Department of Mechanical Engineering

SUBJECT	**MATERIAL SCIENCE**
SUBJECT CODE	**17ME32**
CO1	Describe the mechanical properties of metals, their alloys and various modes of failure.
CO2	Understand the microstructures of ferrous and non-ferrous materials to mechanical properties.
CO3	Explain the processes of heat treatment of various alloys.
CO4	Understand the properties and potentialities of various materials available and material selection procedures.
CO5	Know about composite materials and their processing as well as applications.

SUBJECT	**BASIC THERMODYNAMICS**
SUBJECT CODE	**17ME33**
CO1	Explain thermodynamic systems, properties, Zeroth law of thermodynamics, temperature scales and energy interactions.
CO2	Determine heat, work, internal energy, enthalpy for flow & non flow process using First and Second Law of Thermodynamics.
CO3	Interpret behavior of pure substances and its applications to practical problems.

CO4	Determine change in internal energy, change in enthalpy and change in entropy using TD relations for ideal gases.
CO5	Calculate Thermodynamics properties of real gases at all ranges of pressure, temperatures using modified equation of state including Vander Waals equation, Redlich Wong equation and Beattie-

SUBJECT	**MECHANICS OF MATERIALS**
SUBJECT CODE	**17ME34**
CO1	Understand simple, compound, thermal stresses and strains their relations, Poisson's ratio, Hooke's law, mechanical properties including elastic constants and their relations.
CO2	Determine stresses, strains and deformations in bars with varying circular and rectangular cross-sections subjected to normal and temperature loads
CO3	Determine plane stress, principal stress, maximum shear stress and their orientations using analytical method and Mohr's circle
CO4	Determine the dimensions of structural members including beams, bars and rods using Energy methods and also stress distribution in thick and thin cylinders
CO5	Draw SFD and BMD for different beams including cantilever beams, simply supported beams and overhanging beams subjected to UDL, UVL, Point loads and couples

SUBJECT	METAL CASTING AND WELDING
SUBJECT CODE	17ME35 A /45A
CO1	Describe the casting process, preparation of Green, Core, dry sand molds and Sweep, Shell, Investment and plaster molds.
CO2	Explain the Pattern, Core, Gating, Riser system and Jolt, Squeeze, Sand Slinger Molding Machines.
CO3	Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces.
CO4	Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mold castings.
CO5	Explain the Solidification process and Casting of Non-Ferrous Metals.

SUBJECT	MACHINE TOOLS AND OPERATIONS
SUBJECT CODE	17ME35 B / 45B
CO1	Explain the construction & specification of various machine tools.
CO2	Describe various machining processes pertaining to relative motions between tool & work piece.
CO3	Discuss different cutting tool materials, tool nomenclature & surface finish.
CO4	Apply mechanics of machining process to evaluate machining time.
CO5	Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost.

SUBJECT	COMPUTER AIDED MACHINE DRAWING
SUBJECT CODE	17ME36 A / 46A

CO1	Sections of pyramids, prisms, cubes, cones and cylinders resting on their bases in 2D
CO2	Orthographic views of machine parts with and without sectioning in 2D.
CO3	Sectional views for threads with terminologies of ISO Metric, BSW, square and acme, sellers and American standard threads in 2D.
CO4	Hexagonal and square headed bolt and nut with washer, stud bolts with nut and lock nut, flanged nut, slotted nut, taper and split pin for locking counter sunk head screw, grub screw, Allen screw assemblies in 2D
CO5	Parallel key, Taper key, and Woodruff Key as per the ISO standards in 2D

SUBJECT	**MECHANICAL MEASUREMENTS AND METROLOGY**
SUBJECT CODE	**17ME36 B / 46B**
CO1	Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars.
CO2	Describe slip gauges, wringing of slip gauges and building of slip gauges, angle measurement using sine bar, sine center, angle gauges, optical instruments and straightness measurement using Autocollimator.

CO3	Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design.
CO4	Understand the principle of Johnson Mikrokator, sigma comparator, dial indicator, LVDT, back pressure gauges, Solex comparators and Zeiss Ultra Optimeter
CO5	Describe measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 – wire, 3 – wire methods, screw thread gauges and tool maker's microscope.

