CO ATTAINMENT

Batch Type : Generic Academics
Academic Year : 2020-21

Faculty : Mr Praveen D
Department Name : Civil Engineering (CV)
Semester : 6 - Section : A - CourseCode : 18ME651
Course Outcome Attainment Data
Department Name : Mechanical Engineering (ME)

Semester : 5 - Section : B - CourseCode : 18ME55

Course Outcomes	IA (IA)		OA (Other Assessment)		University Exam		Direct Attainment		Feedback		Indirect Attainment		Total Attainment	
	Attainment(out of 3)	Attainment(out of 100)	Attainment(out of 3)	Attainment(out of 100)	Attainment(out of 3)	Attainment(out of 100)	Attainment(out of 3)	Attainment(out of 100)	Attainment(out of 3)	Attainment(out of 100)	Attainment(out of 3)	Attainment(out of 100)	Attainment(out of 3)	Attainment(out of 100)
18ME55.1	3	100	3	100	2.46	81.92	2.78	92.77	2.78	92.77	2.78	92.77	2.23	74.21
18ME55.2	3	100	3	100	2.46	81.92	2.78	92.77	2.78	92.77	2.78	92.77	2.23	74.21
18ME55.3	3	100	3	100	2.46	81.92	2.78	92.77	2.78	92.77	2.78	92.77	2.23	74.21
18ME55.4	3	100	3	100	2.46	81.92	2.78	92.77	2.78	92.77	2.78	92.77	2.23	74.21
18ME55.5	3	100	3	100	2.46	81.92	2.78	92.77	2.78	92.77	2.78	92.77	2.23	74.21

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PO Attainment														
Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	1.67	1.67	0.54	0.56	0	0	0	0	0	0	0	0	0	0
CO 2	1.85	1.85	0.62	0.62	0	0	0	0	0	0	0	0	0	0
CO 3	1.56	1.56	0.52	0.52	0	0	0	0	0	0	0	0	0	0
CO 4	1.18	1.18	0.39	0.39	0	0	0	0	0	0	0	0	0	0
CO 5	2.03	2.03	0.68	0.68	0	0	0	0	0	0	0	0	0	0

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE OUTCOMES

ADICUNCHANGIRI INSTITUTE OF TECHNOLOGY

DEPARTMENT OF Mechanical Engineering

2017 scheme

Semester	Subject	Subject code	Course Outcomes
1,2	Engineering Graphics	17EGDL15/ 25	• Understand and visualize the objects with definite shape and dimensions • Analyze the shape and size of objects through different views • Develop the lateral surfaces of the object • Create a 3D view using CAD software. • Identify the interdisciplinary engineering components or systems through its graphical representation
	Elements of Mechanical Engineering	17EME15/ 25	• Understand basic concepts of mechanical engineering in the fields of energy and its utilization, materials technology, manufacturing techniques, and transmission systems through demonstrations. • Understand the application of energy sources in Power generation and utilization, Engineering materials, manufacturing, and machining techniques leading to the latest advancements and transmission systems in day to day activities • Apply the skills in developing simple mechanical elements and processes

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3	Engineering mathematics-III	17MAT31	• Know the use of periodic signals and Fourier series to analyze circuits and system communications. • Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform. • Employ appropriate numerical methods to solve algebraic and transcendental equations. • 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. • Determine the externals of functional and solve the simple problems of the calculus of variations
	Material science	17ME32	• Describe the mechanical properties of metals, their alloys and various modes of failure • Understand the microstructures of ferrous and non-ferrous materials to mechanical properties • Explain the processes of heat treatment of various alloys • Understand the properties and potentialities of various materials available and material selection procedures • Know about composite materials and their processing as well as applications
	Basic thermodynamics	17ME33	• Explain thermodynamic systems, properties, Zeroth law of thermodynamics, temperature scales and energy interactions • Determine heat, work, internal energy, enthalpy for flow & non flow process using First and Second Law of Thermodynamics • Interpret behavior of pure substances and its applications to practical problems • Determine change in internal energy, change in enthalpy and change in entropy using TD relations for ideal gases • 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
	Mechanics of materials	17ME34	• Understand simple, compound, thermal stresses and strains their relations, Poisson's ratio, Hooke's law, mechanical properties including elastic constants and their relations

			• Determine stresses, strains and deformations in bars with varying circular and rectangular cross-sections subjected to normal and temperature loads • Determine plane stress, principal stress, maximum shear stress and their orientations using analytical method and Mohr's circle • Determine the dimensions of structural members including beams, bars and rods using Energy methods and also stress distribution in thick and thin cylinders • Draw SFD and BMD for different beams including cantilever beams, simply supported beams and overhanging beams subjected to UDL, UVL, Point loads and couples • 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 • 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
	Metal casting and welding	17ME35 A /45A	• Describe the casting process, preparation of Green, Core, dry sand molds and Sweep, Shell, Investment and plaster molds • Explain the Pattern, Core, Gating, Riser system and Jolt, Squeeze, Sand Slinger Molding Machines • Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces • Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mold castings • Explain the Solidification process and Casting of Non-Ferrous Metals • Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes used in manufacturing • Explain the Resistance spot, Seam, Butt, Projection, Friction, Explosive, Thermit, Laser and Electron Beam Special type of welding process used in manufacturing • Describe the Metallurgical aspects in Welding and inspection methods for the quality assurance of components made of casting and joining process
	Machine tools and operations	17ME35 B / 45B	• Explain the construction & specification of various machine tools. • Describe various machining processes pertaining to relative motions between tool & work piece. • Discuss different cutting tool materials, tool nomenclature & surface finish. • Apply mechanics of machining process to evaluate machining time.

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			• Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost.
	Computer aided machine drawing	17ME36 A / 46A	• Sections of pyramids, prisms, cubes, cones and cylinders resting on their bases in 2D • Orthographic views of machine parts with and without sectioning in 2D. • Sectional views for threads with terminologies of ISO Metric, BSW, square and acme, sellers and American standard threads in 2D. • 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 counter sunk head screw, grub screw, Allen screw assemblies in 2D • Parallel key, Taper key, and Woodruff Key as per the ISO standards in 2D • single and double riveted lap joints, butt joints with single/double cover straps, cotter and knuckle joint for two rods in 2D • Sketch split muff, protected type flanged, pin type flexible, Oldham's and universal couplings in 2D • Assemblies from the part drawings with limits ,fits and tolerance given for Plummer block, Ram bottom safety valve, I.C. Engine • connecting rod, Screw Jack, Tailstock of lathe, Machine Vice and Lathe square tool post in 2D and 3D
	Mechanical measurements and metrology	17ME36 B / 46B	• Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement • and calibration of end bars. • 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. • Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design. • Understand the principle of Johnson Mikrokator, sigma comparator, dial indicator, LVDT, back pressure gauges, Solex comparators • and Zeiss Ultra Optimeter • 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.

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			• 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 • Understand laser interferometers and Coordinate measuring machines. • Explain measurement systems, transducers, intermediate modifying devices and terminating devices. • Describe functioning of force, torque, pressure, strain and temperature measuring devices
	Materials testing lab	17MEL37 A / 47A	• Acquire experimentation skills in the field of material testing. • Develop theoretical understanding of the mechanical properties of materials by performing experiments. • Apply the knowledge to analyze a material failure and determine the failure inducing agent/s. • Apply the knowledge of testing methods in related areas. • Know how to improve structure/behavior of materials for various industrial applications
	Mechanical measurements and metrology lab	17MEL37 B / 47B	• To calibrate pressure gauge, thermocouple, LVDT, load cell, micrometer.. • To measure angle using Sine Center/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set. • To demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats.. • To measure cutting tool forces using Lathe/Drill tool dynamometer.. • To measure Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth vernier/Gear tooth micrometer. • To measure surface roughness using Tally Surf/ Mechanical Comparator
	Foundry and forging lab	17MEL38A / 48A	• Demonstrate various skills of sand preparation, molding. • Demonstrate various skills of forging operations. • Work as a team keeping up ethical principles
	Machine shop	17MEL38B / 48B	• Perform turning , facing , knurling , thread cutting, tapering , eccentric turning and allied operations, keyways / slots , grooves • etc using shaper • Perform gear tooth cutting using milling machine • Understand the formation of cutting tool parameters of single point cutting tool using

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			bench grinder / tool and cutter grinder, • Surface Milling/Slot Milling • Demonstrate precautions and safety norms followed in Machine Shop • Exhibit interpersonal skills towards working in a team
4			•
	Kinematics of machines	17ME42	• Identify mechanisms with basic understanding of motion. • Comprehend motion analysis of planar mechanisms, gears, gear trains and cams. • Carry out motion analysis of planar mechanisms, gears, gear trains and cams.
	Applied thermodynamics	17ME43	• Apply thermodynamic concepts to analyze the performance of gas power cycles including propulsion systems. • Evaluate the performance of steam turbine components. • Understand combustion of fuels and combustion processes in I C engines including alternate fuels and pollution effect on environment. • Apply thermodynamic concepts to analyze turbo machines. • Determine performance parameters of refrigeration and air-conditioning systems. • Understand the principles and applications of refrigeration systems. • Analyze air-conditioning processes using the principles of psychrometry and Evaluate cooling and heating loads in an air conditioning system. • Understand the working, applications, relevance of air and identify methods for performance improvement.
	Fluid mechanics	17ME44	• Identify and calculate the key fluid properties used in the analysis of fluid behavior. • Understand and apply the principles of pressure, buoyancy and floatation • Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of mechanical and chemical engineering. • Understand and apply the principles of fluid kinematics and dynamics. • Understand the concept of boundary layer in fluid flow and apply dimensional analysis to form dimensionless numbers in terms of input output variables. • Understand the basic concept of compressible flow and CFD
5	Management and engineering economics	17ME51	• Explain the development of management and the role it plays at different levels in an organization. • Comprehend the process and role of effective planning, organizing and staffing for the

