Cambridge Institute of Technology

DEPARTMENT OF MECHANICAL ENGINEERING

Course outcomes of 2017 scheme

Course Code	Course Name	Course Outcomes-On completion of this course the students will be able to
3rd SEMESTER		
17MAT31	ENGINEERING MATHEMATICS-III	CO1: Know the use of periodic signals and Fourier series to analyze circuits and system communications. CO2: Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform. CO3: Employ appropriate numerical methods to solve algebraic and transcendental equations. CO4: Apply Green's Theorem, Divergence Theorem and Stokes' theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems. CO5: Determine the extremals of functionals and solve the simple problems of the calculus of variations.
17ME32	MATERIAL SCIENCE	CO1: Describe the mechanical properties of metals, their alloys and various modes of failure. CO2: Understand the microstructures of ferrous and non-ferrous materials to mechanical properties. CO3: Explain the processes of heat treatment of various alloys.

		CO4: Understand the properties and potentialities of various materials available and material selection procedures. CO5: Know about composite materials and their processing as well as applications.
17ME33	BASIC THERMODYNAMICS	CO1: Explain thermodynamic systems, properties, Zeroth law of thermodynamics, temperature scales and energy interactions. CO2: Determine heat, work, internal energy, enthalpy for flow & non flow process using First and Second Law of Thermodynamics. CO3: Interpret behavior of pure substances and its applications to practical problems. CO4: Determine change in internal energy, change in enthalpy and change in entropy using TD relations for ideal gases. CO5: Calculate Thermodynamics properties of real gases at all ranges of pressure, temperatures using modified equation of state including Vander Waals equation, Redlich Wong equation and Beattie-Bridgeman equation
17ME34	MECHANICS OF MATERIALS	CO1: Understand simple, compound, thermal stresses and strains their relations, Poisson's ratio, Hooke's law, mechanical properties including elastic constants and their relations CO2: Determine stresses, strains and deformations in bars with varying circular and rectangular cross-sections subjected to normal and temperature loads CO3: Determine plane stress, principal stress, maximum shear stress and their orientations using analytical method and Mohr's circle CO4: Determine the dimensions of structural members including beams, bars and rods using Energy methods and also stress distribution in thick and thin cylinders CO5: Draw SFD and BMD for different beams including cantilever beams, simply supported beams and overhanging beams subjected to UDL, UVL, Point loads and couples

		CO6: Determine dimensions, bending stress, shear stress and its distribution in beams of circular, rectangular, symmetrical I and T sections subjected to point loads and UDL CO7: Determine slopes and deflections at various points on beams subjected to UDL, UVL, Point loads and couples CO8: Determine the dimensions of shafts based on torsional strength, rigidity and flexibility and also elastic stability of columns using Rankin's and Euler's theory
17ME35A	METAL CASTING AND WELDING	CO1: Describe the casting process, preparation of Green, Core, dry sand molds and Sweep, Shell, Investment and plaster molds CO2: Explain the Pattern, Core, Gating, Riser system and Jolt, Squeeze, Sand SlingerMolding Machines. CO3: Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces. CO4: Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mold castings. CO5: Explain the Solidification process and Casting of Non-Ferrous Metals CO6: Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes used in manufacturing. CO7: Explain the Resistance spot, Seam, Butt , Projection, Friction, Explosive, Thermit, Laser and Electron Beam Special type of welding process used in manufacturing CO8: Describe the Metallurgical aspects in Welding and inspection methods for the quality assurance of components made of casting and joining process.
17ME36A	COMPUTER AIDED MACHINE DRAWING	CO1: Sections of pyramids, prisms, cubes, cones and cylinders resting on their bases in 2D CO2: Orthographic views of machine parts with and without sectioning in 2D.

