2:Analyse the impact of jet on Vanes.

		and Machinery Lab	CO3:Calibrate flow discharge measuring device used in pipes
			CO4:Conduct performance test on impulse and reaction turbines with respect to head and speed
			CO5:Analyze performance variations in the pump with respect to head and speed
			CO6:Analyze the performance of air blower at constant speed.
4	**17ME 41**	**Mechanisms and Machines**	CO1:Demonstrate knowledge on fundamental concepts of links, pairs and their mechanisms.
			CO2:Justify the design parameters for cam systems and gears.
			CO3:Determine the static forces in four bar chain and slider crank chain
			CO4:Analyze systems with unbalanced masses and energy fluctuations of flywheel
			CO5:Analyze stabilization of sea vehicles, aircrafts and automobile vehicles using gyroscope.
			CO6:Utilize analytical, mathematical and graphical aspects of kinematics of Machines for effective design.
	17ME 42	**Basic Thermodynamics**	CO1:Explain the fundamental concepts and applications of thermodynamics
			CO2:Apply basic laws of thermodynamics for energy interactions across the system.
			CO3:Evaluate thermodynamic properties of pure substances
			CO4:Formulate mass and energy balance equations for gas vapour mixture
			CO5:Explain fundamentals of gas law related to real and ideal gases
			CO6:Formulate thermodynamic relations for mechanical engineering applications.
	17ME 43	**Manufacturing Technology**	CO1:Discuss on various types of manufacturing processes and recent developments in manufacturing
			CO2:Illustrate the basic principles of foundry practices and special casting processes.
			CO3:Explain bulk deformation and welding processes
			CO4:Describe the theory of metal cutting and machine tools
			CO5:Discuss the basic concepts of powder metallurgy
			CO6:Select appropriate manufacturing process to make engineering components.
	17ME 44	**Design of Mahcine Elements 1**	CO1:Discuss on the concepts of design process, material selection and theories of failures
			CO2:Apply the concepts of stress concentration and multidimensional fatigue failure criteria in the design of mechanical components
			CO3:Design power transmission shafts, keys, couplings, cotter joints and knuckle joints.
			CO4:Analyze the riveted and welded joints under eccentric loading.
			CO5:Design the power screws
			CO6:Implement standards, safety, reliability, dimensional parameters and manufacturing aspects in mechanical design.
	17ME	**Machine**	CO1:Demonstrate knowledge on various practices with regard to the dimensioning, sectioning and development of views.

	45	**drawing**	CO2:Explain the importance of the visualization aspects in the preparation of the part drawings
			CO3:Illustrate the conventional representation of riveted joints
			CO4:Illustrate the significance of drawing of screw threads , nuts and bolts.

			CO5:Prepare the parts or assembly drawings as per the conventions
			CO6:Interpret assembly drawings of various machine components with moderate complexity.
	17ME 43L	**Foundry Practice**	CO1:Conduct compression and shear tests on universal Sand Testing Machine.
			CO2:Determine the core hardness and mould hardness of sand specimens.
			CO3:Determine molding sand properties with different additives
			CO4:Demonstrate different foundry tools and equipments
			CO5:Design a mould for the required applications
			CO6:Equip with the practical knowledge required in the casting process.
	17ME 46L	**Workshop II**	CO1:Estimate machining time for basic lathe operations.
			CO2:Perform Internal and external thread cutting operations in lathe.
			CO3:Perform gear tooth cutting using milling machine.
			CO4:Create keyways, slots and grooves using shaper machine.
			CO5:Carry out drilling and reaming operations for the given specification
			CO6:Identify the appropriate production process and machine
5	**17ME 51**	**Advanced Manufacturing Processes**	CO1:Demonstrate knowledge on advanced joining processes
			CO2:Explain the working principles of different non-traditional machining techniques
			CO3:Discuss the advanced metal forming processes
			CO4:Describe the surface hardening and surface finishing processes
			CO5:Elucidate the basics of CNC machines and rapid prototyping.
			CO6:Select suitable manufacturing processes for development of complex shaped geometries
	17ME 52	**Applied Thermodynamics and Heat transfer**	CO1:Calculate the thermal performance of different gas power cycles and IC Engines
			CO2:Estimate the performance of reciprocating air compressors and refrigeration systems.
			CO3:Solve 1D heat transfer problems related to conduction and convection
			CO4:Discuss phenomena related to heat exchangers and phase change heat transfer.
			CO5:Determine the heat transfer by radiation between the objects with simple geometries.
			CO6:Relate the concepts of heat transfer theory in industrial applications.
	17ME 53	**Design of Machine Elements II**	CO1:Design different power transmission and absorption components
			CO2:Apply the principles of gear design to parallel gears
			CO3:Apply the principles of gear design to non-parallel gears
			CO4:Design the geometry of brakes and clutches.
			CO5:Select the suitable bearings for machine elements
			CO6:Design a mechanical system integrating machine elements.
	17ME	**Control**	CO1:Explain the concept of open loop and closed loop control systems and types of controllers.