			development of an organization. • Understand the necessity of good leadership, communication and coordination for establishing effective control in an organization. • Understand engineering economics demand supply and its importance in economics decision making and problem solving. • Calculate present worth, annual worth and IRR for different alternatives in economic decision making. • Understand the procedure involved in estimation of cost for a simple component, product costing and depreciation, its methods.
	Dynamics of machinery	17ME52	• Determine the forces and couples for static and dynamic conditions of four bar and slider crank mechanisms to keep the system in equilibrium. • Determine magnitude and angular position of balancing masses under static and dynamic condition of rotating masses in same and different planes. • Determine unbalanced primary, secondary forces and couples in single and multi-cylinder engine. • Determine sensitiveness, isochronism, effort and power of porter and hartnell governors. • Determine gyroscopic couple and effects related to 2, 4 wheeler, plane disc, ship and aeroplanes. • Understand types of vibration, SHM and methods of finding natural frequencies of simple mechanical systems. • Determine equation of motion, natural frequency, damping factor, logarithmic decrement of damped free vibration (SDOF) systems. • Determine the natural frequency, force and motion transmissibility of single degree freedom systems. • Determine equation of motion of rotating and reciprocating unbalance systems, magnification factor, and transmissibility of forced vibration (SDOF) systems.
	Turbo machines	17ME53	• Able to give precise definition of turbomachinery • Identify various types of turbo machinery • Apply the Euler's equation for turbomachinery to analyse energy transfer in turbomachines • Understand the principle of operation of pumps, fans, compressors and turbines. • Perform the preliminary design of turbomachines (pumps, rotary compressors and

			turbines) • Analyze the performance of turbo machinery.
	Design of machine elements – i	17ME54	• Describe the design process, choose materials. • Apply the codes and standards in design process. • Analyze the behavior of machine components under static, impact, fatigue loading using failure theories. • Design shafts, joints, couplings. • Design of riveted and welded joints. • Design of threaded fasteners and power screws
	Refrigeration and air-conditioning	17ME551	• Illustrate the principles, nomenclature and applications of refrigeration systems. • Explainvapor compression refrigeration system and identify methods for performance improvement • Study the working principles of air, vapor absorption, thermoelectric and steam-jet and thermo-acoustic refrigeration systems • Estimate the performance of air-conditioning systems using the principles of psychometry. • Compute and Interpret cooling and heating loads in an air-conditioning system • Identify suitable refrigerant for various refrigerating systems
	Theory of elasticity	17ME552	• Describe the state of stress and strain in 2D and 3D elastic members subjected to direct loads and thermal loads. • Analyse the structural members: beam, rotating disks, columns. • Analyse the torsional rigidity of circular and non-circular sections. • Analyse the stability of columns.
	Human resource management	17ME553	• Understand the importance, functions and principles Human Resource Management and process of Job analysis • Summarize the objectives of Human Resource planning, Recruitment and selection process • Understand the process involved in Placement, Training and development activities. • Understand the characteristics of an effective appraisal system and compensation planning. • Understand the issues related to employee welfare, grievances and discipline.

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	Non traditional machining	17ME554	• Understand the compare traditional and non-traditional machining processand recognize the need for Non-traditional machining process. • Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM. • Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, • process characteristics, applications, advantages and limitations. • Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM. • Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, • advantages and limitations LBM & EBM.
	Optimization techniques	17ME561	• Understand the overview of optimization techniques, concepts of design space, constraint surfaces and objective function. • Review differential calculus in finding the maxima and minima of functions of several variables. • Formulate real-life problems with Linear Programming. • Solve the Linear Programming models using graphical and simplex methods. • Formulate real-life transportation, assignment and travelling salesman problems to find the optimum solution using transportation algorithms • Analyze the Queuing model for effective customer satisfaction • Apply dynamic programming to optimize multi stage decision problems. • Determine the level of inventory that a business must maintain to ensure smooth operation. • 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
	Energy and environment	17ME562	• Summarize the basic concepts of energy, its distribution and general Scenario. • Explain different energy storage systems, energy management, audit and economic analysis. • Summarize the environment eco system and its need for awareness. • Identify the various types of environment pollution and their effects.

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			• Discuss the social issues of the environment with associated acts
	Project management	17ME564	• Understand the selection, prioritization and initiation of individual projects and strategic role of project management. • Understand the work breakdown structure by integrating it with organization. • Understand the scheduling and uncertainty in projects. • Students will be able to understand risk management planning using project quality tools. • Understand the activities like purchasing, acquisitions, contracting, partnering and collaborations related to performing projects. • Determine project progress and results through balanced scorecard approach • Draw the network diagram to calculate the duration of the project and reduce it using crashing
	Fluid mechanics & machinery lab	17MEL57	• Perform experiments to determine the coefficient of discharge of flow measuring devices. • Conduct experiments on hydraulic turbines and pumps to draw characteristics. • Test basic performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations. • Determine the energy flow pattern through the hydraulic turbines and pumps • Exhibit his competency towards preventive maintenance of hydraulic machines
	Energy lab	17MEL58	• Perform experiments to determine the properties of fuels and oils. • Conduct experiments on engines and draw characteristics. • Test basic performance parameters of I.C. Engine and implement the knowledge in industry. • Identify exhaust emission, factors affecting them and report the remedies. • Determine the energy flow pattern through the I C Engine • Exhibit his competency towards preventive maintenance of IC engines.
6	Finite element analysis	17ME61	• Understand the concepts behind formulation methods in FEM. • Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements. • Develop element characteristic equation and generation of global equation. • 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.

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	Computer integrated manufacturing	17ME62	• Able to define Automation, CIM, CAD, CAM and explain the differences between these concepts. • Solve simple problems of transformations of entities on computer screen. • Explain the basics of automated manufacturing industries through mathematical models and analyze different types of automated flow lines. • Analyze the automated flow linesto reduce down time and enhance productivity. • 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. • Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing
	Heat transfer	17ME63	• Understand the basic modes of heat transfer. • Compute temperature distribution in steady-state and unsteady-state heat conduction • Understand and interpret heat transfer through extended surfaces. • Interpret and compute forced and free convective heat transfer. • Explain the principles of radiation heat transfer and understand the numerical formula for heat conduction problems. • Design heat exchangers using LMTD and NTU methods.
	Design of machine elements ii	17ME64	• Apply engineering design tools to product design. • Design mechanical systems involving springs,belts and pulleys. • Design different types of gears and simple gear boxes for different applications. • Design brakes and clutches. • Design hydrodynamic bearings for different applications. • Select Anti friction bearings for different applications using the manufacturers, catalogue. • Develop proficiency to generate production drawings using CAD software. • Become good design engineers through learning the art of working in a team with morality and ethics
	Computational fluid dynamics	17ME651	• Understand mathematical characteristics of partial differential equations. • Explain how to classify and computationally solve Euler and Navier-Stokes equations. • Make use of the concepts like accuracy, stability, consistency of numerical methods for the governing equations. • Identify and implement numerical techniques for space and time integration of partial

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			differential equations. • Conduct numerical experiments and carry out data analysis. • Acquire basic skills on programming of numerical methods used to solve the Governing equations
	Mechanics of composite materials	17ME652	• To identify the properties of fiber and matrix materials used in commercial composites, as well as some common manufacturing techniques. • To predict the failure strength of a laminated composite plate • Understand the linear elasticity with emphasis on the difference between isotropic and anisotropic material behaviour. • Acquire the knowledge for the analysis, design, optimization and test simulation of advanced composite structures and Components.
	Metal forming	17ME653	• Able to understand the concept of different metal forming process. • Able to approach metal forming processes both analytically and numerically • Able to design metal forming processes • Able to develop approaches and solutions to analyze metal forming processes and the associated problems and flaws.
	Automobile engineering	17ME655	• To identify the different parts of an automobile and it's working • To understand the working of transmission and braking systems • To comprehend the working of steering and suspension systems • To learn various types of fuels and injection systems • To know the cause of automobile emissions, its effects on environment and methods to reduce the emissions
	Energy auditing	17ME661	• Understand the basic concepts of energy audit and energy management • Explain different types of energy audit, maximizing and optimizing system efficiency. • Summarize energy management systems, prepare and present energy audit report • Identify energy saving potential of thermal and electrical systems • Discuss Energy audit instruments, Procedures and Techniques.
	Industrial safety	17ME662	• Understand the basic safety terms. • Identify the hazards around the work environment and industries. • Use the safe measures while performing work in and around the work area of the available laboratories. • Able to recognize the sign boards and its application.