		CO3: Sectional views for threads with terminologies of ISO Metric, BSW, square and acme, sellers and American standard threads in 2D. CO4: Hexagonal and square headed bolt and nut with washer, stud bolts with nut and lock nut, flanged nut, slotted nut, taper and split pin for locking CO5: counter sunk head screw, grub screw, Allen screw assemblies in 2D CO6: Parallel key, Taper key, and Woodruff Key as per the ISO standards in 2D CO7: single and double riveted lap joints, butt joints with single/double cover straps, cotter and knuckle joint for two rods in 2D CO8: Sketch split muff, protected type flanged, pin type flexible, Oldham's and universal couplings in 2D CO9: Assemblies from the part drawings with limits ,fits and tolerance given for Plummer block, Ram bottom safety valve, I.C. Engine connecting rod, CO10: Screw Jack, Tailstock of lathe, Machine Vice and Lathe square tool post in 2D and 3D
17MEL37A	MATERIALS TESTING LAB	CO1: Acquire experimentation skills in the field of material testing. CO2: Develop theoretical understanding of the mechanical properties of materials by performing experiments. CO3: Apply the knowledge to analyze a material failure and determine the failure inducing agent/s. CO4: Apply the knowledge of testing methods in related areas. CO5: Know how to improve structure/behavior of materials for various industrial applications.
17MEL38A	FOUNDRY AND FORGING LAB	CO1: Demonstrate various skills of sand preparation, molding. CO2: Demonstrate various skills of forging operations. CO3: Work as a team keeping up ethical principles.

4TH SEMESTER		
17MAT41	ENGINEERING MATHEMATICS - IV	CO1: Solve first and second order ordinary differential equations arising in flow problems using single step and multistep numerical methods. CO2: Understand the analyticity, potential fields, residues and poles of complex potentials in field theory and electromagnetic theory. CO3: Describe conformal and bilinear transformation arising in aerofoil theory, fluid flow visualization and image processing. CO4: Solve problems of quantum mechanics, hydrodynamics and heat conduction by employing Bessel's function relating to cylindrical polar coordinate systems and Legendre's polynomials relating to spherical polar coordinate systems. CO5: Solve problems on probability distributions relating to digital signal processing , information theory and optimization concepts of stability of design and structural engineering. CO6: Draw the validity of the hypothesis proposed for the given sampling distribution in accepting or rejecting the hypothesis. CO7: Determine joint probability distributions and stochastic matrix connected with the multivariable correlation problems for feasible random events. CO8: Define transition probability matrix of a Markov chain and solve problems related to discrete parameter random process.
17ME42	KINEMATICS OF MACHINERY	CO1: Identify mechanisms with basic understanding of motion. CO2: Comprehend motion analysis of planar mechanisms, gears, gear trains and cams. CO3: Carry out motion analysis of planar mechanisms, gears, gear trains and cams.
17ME43	APPLIED THERMODYNAMICS	CO1: Apply thermodynamic concepts to analyze the performance of gas power cycles including propulsion systems.

		CO2: Evaluate the performance of steam turbine components. CO3: Understand combustion of fuels and combustion processes in I C engines including alternate fuels and pollution effect on environment. CO4: Apply thermodynamic concepts to analyze turbo machines. CO5: Determine performance parameters of refrigeration and air-conditioning systems. CO6: Understand the principles and applications of refrigeration systems. CO7: Analyze air-conditioning processes using the principles of psychrometry and Evaluate cooling and heating loads in an airconditioning system. CO8: Understand the working, applications, relevance of air and identify methods for performance improvement.
17ME44	FLUID MECHANICS	CO1: Identify and calculate the key fluid properties used in the analysis of fluid behavior. CO2: Understand and apply the principles of pressure, buoyancy and floatation CO3:Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of mechanical and chemical engineering. CO4:Understand and apply the principles of fluid kinematics and dynamics. CO5:Understand the concept of boundary layer in fluid flow and apply dimensional analysis to form dimensionless numbers in terms of input output variables. CO6: Understand the basic concept of compressible flow and CFD
17ME45B	MACHINE TOOLS AND OPERATIONS	CO1: Explain the construction & specification of various machine tools. CO2: Describe various machining processes pertaining to relative motions between tool & work piece.