SUBJECT	**MATERIALS TESTING LAB**
SUBJECT CODE	**17MEL37 A / 47A**
CO1	Acquire experimentation skills in the field of material testing.
CO2	Develop theoretical understanding of the mechanical properties of materials by performing experiments.
CO3	Apply the knowledge to analyze a material failure and determine the failure inducing agent/s.
CO4	Apply the knowledge of testing methods in related areas.
CO5	Know how to improve structure/behavior of materials for various industrial applications.

SUBJECT	**MECHANICAL MEASUREMENTS AND METROLOGY LAB**
SUBJECT CODE	**17MEL37 B / 47B**
CO1	To calibrate pressure gauge, thermocouple, LVDT, load cell, micrometer..

CO2	To measure angle using Sine Center/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set.
CO3	To demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats..
CO4	To measure cutting tool forces using Lathe/Drill tool dynamometer..
CO5	To measure Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth vernier/Gear tooth micrometer.

SUBJECT	**FOUNDRY AND FORGING LAB**
SUBJECT CODE	**17MEL38A / 48A**
CO1	Demonstrate various skills of sand preparation, molding.
CO2	Demonstrate various skills of forging operations.
CO3	Work as a team keeping up ethical principles.

SUBJECT	**MACHINE SHOP**
SUBJECT CODE	17MEL38B / 48B
CO1	Perform turning , facing , knurling , thread cutting, tapering , eccentric turning and allied operations, keyways / slots , grooves etc using shaper
CO2	Perform gear tooth cutting using milling machine

CO3	Understand the formation of cutting tool parameters of single point cutting tool using bench grinder / tool and cutter grinder, Surface Milling/Slot Milling
CO4	Demonstrate precautions and safety norms followed in Machine Shop
CO5	Exhibit interpersonal skills towards working in a team

SUBJECT	**KINEMATICS OF MACHINES**
SUBJECT CODE	**17ME42**
CO1	Identify mechanisms with basic understanding of motion.
CO2	Comprehend motion analysis of planar mechanisms, gears, gear trains and cams.
CO3	Carry out motion analysis of planar mechanisms, gears, gear trains and cams.

SUBJECT	**APPLIED THERMODYNAMICS**
SUBJECT CODE	17ME43
CO1	Apply thermodynamic concepts to analyze the performance of gas power cycles including propulsion systems
CO2	Evaluate the performance of steam turbine components
CO3	Understand combustion of fuels and combustion processes in I C engines including alternate fuels and pollution effect on environment
CO4	Apply thermodynamic concepts to analyze turbo machines

CO5	Determine performance parameters of refrigeration and air-conditioning systems

SUBJECT	**FLUID MECHANICS**
SUBJECT CODE	17ME44
CO1	Identify and calculate the key fluid properties used in the analysis of fluid behavior.
CO2	Understand and apply the principles of pressure, buoyancy and floatation
CO3	Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of mechanical and chemical engineering.
CO4	Understand and apply the principles of fluid kinematics and dynamics.
CO5	Understand the concept of boundary layer in fluid flow and apply dimensional analysis to form dimensionless numbers in terms of input output variables.

SUBJECT	**MACHINE TOOLS AND OPERATIONS**
SUBJECT CODE	**17ME35 B / 45B**
CO1	Explain the construction & specification of various machine tools.
CO2	Describe various machining processes pertaining to relative motions between tool & work piece.
CO3	Discuss different cutting tool materials, tool nomenclature & surface finish.
CO4	Apply mechanics of machining process to evaluate machining time.

CO5	Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost.

SUBJECT	**MANAGEMENT AND ENGINEERING ECONOMICS**
SUBJECT CODE	**17ME51**
CO1	Explain the development of management and the role it plays at different levels in an organization.
CO2	Comprehend the process and role of effective planning, organizing and staffing for the development of an organization.
CO3	Understand the necessity of good leadership, communication and coordination for establishing effective control in an organization.
CO4	Understand engineering economics demand supply and its importance in economics decision making and problem solving.
CO5	Calculate present worth, annual worth and IRR for different alternatives in economic decision making.

SUBJECT	**DYNAMICS OF MACHINERY**
SUBJECT CODE	17ME52
CO1	Determine the forces and couples for static and dynamic conditions of four bar and slider crank mechanisms to keep the system in equilibrium.