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			• Able to demonstrate the portable extinguishers used for different class of fires. • 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. • Able to understand and report the case studies from various references (text books, news report, journals, visiting industries like power stations, manufacturing and maintenance).
	Maintenance engineering	17ME663	• Understand maintenance objectives and evaluate various maintenance strategies for process plant application, Develop necessary planning and scheduling and control of preventive maintenance activities. • Evaluate reliability of a simple plant component and system. • Understand and apply the advanced concepts such as RCM and advantages for a company employing them • Understand and apply the advanced concepts such as TPM and advantages for a company employing • Apply the principles of condition monitoring systems. • Apply the mechanical condition monitoring techniques and analyze the data used in condition monitoring
	Total quality management	17ME664	• Explain the various approaches of TQM • Infer the customer perception of quality • Analyze customer needs and perceptions to design feedback systems. • Apply statistical tools for continuous improvement of systems • Apply the tools and technique for effective implementation of TQM.
	Heat transfer lab	17MEL67	• Perform experiments to determine the thermal conductivity of a metal rod • Conduct experiments to determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values. • Estimate the effective thermal resistance in composite slabs and efficiency in pin-fin • Determine surface emissivity of a test plate • Estimate performance of a refrigerator and effectiveness of fin • Calculate temperature distribution of study and transient heat conduction through plane wall, cylinder and fin using numerical approach.
	Modeling and Analysis Lab (FEA)	17MEL68	• Demonstrate the basic features of an analysis package. • Use the modern tools to formulate the problem, and able to create geometry, descritize,

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			apply • boundary condition to solve problems of bars, truss, beams, plate to find stress with different loading conditions. • 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. • Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions. • Carry out dynamic analysis and finding natural frequencies for various boundary conditions and also analyze with forcing function
7	Energy engineering	17ME71	• Summarize the basic concepts of thermal energy systems, • Identify renewable energy sources and their utilization. • Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems. • Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas. • Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator. • Identify methods of energy storage for specific applications
	Fluid power systems	17ME72	• Identify and analyze the functional requirements of a fluid power transmission system for a given application. • Visualize how a hydraulic/pneumatic circuit will work to accomplish the function. • Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application. • Select and size the different components of the circuit. • Develop a comprehensive circuit diagramby integrating the components selected for the given application.
	Control engineering	17ME73	• Recognize control system and its types , control actions • Determine the system governing equations for physical models(Electrical, Thermal, Mechanical, Electro Mechanical) • Calculate the gain of the system using block diagram and signal flow graph • Illustrate the response of 1st and 2nd order systems

			• Determine the stability of transfer functions in complex domain and frequency domain • Employ state equations to study the controllability and observability
	Design of thermal equipments	17ME741	• To have complete knowledge of heat exchanger and its applications • To be able to design shell and tube heat exchanger • To be able to select and design of steam heat condenser and compact heat exchanger condenser and heat pipes for various application
	Tribology	17ME742	• Understand the fundamentals of tribology and associated parameters. • Apply concepts of tribology for the performance analysis and design of components experiencing relative motion. • Analyse the requirements and design hydrodynamic journal and plane slider bearings for a given application. • Select proper bearing materials and lubricants for a given tribological application. • Apply the principles of surface engineering for different applications of tribology
	Financial management	17ME743	• Measure the returns from engineering projects of differing risks and present a risk-return tradeoff relationship • Determine the financial ratios and profitability margins of projects to evaluate economic viability to accept or reject the project. • Evaluate cost break ups of engineering projects and processes to determine and control the prohibitive cost components • Apply a Engineering Asset Management techniques to evaluate the economic value of physical assets.
	Design for Manufacturing	17ME744	• Describe the different types of manufacturing systems and compare their suitability for economic production of various components and products. • 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. • Select proper materials and manufacturing processes for designing products/components by applying the relevant principles for ease and economic production.
	Smart materials and MEMS	17ME745	• Describe the methods of controlling vibration using smart systems and fabrication methods of MEMS. • Explain the principle concepts of Smart materials, structures, Fibre optics, ER & MR Fluids, Biomimetics and MEMS with principles of working.

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			• Analyze the properties of smart structures, MEMS, with the applications and select suitable procedure for fabrication. • Summarize the methods and uses of Micro fabrications, Biomimetics, types of polymers used in MEMS, Fibre optics, piezoelectric sensing and actuation.
	Automotive electronics	17ME751	• Explain the electronics systems used for control of automobiles • Select sensors, actuators and control systems used in automobiles • Diagnose the faults in the sub systems and systems used automobile
	Fracture mechanics	17ME752	• Develop basic fundamental understanding of the effects of crack like defects on the performance of aerospace, civil, and Mechanical Engineering structures. • Learn to select appropriate materials for engineering structures to insure damage tolerance. • Learn to employ modern numerical methods to determine critical crack sizes and fatigue crack propagation rates in engineering structures. • Gain an appreciation of the status of academic research in field of fracture mechanics
	Mechatronics	17ME753	• Illustrate various components of Mechatronics systems. • Assess various control systems used in automation. • Develop mechanical, hydraulic, pneumatic and electrical control systems
	Mechanical vibrations	17ME754	• Understand and characterize the single and multi degrees of freedom systems subjected to free and forced vibrations with and without damping. • Understand the method of vibration measurements and its controlling. • Understand the concept of dynamic vibrations of a continuous systems.
	Design laboratory	17MEL76	• To understand the working principles of machine elements such as Governors, Gyroscopes etc., • To identify forces and couples in rotating mechanical system components. • To identify vibrations in machine elements and design appropriate damping methods and to determine the critical speed of a rotating shaft. • To measure strain in various machine elements using strain gauges • To determine the minimum film thickness, load carrying capacity, frictional torque and pressure distribution of journal bearing. • To determine strain induced in a structural member using the principle of photo-elasticity.
	Computer integrated	17MEL77	• Generate CNC Lathe part program for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning, Circular interpolation etc.

	manufacturing lab		• Generate CNC Mill Part programming for Point to point motions, Line motions, Circular interpolation, Contour motion, Pocket milling- circular, rectangular, Mirror commands etc. • Use Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning Thread cutting etc. • Simulate Tool Path for different Machining operations of small components using CNC Lathe & CNC Milling Machine. • Use high end CAM packages for machining complex parts; use state of art cutting tools and related cutting parameters; optimize cycle time; set up and cut part on. • Understand & write programs for Robot control; understand the operating principles of hydraulics, pneumatics and electro pneumatic systems
8	Operations research	17ME81	• Understand the meaning, definitions, scope; need, phases and techniques of operations research. • 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. • Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems. • Solve problems on game theory for pure and mixed strategy under competitive environment. • Solve waiting line problems for M/M/1 and M/M/K queuing models. • Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks. • Determine minimum processing times for sequencing of n jobs-2 machines, n jobs-3machines,n jobs-m machines and 2 jobs-n machines using Johnson's algorithm.
	Additive manufacturing	17ME82	• Understand the different process of Additive Manufacturing. using Polymer, Powder and Nano materials manufacturing. • Analyse the different characterization techniques. • Describe the various NC, CNC machine programing and Automation techniques
	Cryogenics	17ME831	• To be able to understand the cryogenic system. • To have complete knowledge of cryogenic refrigeration system • To be able to design gas separation and gas purification system • To able to solve the problem in , insulation, storage of cryogenic liquids • To be able to apply cryogenic in various areas and to be able take up research in

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			cryogenics
	Experimental stress analysis	17ME832	• Explain and the elastic behavior of solid bodies. • Describe stress strain analysis of mechanical systems using electrical resistance strain gauges. • Understand the experimental methods of determining stresses and strains induced. • Apply the coating techniques to determine the stresses and strains.
	Theory of plasticity	17ME833	• Understand stress, strain, deformations, relation between stress and strain and plastic deformation in solids. • Understand plastic stress-strain relations and associated flow rules. • Perform stress analysis in beams and bars including Material nonlinearity. • Analyze the yielding of a material according to different yield theory for a given state of stress. • Interpret the importance of plastic deformation of metals in engineering problems
	Green Manufacturing	17ME834	• Understand the basic design concepts, methods, tools, the key technologies and the operation of sustainable green manufacturing. • Apply the principles, techniques and methods to customize the learned generic concepts to meet the needs of a particular industry/enterprise. • Identify the strategies for the purpose of satisfying a set of given sustainable green manufacturing requirements. • 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.
	Product life cycle management	17ME835	• Explain the various strategies of PLM and Product Data Management • Describe decomposition of product design and model simulation • Apply the concept of New Product Development and its structuring. • Analyze the technological forecasting and the tools in the innovation. • Apply the virtual product development and model analysis

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2018 Scheme

Semester	Subject	Subject code	Course Outcomes
1,2	Engineering Graphics	18EGDL15/25	• Understand and visualize the objects with definite shape and dimensions • Analyze the shape and size of objects through different views • Develop the lateral surfaces of the object • Create a 3D view using CAD software. • Identify the interdisciplinary engineering components or systems through its graphical representation
	Elements of Mechanical Engineering	18EME15/25	• Understand basic concepts of mechanical engineering in the fields of energy and its utilization, materials technology, manufacturing techniques, and transmission systems through demonstrations. • Understand the application of energy sources in Power generation and utilization, Engineering materials, manufacturing, and machining techniques leading to the latest advancements and transmission systems in day to day activities • Apply the skills in developing simple mechanical elements and processes
3	Transform Calculus, Fourier Series And Numerical Techniques	18MAT31	• Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering. • Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory. • Make use of Fourier transform and Z-transform to illustrate

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			discrete/continuous function arising in wave and heat propagation, signals and systems. • Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods. • Determine the externals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis. •
	MECHANICS OF MATERIALS	18ME32	• Understand simple, compound, thermal stresses and strains their relations and strain energy. • Analyze structural members for stresses, strains and deformations. • Analyze the structural members subjected to bending and shear loads. • Analyze shafts subjected to twisting loads. • Analyze the short columns for stability.
	BASIC THERMODYNAMICS-	18ME33	• Explain fundamentals of thermodynamics and evaluate energy interactions across the boundary of thermodynamic systems. • Evaluate the feasibility of cyclic and non-cyclic processes using 2nd law of thermodynamics. • Apply the knowledge of entropy, reversibility and irreversibility to solve numerical problems and apply 1st law of thermodynamics to closed and open systems and determine quantity of energy transfers and change in properties. • Interpret the behavior of pure substances and its application in practical problems. • Recognize differences between ideal and real gases and evaluate thermodynamic properties of ideal and real gas mixtures using various relations.