		CO3: Discuss different cutting tool materials, tool nomenclature & surface finish. CO4: Apply mechanics of machining process to evaluate machining time. CO5: Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost.
17ME46B	MECHANICAL MEASUREMENTS AND METROLOGY	CO1: Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars. CO2: Describe slip gauges, wringing of slip gauges and building of slip gauges, angle measurement using sine bar, sine center, angle gauges, optical instruments and straightness measurement using Autocollimator CO3: Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design. CO4: Understand the principle of Johnson Mikrokator, sigma comparator, dial indicator, LVDT, back pressure gauges, Solex comparators and Zeiss Ultra Optimeter CO5: Describe measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 – wire, 3 – wire methods, screw thread gauges and tool maker's microscope. CO6: Explain measurement of tooth thickness using constant chord method, addendum comparator methods and base tangent method, composite error using gear roll tester and measurement of pitch, concentricity, run out and involute profile. CO6: Understand laser interferometers and Coordinate measuring machines. CO7: Explain measurement systems, transducers, intermediate modifying devices and terminating devices. CO8: Describe functioning of force, torque, pressure, strain and temperature measuring devices

17MEL47B	MECHANICAL MEASUREMENTS AND METROLOGY LAB	CO1: To calibrate pressure gauge, thermocouple, LVDT, load cell, micrometer. CO2: To measure angle using Sine Center/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set. CO3: To demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats CO4: To measure cutting tool forces using Lathe/Drill tool dynamometer CO5: To measure Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth vernier/Gear tooth micrometer CO6: To measure surface roughness using Tally Surf/ Mechanical Comparator.
17MEL48B	MACHINE SHOP	CO1: Perform turning , facing , knurling , thread cutting, tapering , eccentric turning and allied operations CO2: Perform keyways / slots , grooves etc using shaper CO3: Perform gear tooth cutting using milling machine CO4: Understand the formation of cutting tool parameters of single point cutting tool using bench grinder / tool and cutter grinder CO5: Understand Surface Milling/Slot Milling CO6: Demonstrate precautions and safety norms followed in Machine Shop CO7: Exhibit interpersonal skills towards working in a team
5TH SEMESTER		
17ME51	MANAGEMENT AND ENGINEERING ECONOMICS	CO1: Explain the development of management and the role it plays at different levels in an organization.

		CO2: Comprehend the process and role of effective planning, organizing and staffing for the development of anorganization. CO3: Understand the necessity of good leadership, communication and coordination for establishing effective control in an organization. CO4: Understand engineering economics demand supply and its importance in economics decision making and problemsolving. CO5: Calculate present worth, annual worth and IRR for different alternatives in economic decision making. CO6: Understand the procedure involved in estimation of cost for a simple component, product costing and depreciation, its methods.
17ME52	DYNAMICS OF MACHINERY	CO1: Determine the forces and couples for static and dynamic conditions of four bar and slider crank mechanisms to keep the system in equilibrium. CO2: Determine magnitude and angular position of balancing masses under static and dynamic condition of rotating masses in same and different planes. CO3: Determine unbalanced primary, secondary forces and couples in single and multi-cylinder engine. CO4: Determine sensitiveness, isochronism, effort and power of porter and hartnell governors. CO5: Determine gyroscopic couple and effects related to 2, 4 wheeler, plane disc, ship and aeroplanes. CO6: Understand types of vibration, SHM and methods of finding natural frequencies of simple mechanical systems. CO7: Determine equation of motion, natural frequency, damping factor, logarithmic decrement of damped free vibration (SDOF) systems.