CO2	Determine magnitude and angular position of balancing masses under static and dynamic condition of rotating masses in same and different planes.
CO3	Determine unbalanced primary, secondary forces and couples in single and multi-cylinder engine.
CO4	Determine sensitiveness, isochronism, effort and power of porter and hartnell governors.
CO5	Determine gyroscopic couple and effects related to 2, 4 wheeler, plane disc, ship and aeroplanes

SUBJECT	**TURBO MACHINES**
SUBJECT CODE	17ME53
CO1	Able to give precise definition of turbomachinery
CO2	Identify various types of turbo machinery
CO3	Apply the Euler‟s equation for turbomachinery to analyse energy transfer in turbomachines
CO4	Understand the principle of operation of pumps, fans, compressors and turbines.
CO5	Perform the preliminary design of turbomachines (pumps, rotary compressors and turbines)

SUBJECT	**DESIGN OF MACHINE ELEMENTS – I**
SUBJECT CODE	17ME54

CO1	Describe the design process, choose materials.
CO2	Apply the codes and standards in design process.
CO3	Analyze the behavior of machine components under static, impact, fatigue loading using failure theories.
CO4	Design shafts, joints, couplings.
CO5	Design of riveted and welded joints.

SUBJECT	**NON TRADITIONAL MACHINING**
SUBJECT CODE	**17ME554**
CO1	Understand the compare traditional and non-traditional machining processand recognize the need for Non-traditional machining process.
CO2	Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM.
CO3	Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations.
CO4	Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM.
CO5	Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM.

SUBJECT	**ENERGY AND ENVIRONMENT**

SUBJECT CODE	17ME562
CO1	Summarize the basic concepts of energy, its distribution and general Scenario.
CO2	Explain different energy storage systems, energy management, audit and economic analysis.
CO3	Summarize the environment eco system and its need for awareness.
CO4	Identify the various types of environment pollution and their effects.
CO5	Discuss the social issues of the environment with associated acts.

SUBJECT	FLUID MECHANICS & MACHINERY LAB
SUBJECT CODE	17MEL57
CO1	Perform experiments to determine the coefficient of discharge of flow measuring devices.
CO2	Conduct experiments on hydraulic turbines and pumps to draw characteristics.
CO3	Test basic performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations.
CO4	Determine the energy flow pattern through the hydraulic turbines and pumps
CO5	Exhibit his competency towards preventive maintenance of hydraulic machines

SUBJECT	ENERGY LAB

SUBJECT CODE	17MEL58
CO1	Perform experiments to determine the properties of fuels and oils.
CO2	Conduct experiments on engines and draw characteristics.
CO3	Test basic performance parameters of I.C. Engine and implement the knowledge in industry.
CO4	Identify exhaust emission, factors affecting them and report the remedies.
CO5	Determine the energy flow pattern through the I C Engine

SUBJECT	**FINITE ELEMENT ANALYSIS**
SUBJECT CODE	**17ME61**
CO1	Understand the concepts behind formulation methods in FEM.
CO2	Identify the application and characteristics of FEA elements such as bars, beams, plane andiso-parametric elements. 3.Develop element characteristic equation and generation of global equation.
CO3	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.

SUBJECT	**Computer Integrated Manufacturing**
SUBJECT CODE	**17ME62**

CO1	Able to define Automation, CIM, CAD, CAM and explain the differences between these concepts
CO2	Solve simple problems of transformations of entities on computer screen
CO3	Explain the basics of automated manufacturing industries through mathematical models and analyze different types of automated flow lines
CO4	Analyze the automated flow linesto reduce down time and enhance productivity.
CO5	□ 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.□

SUBJECT	**Heat Transfer**
SUBJECT CODE	**17ME63**
CO1	Understand the basic modes of heat transfer.
CO2	Compute temperature distribution in steady-state and unsteady-state heat conduction
CO3	Understand and interpret heat transfer through extended surfaces.
CO4	Interpret and compute forced and free convective heat transfer.
CO5	Explain the principles of radiation heat transfer and understand the numerical formula for heat conduction problems.

SUBJECT	**DESIGN OF MACHINE ELEMENTS II**
SUBJECT CODE	**17ME64**

CO1	Apply engineering design tools to product design.
CO2	Design mechanical systems involving springs,belts and pulleys.
CO3	Design different types of gears and simple gear boxes for different applications.
CO4	Design brakes and clutches.
CO5	Design hydrodynamic bearings for different applications.