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	MATERIAL SCIENCE	18ME34	• Understand the mechanical properties of metals and their alloys. • Analyze the various modes of failure and understand the microstructures of ferrous and nonferrous materials. • Describe the processes of heat treatment of various alloys. • Acquire the Knowledge of composite materials and their production process as well as applications. • Understand the properties and potentialities of various materials available and material selection procedures.
	METAL CUTTING AND FORMING-	18ME35A	• Explain the construction & specification of various machine tools. • Discuss different cutting tool materials, tool nomenclature & surface finish. • Apply mechanics of machining process to evaluate machining time. • Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost. Understand the concepts of different metal forming processes. • CO6: Apply the concepts of design of sheet metal dies to design different dies for simple sheet metal components.
	METAL CASTING AND WELDING-	18ME35B	• Describe the casting process and prepare different types of cast products. • Acquire knowledge on Pattern, Core, Gating, Riser system and to use Jolt, Squeeze, Sand Slinger Moulding machines. • Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces. • Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mold castings. • Understand the Solidification process and Casting of Non-Ferrous Metals. • Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes etc. used in manufacturing. • Describe methods for the quality assurance of components made of

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			casting and joining process
	COMPUTER AIDED MACHINE DRAWING-	18ME36A	• Identify the national and international standards pertaining to machine drawing. • Understand the importance of the linking functional and visualization aspects in the preparation of the part drawings • Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies. • Interpret the Machining and surface finish symbols on the component drawings. • Preparation of the part or assembly drawings as per the conventions.
	MECHANICAL MEASUREMENTS AND METROLOGY-	18ME36B	• Understand the objectives of metrology, methods of measurement, standards of measurement & various measurement parameters. • Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design Understand the working principle of different types of comparators. • Describe measurement of major & minor diameter, pitch, angle and effective diameter of screw threads. • Explain measurement systems, transducers, intermediate modifying devices and terminating devices.. • Describe functioning of force, torque, pressure, strain and temperature measuring devices.
	MATERIAL TESTING LAB	18MEL37A	• Acquire experimentation skills in the field of material testing. • Develop theoretical understanding of the mechanical properties of materials by performing experiments. • Apply the knowledge to analyze a material failure and determine the failure inducing agent/s. • Apply the knowledge of testing methods in related areas. • Understand how to improve structure/behavior of materials for

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			various industrial applications.
	MECHANICAL MEASUREMENTS AND METROLOGY LAB	18MEL37B	• Understand Calibration of pressure gauge, thermocouple, LVDT, load cell, micrometer. • Apply concepts of Measurement of angle using Sine Centre/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set. • Demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats. • Analyze tool forces using Lathe/Drill tool dynamometer. • Analyze Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth Vernier/Gear tooth micrometer • CO6: Understand the concepts of measurement of surface roughness.
	WORKSHOP AND MACHINE SHOP PRACTICE-	18MEL38A	• To read working drawings, understand operational symbols and execute machining operations. Prepare fitting models according to drawings using hand tools- V-block, marking gauge, files, hack saw, drills etc. • Understand integral parts of lathe, shaping and milling machines and various accessories and attachments used. • O4: Select cutting parameters like cutting speed, feed, depth of cut, and tooling for various machining operations. • Perform cylindrical turning operations such as plain turning, taper turning, step turning, thread Cutting, facing, knurling, internal thread cutting, eccentric turning and estimate cutting time. CO6:Perform machining operations such as plain shaping, inclined shaping, keyway cutting, Indexing
	FOUNDRY, FORGING AND WELDING LAB-	18MEL38B	• Demonstrate various skills in preparation of molding sand for conducting tensile, shear and compression tests using Universal sand testing machine. • Demonstrate skills in determining permeability, clay content and Grain Fineness Number of base sands.

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			• Demonstrate skills in preparation of forging models involving upsetting, drawing and bending
	ADDITIONAL MATHEMATICS – I-	18MATDIP31	• Apply concepts of complex numbers and vector algebra to analyze the problems arising in related area. • Use derivatives and partial derivatives to calculate rate of change of multivariate functions. • Analyze position, velocity and acceleration in two and three dimensions of vector valued functions. • Learn techniques of integration including the evaluation of double and triple integrals. • Identify and solve first order ordinary differential equations.
	CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW	18CPC39/49	• Have constitutional knowledge and legal literacy. • Understand Engineering and Professional ethics and responsibilities of Engineers. • Understand the the cybercrimes and cyber laws for cyber safety measures.
4	Complex Analysis, Probability and Statistical Methods	18MAT41	• Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory. • Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing. • Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field. • Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data. • Construct joint probability distributions and demonstrate the validity of testing the hypothesis.
	APPLIED THERMODYNAMICS-	18ME42	• Apply thermodynamic concepts to analyze the performance of gas power cycles. • Apply thermodynamic concepts to analyze the performance of vapour power cycles.

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			• Understand combustion of fuels and performance of I C engines. • Understand the principles and applications of refrigeration systems. • Apply Thermodynamic concepts to determine performance parameters of refrigeration and air-conditioning systems. • Understand the working principle of Air compressors and Steam nozzles, applications, relevance of air and identify methods for performance improvement.
	FLUID MECHANICS-	18ME43	• Identify and calculate the key fluid properties used in the analysis of fluid behavior. • Explain the principles of pressure, buoyancy and floatation • Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of mechanical and chemical engineering. • Describe the principles of fluid kinematics and dynamics. • Explain the concept of boundary layer in fluid flow and apply dimensional analysis to form dimensionless numbers in terms of input output variables. • Illustrate and explain the basic concept of compressible flow and CFD
	KINEMATICS OF MACHINES-	18ME44	• Knowledge of mechanisms and their motion. • Understand the inversions of four bar mechanisms. • Analyze the velocity, acceleration of links and joints of mechanisms. • Analysis of cam follower motion for the motion specifications. • Understand the working of the spur gears. • Analyze the gear trains speed ratio and torque.
	METAL CUTTING AND FORMING-	18ME45A	• Explain the construction & specification of various machine tools. • Discuss different cutting tool materials, tool nomenclature & surface finish. • Apply mechanics of machining process to evaluate machining time. • Analyze tool wear mechanisms and equations to enhance tool life

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			and minimize machining cost. Understand the concepts of different metal forming processes. • Apply the concepts of design of sheet metal dies to design different dies for simple sheet metal components.
	METAL CASTING AND WELDING-	18ME45B	• Describe the casting process and prepare different types of cast products. • Acquire knowledge on Pattern, Core, Gating, Riser system and to use Jolt, Squeeze, Sand Slinger moulding machines. • Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces. • Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mould castings. • Understand the Solidification process and Casting of Non-Ferrous Metals. • Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes etc. used in manufacturing. • Describe methods for the quality assurance of components made of casting and joining process
	COMPUTER AIDED MACHINE DRAWING-	18ME46A	• Identify the national and international standards pertaining to machine drawing. • Understand the importance of the linking functional and visualization aspects in the preparation of the part drawings • Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies. • Interpret the Machining and surface finish symbols on the component drawings. • Preparation of the part or assembly drawings as per the conventions.
	MECHANICAL	18ME46B	• Understand the objectives of metrology, methods of measurement,

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	MEASUREMENTS AND METROLOGY-		standards of measurement & various measurement parameters. • Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design Understand the working principle of different types of comparators. • Describe measurement of major & minor diameter, pitch, angle and effective diameter of screw threads. • Explain measurement systems, transducers, intermediate modifying devices and terminating devices.. • Describe functioning of force, torque, pressure, strain and temperature measuring devices.
	MATERIAL TESTING LAB-	18MEL47A	• Acquire experimentation skills in the field of material testing. • Develop theoretical understanding of the mechanical properties of materials by performing experiments. • Apply the knowledge to analyze a material failure and determine the failure inducing agent/s. • Apply the knowledge of testing methods in related areas. • Understand how to improve structure/behavior of materials for various industrial applications.
	MECHANICAL MEASUREMENTS AND METROLOGY LAB-	18MEL47B	• Understand Calibration of pressure gauge, thermocouple, LVDT, load cell, micrometer. • Apply concepts of Measurement of angle using Sine Centre/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set. • Demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats. • Analyze tool forces using Lathe/Drill tool dynamometer. • Analyze Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth Vernier/Gear tooth micrometer • Understand the concepts of measurement of surface roughness.

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	WORKSHOP AND MACHINE SHOP PRACTICE-	18MEL48A	• To read working drawings, understand operational symbols and execute machining operations. Prepare fitting models according to drawings using hand tools- V-block, marking gauge, files, hack saw, drills etc. • Understand integral parts of lathe, shaping and milling machines and various accessories and attachments used. • Select cutting parameters like cutting speed, feed, depth of cut, and tooling for various machining operations. • Perform cylindrical turning operations such as plain turning, taper turning, step turning, thread Cutting, facing, knurling, internal thread cutting, eccentric turning and estimate cutting time. • Perform machining operations such as plain shaping, inclined shaping, keyway cutting, Indexing and Gear cutting and estimate cutting time.
	FOUNDRY, FORGING AND WELDING LAB-	18MEL48B	• Understand needs, functions, roles, scope and evolution of Management. • Understand importance, purpose of Planning and hierarchy of planning and also53nalyse its types. Discuss Decision making, Organizing, Staffing, Directing and Controlling. • Select the best economic model from various available alternatives. • Understand various interest rate methods and implement the suitable one. • Estimate various depreciation values of commodities. • Prepare the project reports effectively.
5	MANAGEMENT AND ECONOMICS-	18ME51	• Understand needs, functions, roles, scope and evolution of Management • Understand importance, purpose of Planning and hierarchy of planning and also54nalyse its types. Discuss Decision making, Organizing, Staffing, Directing and Controlling. • Select the best economic model from various available alternatives.

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			• Understand various interest rate methods and implement the suitable one.
	DESIGN OF MACHINE ELEMENTS I-	18ME52	• Apply the concepts of selection of materials for given mechanical components. • List the functions and uses of machine elements used in mechanical systems. • Apply codes and standards in the design of machine elements and select an element based on the Manufacturer's catalogue. • Analyze the performance and failure modes of mechanical components subjected to combined loading and fatigue loading using the concepts of theories of failure. • Demonstrate the application of engineering design tools to the design of machine components like shafts, couplings, power screws, fasteners, welded and riveted joints. • Understand the art of working in a team.
	DYNAMICS OF MACHINES-	18ME53	• Analyze the mechanisms for static and dynamic equilibrium. • Carry out the balancing of rotating and reciprocating masses • Analyze different types of governors used in real life situation. • Analyze the gyroscopic effects on disks, airplanes, stability of ships, two and four wheelers • Understand the free and forced vibration phenomenon. • Determine the natural frequency, force and motion transmitted in vibrating systems.
	TURBO MACHINES-	18ME54	• Model studies and thermodynamics analysis of turbomachines. • Analyze the energy transfer in Turbo machine with degree of reaction and utilisation factor. • Classify, analyze and understand various type of steam turbine.