	54	**Engineering**	CO2:Interpret and apply block diagram representations of control systems and design PID controllers based on empirical tuning rules.

			CO3:Analyse gain and phase margins and their implications in terms of robust stability.
			CO4:Compute stability of linear systems using the Routh array test
			CO5:Analyse controllability and observability of state space models
			CO6:Analyse control systems satisfying requirements of stability and steady state error.
	17ME 55	**CAD/CAM**	CO1:Demonstrate the importance of CAD/CAM system in product development.
			CO2:Categorize the features of various hardware and software packages in CAD system.
			CO3:Apply knowledge of mathematical concept for geometry manipulation and modeling of curves, surfaces and solids.
			CO4:Explain basic concepts of NC, DNC, CNC and the constructional features of CNC machines
			CO5:Formulate CNC part programming for turning & milling operations.
			CO6:Discuss on the fundamental elements of CAPP and Robotics.
	17ME 56	**Metrology and Measurements**	CO1:Explain the basics of standards of measurements, limits, fits and tolerances
			CO2:Demonstrate knowledge on linear and angular measurements, screw thread, gear measurement and comparators.
			CO3:Understand the significance of measurement and measurement systems.
			CO4:Interpret the principles of measuring pressure, force and torque.
			CO5:Comprehend fundamentals of temperature and strain measurements
			CO6:Choose appropriate method and instruments for inspection and measurement for industrial applications
	17ME 52L	**Energy Conversion and Heat Transfer Lab**	CO1:Perform experiments to determine the properties of fuels.
			CO2:Determine performance characteristics of I.C. Engine
			CO3:Calculate thermal conductivity of composite wall and metal rod
			CO4:Determine the heat transfer coefficient for natural and forced convection.
			CO5:Estimate emissivity of a material and Steffan-Boltzmann constant for black body.
			CO6:Calculate heat transfer in parallel flow and counter flow heat exchangers
	17ME 56L	**Design and Metrology Lab**	CO1:Calculate natural frequency of longitudinal vibrations od damped and undamped systems
			CO2:Analyse performance of governors and effects of gyroscope
			CO3:Determine principal stresses and principal strains using strain gauge rosette.
			CO4:Demonstrate measurements using optical projector, polariscope and tool maker microscope.
			CO5:Measure angle using Sine Center/ Sine Bar/ Bevel Protractor
			CO6:Select appropriate measuring instrument according to a specific requirement.

6			CO1:Explain basic concepts and energy transfer in turbomachines

	17ME 61	**Turbo Machinery**	CO2:Perform the Turbomachines analysis and preliminary design of Pelton turbine
			CO3:Evaluate the performance characteristics of Francis, Kaplan and Steam turbines.
			CO4:Discuss the operation and effect of cavitation in centrifugal pumps
			CO5:Analyze the performance of Centrifugal and axial flow compressors.
			CO6:Select the right type of pump, compressor or turbine for given operating conditions.
	17ME 62	**Finite Element Methods**	CO1:Explain the concepts behind formulation methods in FEM.
			CO2:Discuss the concepts of displacement models, shape function using natural, cartesian coordinates.
			CO3:Formulate the element stiffness matrix and load vector for 1-D bar, Truss and Axi-symmetric solid elements.
			CO4:Determine the stresses and displacements in beam and shafts using finite element method
			CO5:Develop steady state heat transfer formulation for conduction and convection problems
			CO6:Apply finite element methods to real world problems and obtain solutions.
	17ME 63	**Maintenance and reliability Enigneering**	CO1:Discuss the strategies of principles, policies and practices of maintenance Engineering
			CO2:Describe various condition monitoring techniques and repair methods for machine elements.
			CO3:Explain reliability concepts and hazard analysis techniques
			CO4:Enumerate the various testing procedures for reliability.
			CO5:Illustrate the use of redundancy to improve reliability.
			CO6:Implement the maintenance function and different practices in industries for the successful management of maintenance activities.
	17ME 64	**Mechanical vibrations**	CO1:Understand the basic principles of vibrations, need and importance of vibration analysis in mechanical design of machine parts.
			CO2:Appreciate the concept of vibration to represent a system as a set of masses and springs to evaluate the vibration characteristics in undamped and damped conditions
			CO3:Analytically solve the equations of motion for harmonic excitation, base excitation and force transmission in single degree of freedom systems
			CO4:Analyze problems involving free or forced vibrations with appropriate vibration measurement instrument
			CO5:Formulate governing equations of motion for two degrees, multi degree systems in continuous systems.
			CO6:Obtain design parameters and indicate methods of solution for a complicated vibratory problem