		CO8: Determine the natural frequency, force and motion transmissibility of single degree freedom systems. CO9: Determine equation of motion of rotating and reciprocating unbalance systems, magnification factor, and transmissibility of forced vibration (SDOF) systems.
17ME53	TURBO MACHINES	CO1: Able to give precise definition of turbomachinery CO2: Identify various types of turbo machinery CO3: Apply the Euler's equation for turbomachinery to analyse energy transfer in turbomachines CO4: Understand the principle of operation of pumps, fans, compressors and turbines. CO5: Perform the preliminary design of turbomachines (pumps, rotary compressors and turbines) CO6: Analyze the performance of turbo machinery.
17ME54	DESIGN OF MACHINE ELEMENTS – I	CO1: Describe the design process, choose materials. CO2: Apply the codes and standards in design process. CO3: Analyze the behavior of machine components under static, impact, fatigue loading using failure theories. CO4: Design shafts, joints, couplings. CO5: Design of riveted and welded joints. CO6: Design of threaded fasteners and power screws
17ME551	REFRIGERATION AND AIR-CONDITIONING	CO1: Illustrate the principles, nomenclature and applications of refrigeration systems. CO2: Explain vapour compression refrigeration system and identify methods for performance improvement

		CO3: Study the working principles of air, vapour absorption, thermoelectric and steam-jet and thermo-acoustic refrigeration systems CO4: Estimate the performance of air-conditioning systems using the principles of psychometry. CO5: Compute and Interpret cooling and heating loads in an air-conditioning system CO6: Identify suitable refrigerant for various refrigerating systems
17ME552	THEORY OF ELASTICITY	CO1: Describe the state of stress and strain in 2D and 3D elastic members subjected to direct loads and thermal loads. CO2: Analyse the structural members: beam, rotating disks, columns CO3: Analyse the torsional rigidity of circular and non-circular sections. CO4: Analyse the stability of columns
17ME553	HUMAN RESOURCE MANAGEMENT	CO1: Understand the importance, functions and principles Human Resource Management and process of Job analysis CO2: Summarize the objectives of Human Resource planning, Recruitment and selection process CO3: Understand the process involved in Placement, Training and development activities. CO4: Understand the characteristics of an effective appraisal system and compensation planning. CO5: Understand the issues related to employee welfare, grievances and discipline.
17ME554	NON TRADITIONAL MACHINING	CO1: Understand the compare traditional and non-traditional machining processand recognize the need for Non-traditional machining process. CO2: Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM.

		CO3: Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations. CO4: Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM. CO5: Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM.
17ME561	OPTIMIZATION TECHNIQUES	CO1: Understand the overview of optimization techniques, concepts of design space, constraint surfaces and objective function. CO2: Review differential calculus in finding the maxima and minima of functions of several variables. CO3: Formulate real-life problems with Linear Programming. CO4: Solve the Linear Programming models using graphical and simplex methods. CO5: Formulate real-life transportation, assignment and travelling salesman problems to find the optimum solution using transportation algorithms CO6: Analyze the Queuing model for effective customer satisfaction CO7: Apply dynamic programming to optimize multi stage decision problems. CO8: Determine the level of inventory that a business must maintain to ensure smooth operation. CO9: Construct precedence diagram for series of activities in a huge project to find out probability of expected completion time using PERT-CPM networks. Also reduce the duration of project by method of crashing.
17ME562	ENERGY AND ENVIRONMENT	CO1: Summarize the basic concepts of energy, its distribution and general Scenario.

		CO2: Explain different energy storage systems, energy management, audit and economic analysis. CO3: Summarize the environment eco system and its need for awareness. CO4: Identify the various types of environment pollution and their effects. CO5: Discuss the social issues of the environment with associated acts.
17ME563	AUTOMATION AND ROBOTICS	CO1: Classify various types of automation &manufacturing systems CO2: Discuss different robot configurations, motions, drive systems and its performance parameters. CO3: Describe the basic concepts of control systems, feedback components, actuators and power transmission systems used in robots. CO4: Explain the working of transducers, sensors and machine vision systems. CO5: Discuss the future capabilities of sensors, mobility systems and Artificial Intelligence in the field of robotics.
17ME564	PROJECT MANAGEMENT	CO1: Understand the selection, prioritization and initiation of individual projects and strategic role of project management. CO2: Understand the work breakdown structure by integrating it with organization. CO3: Understand the scheduling and uncertainty in projects. CO4: Students will be able to understand risk management planning using project quality tools. CO5: Understand the activities like purchasing, acquisitions, contracting, partnering and collaborations related to performing projects. CO6: Determine project progress and results through balanced scorecard approach