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			• Classify, analyze and understand various type of hydraulic turbine. • Understand the concept of radial power absorbing machine and the problems involved during its operation.
	FLUID POWER ENGINEERING-	18ME55	• Identify and analyze the functional requirements of a fluid power transmission system for a given application. • Visualize how a hydraulic/pneumatic circuit will work to accomplish the function. • Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro- pneumatics for a given application. • Select and size the different components of the circuit. • Develop a comprehensive circuit diagram by integrating the components selected for the given application
	OPERATIONS MANAGEMENT-	18ME56	• Explain the concept and scope of operations management in a business context • Recognize the role of Operations management among various business functions and its role in the organizations' strategic planning and gaining competitive advantage. • Analyze the appropriateness and applicability of a range of operations management systems/models in decision making. • Assess a range of strategies for improving the efficiency and effectiveness of organizational operations. • Evaluate a selection of frameworks used in the design and delivery of operations
	FLUID MECHANICS AND MACHINES LAB-	18MEL57	• Perform experiments to determine the coefficient of discharge of flow measuring devices. • Conduct experiments on hydraulic turbines and pumps to draw characteristics. • Test basic performance parameters of hydraulic turbines and pumps

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			and execute the knowledge in real life situations. • Determine the energy flow pattern through the hydraulic turbines and pumps. • Exhibit his competency towards preventive maintenance of hydraulic machines.
	ENERGY CONVERSION LABORATORY-	18MEL58	• Perform experiments to determine the properties of fuels and oils. • Conduct experiments on engines and draw characteristics. • Test basic performance parameters of I.C. Engine and implement the knowledge in industry. • Identify exhaust emission, factors affecting them and exhibit his competency towards preventive maintenance of IC engines
	ENVIRONMENTAL STUDIES-	18CIV59	• Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale, • Develop critical thinking and/or observation skills, and apply them to the • analysis of a problem or question related to the environment. • Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components. • Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.
	FINITE ELEMENT METHODS-	18ME61	• Identify the application and characteristics of FEA elements such as bars, beams, plane and iso- parametric elements. • Develop element characteristic equation and generation of global equation. • Formulate and solve Axi-symmetric and heat transfer problems. • Apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi-symmetric and dynamic problems

	DESIGN OF MACHINE ELEMENTS II Course Code	18ME62	• Apply design principles for the design of mechanical systems involving springs, belts, pulleys, and wire ropes. • Design different types of gears and simple gear boxes for relevant applications. • Understand the design principles of brakes and clutches. • Apply design concepts of hydrodynamic bearings for different applications and select Anti friction bearings for different applications using the manufacturers, catalogue. • Apply engineering design tools to product design. • Become good design engineers through learning the art of working in a team.
	HEAT TRANSFER-	18ME63	• Understand the modes of heat transfer and apply the basic laws to formulate engineering systems. Understand and apply the basic laws of heat transfer to extended surface, composite material and unsteady state heat transfer problems. • Analyze heat conduction through numerical methods and apply the fundamental principle to solve radiation heat transfer problems. • Analyze heat transfer due to free and forced convective heat transfer. • Understand the design and performance analysis of heat exchangers and their practical applications, Condensation and Boiling phenomena.
	NON-TRADITIONAL MACHINING-	18ME641	• Understand the compare traditional and non-traditional machining process and recognize the need for Non- traditional machining process. • Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM. • Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations.

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			• Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM. • Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM.
	REFRIGERATION AND AIR CONDITIONING-	18ME642	• Illustrate the principles, nomenclature and applications of refrigeration systems. • Explain vapour compression refrigeration system and identify methods for performance improvement • Study the working principles of air, vapour absorption, thermoelectric and steam-jet and thermo acoustic refrigeration systems. • Estimate the performance of air-conditioning systems using the principles of psychrometry. • Compute and Interpret cooling and heating loads in an air-conditioning system. • Identify suitable refrigerant for various refrigerating systems.
	THEORY OF ELASTICITY-	18ME643	• Understand the Basic field equations of linear elastic solids, force, stress, strain and equilibrium in solids. • Analyze the 2D structural elements, beams, cylinders. • Use analytical techniques to predict deformation, internal force and failure of simple solids and structural components. • Analyze the ax symmetric structural elements. • Analyze the structural members subjected to torsion Determine the thermal stresses in plain stress and plane stain conditions.
	VIBRATIONS AND NOISE ENGINEERING-	18ME644	• Characterize the single and multi-degrees of freedom systems subjected to free and forced vibrations with and without damping. • Apply the method of vibration measurements and its controlling.

			• Determine vibratory responses of SDOF and MDOF systems to harmonic, periodic and non-periodic excitation. • Analyze the mathematical model of a linear vibratory system to determine its response. • Obtain linear mathematical models of real life engineering systems. • Apply the principles of vibration and noise reduction techniques to real life engineering problems.
	COMPOSITE MATERIALS TECHNOLOGY-	18ME645	• Use different types of manufacturing processes in the preparation of composite materials • Analyze the problems on macro mechanical 88ehavior of composites • Analyze the problems on micromechanical 88ehavior of Composites • Determine stresses and strains relation in composites materials. • Understand and effective use of properties in design of composite structures • Perform literature search on a selected advanced material topic.
	ENTREPRENEURSHIP DEVELOPMENT-	18ME646	• understand the concept of Entrepreneur and Entrepreneurship and relevant roles • learn creativity and entrepreneurial plan including Project Feasibility and Project Appraisal • understand Corporate entrepreneurship and issues related to Corporate entrepreneurship • understand Family and Non Family Entrepreneur & Women entrepreneurs and women entrepreneurs in India • understand International Entrepreneurship Opportunities and Case studies on Indian Start ups
	NON	18ME651	• Describe the environmental aspects of non-conventional energy

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	CONVENTIONAL ENERGY SOURCES		resources. In Comparison with various conventional energy systems, their prospects and limitations. • Know the need of renewable energy resources, historical and latest developments. • Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation, drying, cooking etc. • Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications. • Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications • Compare Solar, Wind and bio energy systems, their prospects, Advantages and limitations. • Acquire the knowledge of fuel cells, wave power, tidal power and geothermal principles and applications.
	WORLD CLASS MANUFACTURING-	18ME652	• Understand recent trends in manufacturing. • Demonstrate the relevance and basics of World Class Manufacturing. • Understand customization of product for manufacturing. • Understand the implementation of new technologies. • Compare the existing industries with WCM industries.
	SUPPLY CHAIN MANAGEMENT-	18ME653	• Understand the framework and scope of supply chain management. • Build and manage a competitive supply chain using strategies, models, techniques and information technology. • Plan the demand, inventory and supply and optimize supply chain network. • Understand the emerging trends and impact of IT on Supply chain.
	ADVANCED MATERIALS	18ME654	- • Explain the concepts and principles of advanced materials and

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	TECHNOLOGY		manufacturing processes. • Understand the applications of all kinds of Industrial materials. • Apply the material selection concepts to select a material for a given application. • Define Nanotechnology, Describe nano material characterization. • Understand the behavior and applications of smart materials, ceramics, glasses and non-metallic materials.
	COMPUTER AIDED MODELLING AND ANALYSIS LAB	18MEL66	• Use the modern tools to formulate the problem, create geometry, descritize, apply boundary conditions to solve problems of bars, truss, beams, and plate to find stresses with different-loading conditions. • Demonstrate the ability to obtain deflection of beams subjected to point, uniformly distributed and varying loads and use the available results to draw shear force and bending moment diagrams. • Analyze and solve 1D and 2D heat transfer conduction and convection problems with different boundary conditions. • Carry out dynamic analysis and finding natural frequencies of beams, plates, and bars for various boundary conditions and also carry out dynamic analysis with forcing functions.
	HEAT TRANSFER LAB-	18MEL67	• Determine the thermal conductivity of a metal rod and overall heat transfer coefficient of composite slabs. • Determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values. • Evaluate temperature distribution characteristics of steady and transient heat conduction through solid cylinder experimentally. • Determine surface emissivity of a test plate and Stefan Boltzmann constant • Estimate performance of a refrigerator and effectiveness of a fin and Double pipe heat exchanger

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7	CONTROL ENGINEERING-	18ME71	• Identify the type of control and control actions. • Develop the mathematical model of the physical systems. • Estimate the response and error in response of first and second order systems subjected standard input signals. • Represent the complex physical system using block diagram and signal flow graph and obtain transfer function. • Analyze a linear feedback control system for stability using Hurwitz criterion, Routh's criterion and root Locus technique in complex domain. • Analyze the stability of linear feedback control systems in frequency domain using polar plots, Nyquist and Bode plots.
	COMPUTER AIDED DESIGN AND MANUFACTURING-	18ME72	• Define Automation, CIM, CAD, CAM and explain the differences between these concepts. Solve simple problems of transformations of entities on computer screen • Explain the basics of automated manufacturing industries through mathematical models and analyze different types of automated flow lines. • Analyze the automated flow lines to reduce time and enhance productivity. • 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. • Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.
	DESIGN FOR MANUFACTURE-	18ME731	• Select proper materials and manufacturing processes for designing products/components by applying the relevant principles for ease and economic production. • Identify faulty design factors leading to increased costs in producing mechanical components.