	17ME 652	**Tribology**	CO1:Apply the basic theories of friction, wear and lubrication to predict about the frictional behaviour of commonly encountered sliding interfaces.
			CO2:Analyze mathematical approach of hydrodynamic and hydrostatic lubrication
			CO3:Describe the concept of idealized journal bearing and slider bearing under different load carrying conditions.
			CO4:Explain different bearing materials with their properties and list the advantages and disadvantages

			CO5:Illustrate the behaviour of tribological components subjected to different working conditions and describe different tribological measures
			CO6:Design a tribological system for optimal performance.
	17ME666	**Composite Materials**	CO1:Explain the basic concepts and common manufacturing techniques of composites.
			CO2:Discuss the fabrication techniques of metal matrix composites.
			CO3:Classify the properties of polymer matrix composites and composites testing techniques.
			CO4:List the applications of composites in various engineering domain.
			CO5:Evaluate the mechanical properties of composites based on rule of mixture.
			CO6:Elucidate the purpose and the ways to develop new materials upon proper combination of known materials
	17ME67	**Finite Element Analysis Lab**	CO1:Conduct structural analysis in 1D bar using finite element analysis techniques.
			CO2:Carry out the structural analysis of engineering trusses.
			CO3:Perform structural analysis for beam and plate with a hole.
			CO4:Conduct finite element analysis of thermal problems involving conduction and convection
			CO5:Analyse the nodal frequency by modal and harmonic analysis using ansys.
			CO6:Perform finite element analysis of systems subjected to transient and buckling loads
	17ME68	**MatLAB Lab**	CO1:Compute roots for quadratic, cubic and biquadrate equations using matlab.
			CO2:Solve the simultaneous equations and matrixes using matlab.
			CO3:Interpret plots of conic sections and regression analysis results
			CO4:Analyse the 1D heat transfer conduction and convection analysis using matlab.
			CO5:Analyse the 1Dheat transfer of composite wall, bar and beams using matlab.
			CO6:Perform the vibrations analysis and modal analysis using matlab.
	17ME716	**Total Quality Management**	CO1:Outline the Dimensions and Barriers regarding with Quality.
			CO2:Illustrate the TQM Principles.
			CO3:Analyze the various types of techniques are used to measure quality
			CO4:Apply the various quality systems
			CO5:Demonstrate implementation of Total quality management.
			CO6:Organize for quality and development of quality culture
	17ME	**Production Planning**	CO1:Demonstrate knowledge on basics of production planning and control including forecasting techniques
			CO2:Apply knowledge on ERP, MRP, JIT and inventory management for proper production planning and control

7	**726**	**and Control**	CO3:Apply scheduling and routing techniques to various specified situations
			CO4:Distribute the task evenly over the work station
			CO5:Manage despatch and follow-up operations
			CO6:Apply the principles and techniques for planning and control of the production and service systems to optimize/make best use of resources

	17ME734	**Statistical Quality Control**	CO1:Demonstrate knowledge on basics of Statistical quality control
			CO2:Use control charts to monitor processes
			CO3:Compute process capability and optimize processes
			CO4:Design experiments for process improvement
			CO5:Implement acceptance sampling
			CO6:Apply statistical quality control techniques from process improvements
	17ME744	**Foundry Technology**	CO1:Express Knowledge about the fundamentals of the casting, basic terminology related to casting process design.
			CO2:Explain the fundamental process of solidification of pure metals and alloys
			CO3:Discuss about the special moulding processes and when their use is warranted.
			CO4:Explain the casting techniques of ferrous and non-ferrous alloys.
			CO5:Elaborate the need for modernization of foundry.
			CO6:Demonstrate the ability to select the proper moulding material, type of furnace with relevant refractory material, use appropriate casting design and temperature measurement device to obtain quality cast products.
8	**17ME PW83**	**Project work**	CO1:Plan the course of action and hypothesize the project work using literature survey.
			CO2:Formulate the problem statement &invent possible solutions.
			CO3:Organize the project activity with the constraints required to implement it.
			CO4:Design the working model and test its functioning.
			CO5:Communicate effectively to a diverse audience and develop technical reports and publications.
			CO6:Work as a team member/leader to manage projects in a multidisciplinary environment.