		CO7: Draw the network diagram to calculate the duration of the project and reduce it using crashing.
17MEL57	FLUID MECHANICS & MACHINERY LAB	CO1: Perform experiments to determine the coefficient of discharge of flow measuring devices. CO2: Conduct experiments on hydraulic turbines and pumps to draw characteristics. CO3: Test basic performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations. CO4: Determine the energy flow pattern through the hydraulic turbines and pumps CO5: Exhibit his competency towards preventive maintenance of hydraulic machines
17MEL58	ENERGY LAB	CO1: Perform experiments to determine the properties of fuels and oils. CO2: Conduct experiments on engines and draw characteristics. CO3: Test basic performance parameters of I.C. Engine and implement the knowledge in industry. CO4: Identify exhaust emission, factors affecting them and report the remedies. CO5: Determine the energy flow pattern through the I C Engine CO6: Exhibit his competency towards preventive maintenance of IC engines.
6TH SEMESTER		
17ME61	FINITE ELEMENT ANALYSIS	CO1: Understand the concepts behind formulation methods in FEM. CO2: Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements. CO3: Develop element characteristic equation and generation of global equation.

		CO4: Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi symmetric and dynamic problems and solve them displacements, stress and strains induced.
17ME62	COMPUTER INTEGRATED MANUFACTURING	CO1: Able to define Automation, CIM, CAD, CAM and explain the differences between these concepts. Solve simple problems of transformations of entities on computer screen. CO2: Explain the basics of automated manufacturing industries through mathematical models andanalyze different types of automated flow lines. CO3: Analyze the automated flow linesto reduce down time and enhance productivity. CO4: Explain the use of different computer applications in manufacturing, and able to prepare part programs for simple jobs on CNC machine tools and robot programming. CO5: Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.
17ME63	HEAT TRANSFER	CO1: Understand the basic modes of heat transfer. CO2: Compute temperature distribution in steady-state and unsteady-state heat conduction CO3: Understand and interpret heat transfer through extended surfaces. CO4: Interpret and compute forced and free convective heat transfer. CO5: Explain the principles of radiation heat transfer and understand the numerical formula for heat conduction problems. CO6: Design heat exchangers using LMTD and NTU methods.

17ME64	DESIGN OF MACHINE ELEMENTS II	CO1: Apply engineering design tools to product design. CO2: Design mechanical systems involving springs,belts and pulleys. CO3: Design different types of gears and simple gear boxes for different applications. CO4: Design brakes and clutches. CO5: Design hydrodynamic bearings for different applications. CO6: Select Anti friction bearings for different applications using the manufacturers, catalogue. CO7: Develop proficiency to generate production drawings using CAD software. CO8: Become good design engineers through learning the art of working in a team with morality and ethics.
17ME651	COMPUTATIONAL FLUID DYNAMICS	CO1: Understand mathematical characteristics of partial differential equations. CO2: Explain how to classify and computationally solve Euler and Navier-Stokes equations. CO3: Make use of the concepts like accuracy, stability, consistency of numerical methods for the governing equations. CO4: Identify and implement numerical techniques for space and time integration of partial differential equations. CO5: Conduct numerical experiments and carry out data analysis. CO6: Acquire basic skills on programming of numerical methods used to solve the Governing equations.
17ME652	MECHANICS OF COMPOSITE MATERIALS	CO1: To identify the properties of fiber and matrix materials used in commercial composites, as well as some common manufacturing techniques. CO2: To predict the failure strength of a laminated composite plate