			• Apply appropriate design tolerances – dimensional, geometric and true position tolerances for the production processes of mechanical components. • Apply the concepts related to reducing machined areas, simplification by amalgamation and separation, clamp ability, accessibility etc., in the design of mechanical components. • Analyze the design of castings, weldments, forgings, powder metallurgy components and suggest design modifications to reduce the cost.
	AUTOMATION & ROBOTICS-	18ME732	• Translate and simulate a real time activity using modern tools and discuss the Benefits of automation. • Identify suitable automation hardware for the given application. • Recommend appropriate modelling and simulation tool for the given manufacturing Application. Explain the basic principles of Robotic technology, configurations, control and Programming of Robots. • Explain the basic principles of programming and apply it for typical Pick & place, Loading & unloading and palletizing applications
	COMPUTATIONAL FLUID DYNAMICS-	18ME733	• Understand mathematical characteristics of partial differential equations. • Explain how to classify and computationally solve Euler and Navier-Stokes equations. • Make use of the concepts like accuracy, stability, consistency of numerical methods for the governing equations. • Identify and implement numerical techniques for space and time integration of partial differential equations. • Conduct numerical experiments and carry out data analysis. • Acquire basic skills on programming of numerical methods used to solve the Governing equations
	TOTAL QUALITY	18ME734	• Explain the various approaches of TQM

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	MANAGEMENT-		• Infer the customer perception of quality • Analyze customer needs and perceptions to design feedback systems. • Apply statistical tools for continuous improvement of systems • Apply the tools and technique for effective implementation of TQM.
	OPERATIONS RESEARCH	18ME735	• Understand the meaning, definitions, scope, need, phases and techniques of operations research. 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. • Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems. • Solve problems on game theory for pure and mixed strategy under competitive environment. • Solve waiting line problems for M/M/1 and M/M/K queuing models. • Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks • Determine minimum processing times for sequencing of n jobs-2 machines, n jobs-3 machines, n jobs-m machines and 2 jobs-n machines using Johnson's algorithm.
	ADDITIVE MANUFACTURING-	18ME741	• Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available. • Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available. • Understand the various software tools, processes and techniques that enable advanced/additive manufacturing. • Apply the concepts of additive manufacturing to design and create components that satisfy product development/prototyping requirements, using advanced/additive manufacturing devices and processes.

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			• Understand characterization techniques in additive manufacturing. • Understand the latest trends and business opportunities in additive manufacturing.
	EMERGING SUSTAINABLE BUILDING COOLING TECHNOLOGIES-	18ME742	• Empathize with sustainable cooling as a means of enhancing social justice in India and mitigating climate change through their intellectual capabilities and ethical orientation • Compute and Interpret cooling and heating loads in a building and how they could be efficiently managed by using building energy modelling software • Estimate the performance of airconditioning systems using the principles of thermodynamics, heat transfer, and psychometry • Calculate and interpret the energy, cost, and greenhouse gas emissions performance of conventional and sustainable cooling technologies. • Conduct building and sustainable cooling modelling projects on a sophisticated building energy modelling software. •
	THEORYOF PLASTICITY-	18ME743	• Understand stress, strain, deformations, relation between stress and strain and plastic deformation in solids. • Understand plastic stress-strain relations and associated flow rules. • Perform stress analysis in beams and bars including Material nonlinearity. • Analyze the yielding of a material according to different yield theory for a given state of stress. Interpret the importance of plastic deformation of metals in engineering problems
	MECHATRONICS-	18ME744	• Illustrate various components of Mechatronics systems. • Assess various control systems used in automation. • Design and conduct experiments to evaluate the performance of a mechatronics system or component with respect to specifications, as well as to analyze and interpret data.

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			• Apply the principles of Mechatronics design to product design. • Function effectively as members of multidisciplinary teams.
	PROJECT MANAGEMENT-	18ME745	• Understand the selection, prioritization and initiation of individual projects and strategic role of project management. • Understand the work breakdown structure by integrating it with organization. • Understand the scheduling and uncertainty in projects. • Understand risk management planning using project quality tools. • Understand the activities like purchasing, acquisitions, contracting, partnering and collaborations related to performing projects. • Determine project progress and results through balanced scorecard approach • Draw the network diagram to calculate the duration of the project and reduce it using crashing.
	ENERGY AND ENVIRONMENT-	18ME751	• Understand energy scenario, energy sources and their utilization. • Understand various methods of energy storage, energy management and economic analysis. • Analyze the awareness about environment and eco system. • Understand the environment pollution along with social issues and acts.
	AUTOMOTIVE ENGINEERING-	18ME752	• Identify the different parts of an automobile and it's working. • Understand the working of transmission and braking systems. • Understand the working of steering and suspension systems and their applications. • Selection and applications of various types of fuels and injection systems. Analyze the cause of automobile emissions, its effects on environment and methods to reduce the emissions.

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	INDUSTRIAL SAFETY-	18ME753	• Understand the basic safety terms and international standards. • Identify the hazards and risk analysis around the work environment and industries. • Use the safe measures while performing work in and around the work area of the available laboratories. Able to recognize the sign boards and its application • Recognize the types of fires extinguishers and to demonstrate the portable extinguishers used for different classes of fires. • Report the case studies by sharing experience of the employees working in housekeeping, laboratories like workshops, electrical labs, machine shops, electronics and computer laboratories. • Recognize the chemical and electrical hazards for its prevention and control.
	OPTIMISATION TECHNIQUES-	18ME754	• Define and use optimization terminology, concepts, and understand how to classify an optimization problem. • Understand how to classify an optimization problem. • Apply the mathematical concepts formulate the problem of the systems. • Analyze the problems for optimal solution using the algorithms. • Interpret the optimum solution.
	DESIGN LAB-	18MEL77	• Compute the natural frequency of the free and forced vibration of single degree freedom systems, critical speed of shafts. • Carry out balancing of rotating masses. • Analyze the governor characteristics. • Determine stresses in disk, beams, plates and hook using photo elastic bench. • Determination of Pressure distribution in Journal bearing • Analyze the stress and strains using strain gauges in compression and bending test and stress distribution in curved beams.

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8	ENERGY ENGINEERING-	18ME81	• Understand the construction and working of steam generators and their accessories. • Identify renewable energy sources and their utilization. • Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, nuclear, hydel and tidal. •
	CNC MACHINE TOOLS	-18ME821	• Understand evolution, classification and principles of CNC machine tools. • Learn constructional details of CNC machine tools, selection of standard components used for CNC machine tools for accuracy and productivity enhancement. • Select drives and positional transducers for CNC machine tools. • Apply CNC programming concepts of for two axis turning centers and three axis vertical milling centers to generate programs different components. • Generate CNC programs for popular CNC controllers. • Analyze and select tooling and work holding devices for different components to be machined on CNC machine tools.
	TRIBOLOGY-	18ME822	• Understand the fundamentals of tribology and associated parameters. • Apply concepts of tribology for the performance analysis and design of components experiencing relative • Analyze the requirements and design hydrodynamic journal and plane slider bearings for a given application. • Select proper bearing materials and lubricants for a given tribological application. • Apply the principles of surface engineering for different applications of tribology.
	NON-DESTRUCTIVE	18ME823	• Classify various 144on-destructive testing methods.

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	TESTINGAND EVALUATION-		• Check different metals and alloys by visual inspection method. • Explain and perform non-destructive tests like: Liquid penetrate test, Magnetic particle test, Ultrasonic test, X- ray and Gamma ray radiography, Leak Test, Eddy current test. • Identify defects using relevant NDT methods. • Differentiate various defect types and select the appropriate NDT methods for better evaluation. • Document the testing and evaluation of the results.
	AUTOMOBILE ENGINEERING-	18ME824	• To identify the different parts of an automobile and it's working • To understand the working of transmission and braking systems • To comprehend the working of steering and suspension systems • To learn various types of fuels and injection systems •To know the cause of automobile emissions, its effects on environment and methods to reduce the emissions.
	TOOL DESIGN-	18ME825	• • Select appropriate cutting tools required for producing a component. • Understand and interpret cutting tool and tool holder designation systems. • Select suitable locating and clamping devices for a given component for various operations. • Analyze and design a jig/fixture for a given simple component. • Understand various press tools and press tool operations. • Classify and explain various die casting and injection molding dies.

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	FRACTURE MECHANICS-	18ME826	• Analyze the effects of crack like defects on the performance of Aerospace, Civil, and Mechanical Engineering structures. • Apply the concepts of fracture mechanics to select appropriate materials for engineering structures to insure damage tolerance. • Understand mechanics of crack tip fields and appropriate fracture characterizing parameters like stress intensity factor and J integral or nonlinear energy release rate and how to compute them using various methods. • Apply the concepts of fracture mechanics to determine critical crack sizes and fatigue crack propagation rates in engineering structures leading to life estimation. • Understand the status of academic research in field of fracture mechanics.

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2021 Scheme

Semester	Subject	Subject code	Course Outcomes
1	Engineering Visualization	21EVN15/25	• Understand and visualize the objects with definite shape and dimensions • Analyze the shape and size of objects through different views • Develop the lateral surfaces of the object • Create a 3D view using CAD software. • Identify the interdisciplinary engineering components or systems through its graphical representation
	ELEMENTS OF MECHANICAL ENGINEERING	21EME15/25	• Understand basic concepts of mechanical engineering in the fields of energy and its utilization, materials technology, manufacturing techniques, and transmission systems through demonstrations. • Understand the application of energy sources in Power generation and utilization, Engineering materials, manufacturing, and machining techniques leading to the latest advancements and transmission systems in day to day activities • Apply the skills in developing simple mechanical elements and processes

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2021 Scheme Mechanical Engineering (3^{rd} to 8^{th} sem)

Semester	Subject	Subject code	Co
3	Transform Calculus, Fourier Series and Numerical Techniques	21MAT31	• To solve ordinary differential equations using Laplace transform. • Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory. • To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations • To solve mathematical models represented by initial or boundary value problems involving partial differential equations • Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.
	METAL CASTING FORMING & JOINING PROCESS (IPCC)	21ME32	• Select appropriate primary manufacturing process and related parameters for obtaining initial shape and size of • components. • Design and develop adequate tooling linked with casting, welding and forming operations. • Appreciate the effect of process parameters on quality of manufactured components • Demonstrate various skills in preparation of molding sand for conducting tensile, shear and compression tests using Universal sand testing machine. • Demonstrate skills in preparation of forging models involving upsetting, drawing and bending operations. • Demonstrate skills in preparation of Welding models.
	MATERIAL SCIENCE AND ENGINEERING (IPCC)	21ME33	• Understand the atomic arrangement in crystalline materials and describe the periodic arrangement of atoms interms of unit cell parameters. • Understand the importance of phase diagrams and the phase transformations. • Know various heat treatment methods for controlling the microstructure.. • Correlate between material properties with component design and identify various kinds of defects. • Apply the method of materials selection, material data and knowledge sources for computer-aided selection of materials.
	THERMODYNAMICS	21ME34	• Describe the fundamental concepts and principles of engineering thermodynamics.

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			• Apply the governing laws of thermodynamics for different engineering applications. • Analyse the various thermodynamic processes, cycles and results. • Interpret and relate the impact of thermal engineering practices to real life problems.
	MACHINE DRAWING AND GD & T	21MEL35	• Interpret the Machining and surface finish symbols on the component drawings. • Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies. • Illustrate various machine components through drawings • Create assembly drawings as per the conventions.
	Ability Enhancement Course II INTRODUCTION TO PYTHON	21ME381	• Demonstrate proficiency in handling of loops and creation of functions. • Identify the methods to create and manipulate lists, tuples and dictionaries. • Discover the commonly used operations involving regular expressions and file system. • Examine working of PDF and word file formats
4	COMPLEX ANALYSIS, PROBABILITY AND LINEAR PROGRAMMING	21MATME41	• Use the concepts of an analytic function and complex potentials to solve the problems arising in fluid flow. • Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and • image processing. • Apply discrete and continuous probability distributions in analyzing the probability models arising in the • engineering field. • Analyze and solve linear programming models of real-life situations and solve LPP by the simplex method • Learn techniques to solve Transportation and Assignment problems.
	MACHINING SCIENCE AND JIGS & FIXTURES (IPCC)	21ME42	• Demonstrate the Conventional CNC machines and advanced manufacturing process operations • Determine tool life, cutting force, and economy of the machining process. • Analyze the influence of various parameters on machine tools' performance. • Select the appropriate machine tools and process, the Jigs, and fixtures for various applications.
	FLUID MECHANICS (IPCC)	21ME43	• CO 1. Understand the basic principles of fluid mechanics and fluid kinematics • CO 2. Acquire the basic knowledge of fluid dynamics and flow measuring instruments • CO 3. Understand the nature of flow and flow over bodies and the dimensionless analysis • CO 4. Acquire the compressible flow fundamental and basics of CFD packages and the need for CFD analysis. • CO 5. Conduct basic experiments of fluid mechanics and understand the experimental uncertainties.
	MECHANICS OF MATERIALS	21ME44	• Understand simple, compound, thermal stresses and strains their relations and strain energy. • Analyse structural members for stresses, strains and deformations. • Analyse the structural members subjected to bending and shear loads. • Analyse shafts subjected to twisting loads. • Analyse the short columns for stability.
	MECHANICAL MEASUREMENTS	21MEL46	• Understand Calibration of pressure gauge, thermocouple, LVDT, load cell, micrometer. • Apply concepts of Measurement of angle

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	AND METROLOGY LABORATORY		• Demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats. • Analyse Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth • Vernier/Gear tooth micrometre • Understand the concepts of measurement of surface roughness. • Demonstrate the use of Coordinate Measuring Machine (CMM) / Laser Scanner
	SPREAD SHEETS FOR ENGINEERS	21MT481	• To create different plots and charts • To compute different functions, conditional functions and make regression analysis • To carryout iterative solutions for roots, multiple roots, optimization and non-linear regression analysis • To carryout matrix operations • To Understand VBA and UDF • To understand VBA subroutines and Macros • To carryout numerical integration and solving differential equations using different methods
	INTRODUCTION TO AI AND ML	21ME482	• Understand the basic principles and goals of AI tasks. • Outline the role of AI in different real-time applications. • Construct a problem with the suitable AI task. • Demonstrate the importance of biology in AI. • Survey the future development of AI.
	Introduction to Augmented Reality	21ME483	• CO1: Describe how AR systems work and list the applications of AR. • CO2: Understand and analyse the hardware requirement of AR. • CO3: Use computer vision concepts for AR and describe AR techniques • CO4: Analyse and understand the working of various state of the art AR devices • CO5: Acquire knowledge of mixed reality
5	THEORY OF MACHINES	21ME51	• Knowledge of mechanisms and their motion and the inversions of mechanisms • Analyse the velocity, acceleration of links and joints of mechanisms.. • Analyse the mechanisms for static and dynamic equilibrium. • Carry out the balancing of rotating and reciprocating masses • Analyse different types of governors used in real life situation. • Analyze the free and forced vibration phenomenon.
	THERMO-FLUIDS ENGINEERING (IPCC)	21ME52	• Apply the concepts of testing of I. C. Engines and evaluate their performance, and evaluate the performance of Reciprocating compressor. • Apply and analyse the concepts related to Refrigeration and Air conditioning, and get conversant with • Psychrometric Charts, Psychrometric processes, human comfort conditions. • Explain the construction, classification and working principle of the Turbo machines and apply of Euler's turbine equation to evaluate the energy transfer and other related parameters. • Compare and evaluate the performance of positive displacement pumps. • Classify, explain and analyse the various types of hydraulic turbines and centrifugal pumps.

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			• Classify, explain and analyse various types of steam turbines and centrifugal compressor.
	FINITE ELEMENT ANALYSIS	21ME53	• Identify the application and characteristics of FEA elements such as bars, beams, plane and isoparametric elements. • Develop element characteristic equation and generation of global equation. • Formulate and solve Axi-symmetric and heat transfer problems. • Apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer,fluid flow, axi-symmetric and dynamic problems.
	MODERN MOBILITY & AUTOMOTIVE MECHANICS	21ME54	• Understand the working of different systems employed in automobile • Analyse the limitation of present day automobiles • Evaluate the energy sources suitability • Apply the knowledge for selection of automobiles based on their suitability
	DESIGN LAB	21MEL55	• Compute the natural frequency of the free and forced vibration of single degree freedom systems, critical speed of shafts. • Carry out balancing of rotating masses and gyroscope phenomenon. • Analyse the governor characteristics. • Determine stresses in disk, beams and plates using photo elastic bench. • Determination of Pressure distribution in Journal bearing • Analyse the stress and strains using strain gauges in compression and bending test • To realize different mechanisms and cam motions
	BASICS OF MATLAB	21ME581	• Able to implement loops, branching, control instruction and functions in MATLAB programming environment. • Able to program curve fitting, numerical differentiation and integration, solution of linear equations in MATLAB and solve electrical engineering problems. • Able to understand implementation of ODE using ode 45 and execute Solutions of nonlinear equations and DFT in MATLAB. • Able to simulate MATLAB Simulink examples
	DIGITAL MARKETING	21ME582	• To identifytheimportance of the digital marketing for marketing success, • to manage customer relationships across all digital channels and build better customer relationships, • to create a digital marketing plan, starting from the SWOT analysis and defining a target group, then identifying digital channels, their advantages and limitations to perceive ways of the integration taking into consideration the available budget.
	PRODUCTION AND OPERATIONS MANAGEMENT	21ME61	• Apply the necessary tools for decision making in operations management. • Examinevariousapproachesforforecastingthesalesdemandforanorganization. • Listvariouscapacityandlocationplanstodeterminethesuitablecapacityrequiredformeetingtheforecastdemandofan organization. • Analyse the aggregate plan and master production schedule for an organization, given its periodic demand. • Apply MRP, purchasing and SCM techniques into practice.
	HEAT TRANSFER	21ME62	• Solve steady state heat transfer problems in conduction.

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	(IPCC)		• Solve transient heat transfer problems • solve convection heat transfer problems using correlations • Solve radiation heat transfer problems • Explain the mechanisms of boiling and condensation. And Determine performance parameters of heat exchangers.
	MACHINE DESIGN	21ME63	• Apply codes and standards in the design of machine elements and select an element based on the Manufacturer's catalogue. • Analyse the performance and failure modes of mechanical components subjected to combined loading and fatigue loading using the concepts of theories of failure. • Demonstrate the application of engineering design tools to the design of machine components like shafts, springs, couplings, fasteners, welded and riveted joints, brakes and clutches • Design different types of gears and simple gear boxes for relevant applications. • Apply design concepts of hydrodynamic bearings for different applications and select Anti friction bearings for different applications using the manufacturers, catalogue.
	SUPPLY CHAIN MANAGEMENT & INTRODUCTION TO SAP	21ME641	• Understand the framework and scope of supply chain management. • Build and manage a competitive supply chain using strategies, models, techniques and information • technology. • Plan the demand, inventory and supply and optimize supply chain network. • Understand the emerging trends and impact of IT on Supply chain. • Understand the basics of SAP material management system
	MECHATRONICS SYSTEM DESIGN	21ME642	• CO1. Discuss about Mechatronics design process and select the sensor and Actuator for a Mechatronics application • CO2. Explain Modeling and Simulation of mechanical Elements, electrical Elements and fluid system • the sensors in mechatronics systems and Fault detection techniques in Mechatronics. • CO3. Understand the elements of Data Acquisition and Control System, Convert the data in real time interfacing • CO4. Model the dynamic response of first order and second order systems.
6	AUTONOMOUS VEHICLES	21ME643	• Describe the evolution of Automotive Electronics and the operation of ECUs. • Compare the different type of sensing mechanisms involved in Autonomous Vehicles. • Discuss about the use of computer vision and learning algorithms in vehicles. • Summarize the aspects of connectivity fundamentals existing in a driverless car. • Identify the different levels of automation involved in an Autonomous Vehicle. • 6. Outline the various controllers employed in vehicle actuation
	INTERNET OF THINGS (IOT)	21ME644	• explain IoT architecture, interpret the design principles that govern connected devices, summarize the roles of various organizations for IoT • explain the basics of microcontrollers, outline the architecture of Arduino, develop simple applications using Arduino • outline the architecture of Raspberry Pi, develop simple applications using Raspberry Pi, select a platform for a