		CO3: Understand the linear elasticity with emphasis on the difference between isotropic and anisotropic material behaviour. CO5: Acquire the knowledge for the analysis, design, optimization and test simulation of advanced composite structures and Components.
17ME653	METAL FORMING	CO1: Able to understandthe concept of different metal forming process. CO2: Able to approach metal forming processes both analytically and numerically CO3: Able to design metal forming processes CO4: Able to develop approaches and solutions to analyze metal forming processes and the associated problems and flaws.
17ME63	TOOL DESIGN	CO1: Selection appropriate cutting tools required for producing a component. CO2: Ability to interpret cutting tool and tool holder designation systems. CO3: Ability to design/select suitable locating and clamping devices for a given component for various operations. CO4: Capability to design a jig/fixture for a given simple component. CO5: Comprehensive understanding of various press tools and press tool operations. CO6: Classify and explain various die casting and injection moulding dies.
17ME655	AUTOMOBILE ENGINEERING	CO1: To identify the different parts of an automobile and it's working CO2: To understand the working of transmission and braking systems CO3: To comprehend the working of steering and suspension systems CO4: To learn various types of fuels and injection systems

		CO5: To know the cause of automobile emissions ,its effects on environment and methods to reduce the emissions.
17ME661	ENERGY AUDITING	CO1: Understand the basic concepts of energy audit and energy management CO2: Explain different types of energy audit, maximizing and optimizing system efficiency. CO3: Summarize energy management systems, prepare and present energy audit report CO4: Identify energy saving potential of thermal and electrical systems CO5: Discuss Energy audit instruments, Procedures and Techniques.
17ME662	INDUSTRIAL SAFETY	CO1: Understand the basic safety terms. CO2: Identify the hazards around the work environment and industries. CO3: Use the safe measures while performing work in and around the work area of the available laboratories. CO4: Able to recognize the sign boards and its application. CO5: Able to demonstrate the portable extinguishers used for different class of fires. CO6: Able to write the case studies by sharing experience of the employees working in housekeeping, laboratories like workshops, electrical labs, machine shops, electronics and computer laboratories. CO7: Able to understand and report the case studies from various references (text books, news report, journals, visiting industries like power stations, manufacturing and maintenance).
17ME663	MAINTENANCE ENGINEERING	CO1: Understand maintenance objectives and evaluate various maintenance strategies for process plant application, Develop necessary planning and scheduling and control of preventive maintenance activities. CO2: Evaluate reliability of a simple plant component and system.

		CO3: Understand and apply the advanced concepts such as RCM and advantages for a company employing them CO4: Understand and apply the advanced concepts such as TPM and advantages for a company employing CO5: Apply the principles of condition monitoring systems. CO6: Apply the mechanical condition monitoring techniques and analyze the data used in condition monitoring
17ME664	TOTAL QUALITY MANAGEMENT	CO1: Explain the various approaches of TQM CO2: Infer the customer perception of quality CO3: Analyze customer needs and perceptions to design feedback systems. CO4: Apply statistical tools for continuous improvement of systems CO5: Apply the tools and technique for effective implementation of TQM.
17MEL67	HEAT TRANSFER LAB	CO1: Perform experiments to determine the thermal conductivity of a metal rod CO2: Conduct experiments to determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values. CO3: Estimate the effective thermal resistance in composite slabs and efficiency in pin-fin CO4: Determine surface emissivity of a test plate CO5: Estimate performance of a refrigerator and effectiveness of fin CO6: Calculate temperature distribution of study and transient heat conduction through plane wall, cylinder and fin using numerical approach.

17MEL68	MODELING AND ANALYSIS LAB	CO1: Demonstrate the basic features of an analysis package. CO2: Use the modern tools to formulate the problem, and able to create geometry, descritize, apply boundary condition to solve problems of bars, truss, beams, plate to find stress with different loading conditions. CO3: Demonstrate the deflection of beams subjected to point, uniformly distributed and varying loads further to use the available results to draw shear force and bending moment diagrams. CO4: Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions. CO5: Carry out dynamic analysis and finding natural frequencies for various boundary conditions and also analyze with forcing function.
7TH SEMESTER		
17ME71	ENERGY ENGINEERING	CO1: Summarize the basic concepts of thermal energy systems, CO2: Identify renewable energy sources and their utilization. CO3: Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems. CO4: Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas. CO5: Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator.