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			particular embedded computing application • interpret different protocols and compare them, select which protocol can be used for a specific application,Utilize the Internet communication protocols for IoT applications • select IoT APIs for an application, design and develop a solution for a given application using APIs, test for errors in the application
	PROJECT MANAGEMENT	21ME651	• Understand the selection, prioritization and initiation of individual projects and strategic role of project • management. • Understand the work breakdown structure by integrating it with organization. • Understand the scheduling and uncertainty in projects. • Understand risk management planning using project quality tools. • Understand the activities like purchasing, acquisitions, contracting, partnering and collaborations related to • performing projects. • Determine project progress and results through balanced scorecard approach • ⊠ Draw the network diagram to calculate the duration of the project and reduce it using crashing.
	RENEWABLE ENERGY POWER PLANTS (OPEN ELECTIVE)	21ME652	• Describe the various forms of non-conventional energy resources. • Apply the fundamental knowledge of mechanical engineering to design various renewable energy systems • Analyze the implications of renewable energy forms for selecting an appropriate system for a specific • application • Discuss on the environmental aspects and impact of non-conventional energy resources, in comparison with • various conventional energy systems, their prospects and limitations.
	MECHATRONICS	21ME653	• Illustrate various components of Mechatronics systems. • Assess various control systems used in automation. • Design and conduct experiments to evaluate the performance of a mechatronics system or component with • respect to specifications, as well as to analyse and interpret data. • Apply the principles of Mechatronics design to product design. • ⊠ Function effectively as members of multidisciplinary teams.
	MODERN MOBILITY	21ME654	• Understand the working of different systems employed in automobile • Analyse the limitation of present day automobiles • Evaluate the energy sources suitability • Apply the knowledge for selection of automobiles based on their suitability
	CNC PROGRAMMING AND 3-D PRINTING LAB	21MEL66	• Students will have knowledge of G-code and M-code for machining operations. • Students will able to perform CNC programming for turning, drilling, milling and threading operation. • Students will able to visualize the 3D models using CAD software's • Students will able to use 3D printing technology • ⊠ Students are able to understand robotic programming and FMS

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7	AUTOMATION AND ROBOTICS (PCC)	21ME71	• Translate and simulate a real time activity using modern tools and discuss the Benefits of automation. • Identify suitable automation hardware for the given application. • Recommend appropriate modelling and simulation tool for the given manufacturing Application. • Explain the basic principles of Robotic technology, configurations, control and Programming of Robots. • Explain the basic principles of programming and apply it for typical Pick & place, Loading & unloading and palletizing applications
	CONTROL ENGINEERING	21ME72	• Identify the type of control and control actions and develop the mathematical model of the physical systems. • Estimate the response and error in response of first and second order systems subjected standard input signals. • Represent the complex physical system using block diagram and signal flow graph and obtain transfer function. • Analyse a linear feedback control system for stability using Hurwitz criterion, Routh's criterion and root Locus technique in complex domain. • Analyse the stability of linear feedback control systems in frequency domain using polar plots, Nyquist and Bode plots.
	ADDITIVE MANUFACTURING	21ME731	• Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that areavailable. • Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available. • Understand the various software tools, processes and techniques that enable advanced/additive manufacturing. • Apply the concepts of additive manufacturing to design and create components that satisfy product development/prototyping requirements, using advanced/additive manufacturing devices and processes. • Understand characterization techniques in additive manufacturing. • Understand the latest trends and business opportunities in additive manufacturing.
	TOTAL QUALITY MANAGEMENT	21ME732	• Explain the various approaches of TQM • Infer the customer perception of quality • Analyse customer needs and perceptions to design feedback systems. • Apply statistical tools for continuous improvement of systems • Apply the tools and technique for effective implementation of TQM.
	REFRIGERATION AND AIR-CONDITIONING	21ME733	• Illustrate the principles, nomenclature and applications of refrigeration systems. • Explain vapour compression refrigeration system and identify methods for performance improvement • Study the working principles of air, vapour absorption, thermoelectric and steam-jet and thermoacoustic refrigeration systems. • Estimate the performance of air-conditioning systems using the principles of psychrometry. • Compute and Interpret cooling and heating loads in an air-conditioning system. • Identify suitable refrigerant for various refrigerating systems.
	MEMS AND MICROSYSTEM	21ME734	• Explain MEMS Technology, Present, Future, and Challenges. • Explain micro-sensors, micro-actuators, their types, and applications.

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	TECHNOLOGY		• Explain fabrication processes for producing micro-sensors and actuators. • Apply Reliability and Failure Analysis Testing. • Understand the operation of microdevices, microsystems, and their applications. • Design the microdevices and microsystems using the MEMS fabrication process.
	DESIGN FOR MANUFACTURING & ASSEMBLY	21ME735	• have knowledge on design principles for manufacturability • have knowledge Influencing factors on Design. • have knowledge on Machining consideration while design. • have knowledge on casting consideration while design. • have knowledge on environment consideration while design. • have ability to understand contemporary issues and their impact on design for manufacturing and assembly.
	ADVANCED VIBRATIONS AND CONDITION MONITORING	21ME741	• Identify & classify the vibration systems • Analyse the vibration parameters through different theoretical methods • Apply the knowledge of vibration measurement instruments and control system • Understand the sound generation and propagation arising through vibration
	Theory and Design of IC Engines	21ME742	• Understand various types of I.C. Engines, Cycles of operation and Identify fuel metering, fuel supply systems for different types of engines. • Understand combustion phenomena in SI and CI engines and Analyze the effect of various operating variables on engine performance. • Evaluate performance Analysis of IC Engine and Justify the suitability for different applications. • Understand the conventional and non-conventional fuels and effects of emission formation of IC engines, its effects, and the legislation standards
	ADVANCED TURBOMACHINES	21ME743	• Explain the various thermodynamic processes involved in turbomachines with the application of 1st and 2nd law of Thermodynamics and also apply of the concept of law of conservation of energy for the flow through nozzle and diffuser. • Demonstrate the concept of two-dimensional cascading and evaluating the cascade performance in compressor and turbines. • Explain the thermodynamics of axial flow turbines and analyse its performance and characteristics. • Explain the thermodynamics of axial flow compressor and fans and analyse its performance and characteristics. • Explain and apply the various vortex flow concepts for designing the blades and describe the process of control and maintenance aspects of turbomachines.
	PRODUCT DESIGN & ERGONOMICS	21ME744	• To learn the concept of product design and the ergonomics. • Design the various controls and displays by knowing the anthropometric data's. • To learn the psychology of visuals effects. • Learning the different colour combinations for optimal design of engineering equipments. • Realize the importance of environmental factors and aesthetics in industrial design
	NON-TRADITIONAL	21ME751	• Understand the compare traditional and non-traditional machining process and recognize the need for

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	MACHINING		Nontraditional machining process. • Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM. • Identify the need of Chemical and electro-chemical machining process along with the constructional features, • process parameters, process characteristics, applications, advantages and limitations. • Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM. • Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism ofmetal removal, applications, advantages and limitations LBM & EBM.
	HYDRAULICS AND PNEUMATICS	21ME752	• Have knowledge of hydraulic and pneumatic system and its components. • Understand the working principle of various hydraulic and pneumatic components. • Apply working principles of Hydraulic and Pneumatic Systems for various applications. • . Determine cause for hydraulic and pneumatic system break down and performance of hydraulic pumps,motors.
	OPERATIONS RESEARCH	21ME753	• Understand the meaning, definitions, scope, need, phases and techniques of operations research. • 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. • Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, • Assignment and travelling salesman problems. • Solve problems on game theory for pure and mixed strategy under competitive environment. • Solve waiting line problems for M/M/1 and M/M/K queuing models. • Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks • Determine minimum processing times for sequencing of n jobs-2 machines, n jobs-3 machines, n jobs-m machines and 2 jobs-n machines using Johnson's algorithm.

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PROGRAM OUTCOMES (POs)

POs are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, analytical ability attitude and behavior that students acquire through the program.

The POs essentially indicate what the students can do from subject-wise knowledge acquired by them during the program. As such, POs define the professional profile of an engineering graduate.

NBA has defined the following twelve POs for an engineering graduate. These are in line with the Graduate Attributes as defined by the Washington Accord:

i) Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

ii) Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

iii) Design/Development of Solutions: 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.

iv) Conduct Investigations of Complex Problems: 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 for complex problems:

- that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline as against problems given at the end of chapters in a typical text book that can be solved using simple engineering theories And techniques;
- that may not have a unique solution .For example ,a design problem can be solved in many Ways and lead to multiple possible solutions;

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- that require consideration of appropriate constraints / requirements not explicitly given in the problem statement such as cost, power requirement, durability, product life, etc.;
- which need to be defined (modeled) within appropriate mathematical framework; and
- that often require use of modern computational concepts and tools, for example, in the design of an antenna or a DSP filter.

v) Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

vi) The Engineer and Society: 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.

vii) Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

viii) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

ix) Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

x) Communication: 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.

xi) Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

xii) Life-long Learning :Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

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