		CO6: Identify methods of energy storage for specific applications
17ME72	FLUID POWER SYSTEMS	CO1: Identify and analyse the functional requirements of a fluid power transmission system for a given application. CO2: Visualize how a hydraulic/pneumatic circuit will work to accomplish the function. CO3: Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application. CO4: Select and size the different components of the circuit. CO5: Develop a comprehensive circuit diagram by integrating the components selected for the given application.
17ME73	CONTROL ENGINEERING	CO1: Recognize control system and its types , control actions CO2: Determine the system governing equations for physical models(Electrical, Thermal, Mechanical, Electro Mechanical) CO3: Calculate the gain of the system using block diagram and signal flow graph CO4: Illustrate the response of 1st and 2nd order systems CO5: Determine the stability of transfer functions in complex domain and frequency domain CO6: Employ state equations to study the controllability and observability
17ME741	DESIGN OF THERMAL EQUIPMENTS	CO1: To have complete knowledge of heat exchanger and its appplications CO2: To be able to design shell and tube heat exchanger CO3: To be able to select and design of steam heat condenser and compact heat exchanger condenser and heat pipes for various application
17ME742	TRIBOLOGY	CO1: Understand the fundamentals of tribology and associated parameters. CO2: Apply concepts of tribology for the performance analysis and design of components

		experiencing relative motion. CO3: Analyse the requirements and design hydrodynamic journal and plane slider bearings for a given application. CO4: Select proper bearing materials and lubricants for a given tribological application. CO5: Apply the principles of surface engineering for different applications of tribology.
17ME743	FINANCIAL MANAGEMENT	CO1: Measure the returns from engineering projects of differing risks and present a risk-return trade off relationship. CO2: Determine the financial ratios and profitability margins of projects to evaluate economic viability to accept or reject the project. CO3: Evaluate cost break ups of engineering projects and processes to determine and control the prohibitive cost components CO4: Apply a Engineering Asset Management techniques to evaluate the economic value of physical assets.
17ME744	DESIGN FOR MANUFACTURING	CO1: Describe the different types of manufacturing systems and compare their suitability for economic production of various components and products. CO2: Identify factors and causing mechanisms of the defects likely to occur with different manufacturing processes in producing mechanical products and the relevant design approaches to rectify them. CO3: Select proper materials and manufacturing processes for designing products/components by applying the relevant principles for ease and economic production
17ME745	SMART MATERIALS AND MEMS	CO1: Describe the methods of controlling vibration using smart systems and fabrication methods of MEMS. CO2: Explain the principle concepts of Smart materials, structures, Fibre optics, ER & MR Fluids, Biomimetics and MEMS with principles of working.

		CO3: Analyze the properties of smart structures, MEMS, with the applications and select suitable procedure for fabrication. CO4: Summarize the methods and uses of Micro fabrications, Biomimetics, types of polymers used in MEMS, Fibre optics, piezoelectric sensing and actuation.
17ME751	AUTOMOTIVE ELECTRONICS	CO1: Explain the electronics systems used for control of automobiles CO2: Select sensors, actuators and control systems used in automobiles CO3: Diagnose the faults in the sub systems and systems used automobile
17ME752	FRACTURE MECHANICS	CO1: Develop basic fundamental understanding of the effects of cracklike defects on the performance of aerospace, civil, and mechanical Engineering structures. CO2: Learn to select appropriate materials for engineering structures to insure damage tolerance. CO3: Learn to employ modern numerical methods to determine critical crack sizes and fatigue crack propagation rates in engineering structures. CO4: Gain an appreciation of the status of academic research in field of fracture mechanics.
17ME753	MECHATRONICS	CO1: Illustrate various components of Mechatronics systems. CO2: Assess various control systems used in automation. CO3: Develop mechanical, hydraulic, pneumatic and electrical control systems.
17ME754	ADVANCED VIBRATIONS	CO1: Understand and characterize the single and multi degrees of freedom systems subjected to free and forced vibrations with and without damping. CO2: Understand the method of vibration measurements and its controlling. CO3: Understand the concept of dynamic vibrations of a continuous systems

17MEL76	DESIGN LABORATORY	CO1: To understand the working principles of machine elements such as Governors, Gyroscopes etc., CO2: To identify forces and couples in rotating mechanical system components. CO3. To identify vibrations in machine elements and design appropriate damping methods and to determine the critical speed of a rotating shaft. CO4: To measure strain in various machine elements using strain gauges. CO5: To determine the minimum film thickness, load carrying capacity, frictional torque and pressure distribution of journal bearing. CO6: To determine strain induced in a structural member using the principle of photo-elasticity.
17MEL77	COMPUTER INTEGRATED MANUFACTURING LAB	CO1: Generate CNC Lathe part program for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning, Circular interpolation etc. CO2: Generate CNC Mill Part programming for Point to point motions, Line motions, Circular interpolation, Contour motion, Pocket milling- circular, rectangular, Mirror commands etc. CO3: Use Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning Thread cutting etc. CO4: Simulate Tool Path for different Machining operations of small components using CNC Lathe & CNC Milling Machine. CO5: Use high end CAM packages for machining complex parts; use state of art cutting tools and related cutting parameters; optimize cycle time. CO6: Understand & write programs for Robot control; understand the operating principles of hydraulics, pneumatics and electro pneumatic systems. Apply this knowledge to automate& improve efficiency of manufacturing.
17MEP78	PROJECT WORK, PHASE I	-

8TH SEMESTER		
17ME81	OPERATIONS RESEARCH	CO1: Understand the meaning, definitions, scope, need, phases and techniques of operations research. CO2: Formulate as L.P.P and derive optimal solutions to linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method. CO3: Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems. CO4: Solve problems on game theory for pure and mixed strategy under competitive environment. CO5: Solve waiting line problems for M/M/1 and M/M/K queuing models. CO6: Construct networkdiagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks. CO7: Determine minimum processing times for sequencing of n jobs-2 machines, n jobs-3machines,n jobs-m machinesand 2 jobs-n machines using Johnson's algorithm.
17ME82	ADDITIVE MANUFACTURING	CO1: Understand the different process of Additive Manufacturing. using Polymer, Powder and Nano materials manufacturing. CO2: Analyse the different characterization techniques. CO3: Describe the various NC, CNC machine programing and Automation techniques
17ME831	CRYOGENICS	CO1: To be able to understand the cryogenic system. CO2: To have complete knowledge of cryogenic refrigeration system CO3: To be able to design gas separation and gas purification system CO4: To able to solve the problem in , insulation, storage of cryogenic liquids

		CO5: To be able to apply cryogenic in various areas and to be able take up research in cryogenics
17ME832	EXPERIMENTAL STRESS ANALYSIS	CO1: Explain and the elastic behavior of solid bodies. CO2: Describe stress strain analysis of mechanical systems using electrical resistance strain gauges. CO3: Understand the experimental methods of determining stresses and strains induced. CO4: Apply the coating techniques to determine the stresses and strains.
17ME833	THEORY OF PLASTICITY	CO1: Understand stress, strain, deformations, relation between stress and strain and plastic deformation in solids. CO2: Understand plastic stress-strain relations and associated flow rules. CO3: Perform stress analysis in beams and bars including Material nonlinearity. CO4: Analyze the yielding of a material according to different yield theory for a given state of stress. CO5: Interpret the importance of plastic deformation of metals in engineering problems.
17ME834	GREEN MANUFACTURING	CO1: Understand the basic design concepts, methods, tools, the key technologies and the operation of sustainable green manufacturing. CO2: Apply the principles, techniques and methods to customize the learned generic concepts to meet the needs of a particular industry/enterprise. CO3: Identify the strategies for the purpose of satisfying a set of given sustainable green manufacturing requirements. CO4: Design the rules and processes to meet the market need and the green manufacturing requirements by selecting and evaluating suitable technical, managerial / project management and supply chain management scheme.

17ME835	PRODUCT LIFE CYCLE MANAGEMENT	CO1: Explain the various strategies of PLM and Product Data Management CO2: Describe decomposition of product design and model simulation CO3: Apply the concept of New Product Development and its structuring. CO4: Analyze the technological forecasting and the tools in the innovation. CO5: Apply the virtual product development and model analysis

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