SUBJECT	**METAL FORMING**
SUBJECT CODE	**17ME653**
CO1	Able to understandthe concept of different metal forming process.
CO2	Able to approach metal forming processes both analytically and numerically
CO3	Able to design metal forming processes
CO4	Able to develop approaches and solutions to analyze metal forming processes

SUBJECT	**AUTOMOBILE ENGINEERING**
SUBJECT CODE	**17ME655**
CO1	To identify the different parts of an automobile and it's working
CO2	To understand the working of transmission and braking systems
CO3	To comprehend the working of steering and suspension systems
CO4	To learn various types of fuels and injection systems

CO5	To know the cause of automobile emissions,its effects on environment and methods to reduce the emissions.

SUBJECT	**TOTAL QUALITY MANAGEMENT**
SUBJECT CODE	**17ME664**
CO1	Explain the various approaches of TQM
CO2	Infer the customer perception of quality
CO3	Analyze customer needs and perceptions to design feedback systems.
CO4	Apply statistical tools for continuous improvement of systems
CO5	Apply the tools and technique for effective implementation of TQM.

SUBJECT	**Heat Transfer Lab**
SUBJECT CODE	**17MEL67**
CO1	Perform experiments to determine the thermal conductivity of a metal rod
CO2	Conduct experiments to determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.
CO3	Estimate the effective thermal resistance in composite slabs and efficiency in pin-fin
CO4	Determine surface emissivity of a test plate
CO5	Estimate performance of a refrigerator and effectiveness of fin

SUBJECT	**Modeling and Analysis Lab (FEA)**

SUBJECT CODE	17MEL68
CO1	Demonstrate the basic features of an analysis package.
CO2	Use the modern tools to formulate the problem, and able to create geometry, descritize, apply boundary condition to solve problems of bars, truss, beams, plate to find stress with different- loading conditions.
CO3	Demonstrate the deflection of beams subjected to point, uniformly distributed and varying loads further to use the available results to draw shear force and bending moment diagrams.
CO4	Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions.
CO5	Carry out dynamic analysis and finding natural frequencies for various boundary conditions

SUBJECT	ENERGY ENGINEERING
SUBJECT CODE	17ME71
CO1	Summarize the basic concepts of thermal energy systems,
CO2	Identify renewable energy sources and their utilization.
CO3	Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
CO4	Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas.
CO5	Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator.

SUBJECT	FLUID POWER SYSTEMS
SUBJECT CODE	17ME72
CO1	Identify and analyse the functional requirements of a fluid power transmission system for a given application.
CO2	Visualize how a hydraulic/pneumatic circuit will work to accomplish the function.
CO3	Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application.
CO4	Select and size the different components of the circuit.
CO5	Develop a comprehensive circuit diagramby integrating the components selected for the given

SUBJECT	CONTROL ENGINEERING
SUBJECT CODE	17ME73
CO1	Recognize control system and its types , control actions
CO2	Determine the system governing equations for physical models(Electrical, Thermal, Mechanical, Electro Mechanical)
CO3	Calculate the gain of the system using block diagram and signal flow graph
CO4	Illustrate the response of 1st and 2nd order systems

CO5	Determine the stability of transfer functions in complex domain and frequency domain

SUBJECT	**TRIBOLOGY**
SUBJECT CODE	**17ME742**
CO1	Understand the fundamentals of tribology and associated parameters.
CO2	Apply concepts of tribology for the performance analysis and design of components experiencing relative motion.
CO3	Analyse the requirements and design hydrodynamic journal and plane slider bearings for a given application.
CO4	Select proper bearing materials and lubricants for a given tribological application.
CO5	Apply the principles of surface engineering for different applications of tribology.

SUBJECT	**SMART MATERIALS and MEMS**
SUBJECT CODE	**17ME745**
CO1	Describe the methods of controlling vibration using smart systems and fabrication methods of MEMS.
CO2	Explain the principle concepts of Smart materials, structures, Fibre optics, ER & MR Fluids, Biomimetics and MEMS with principles of working.
CO3	Analyze the properties of smart structures, MEMS, with the applications and select suitable procedure for fabrication.

CO4	Summarize the methods and uses of Micro fabrications, Biomimetics, types of polymers used in MEMS, Fibre optics, piezoelectric sensing and actuation.

SUBJECT	**MECHATRONICS**
SUBJECT CODE	**17ME753**
CO1	Illustrate various components of Mechatronics systems.
CO2	Assess various control systems used in automation.
CO3	Develop mechanical, hydraulic, pneumatic and electrical control systems.

SUBJECT	**MECHANICAL VIBRATIONS**
SUBJECT CODE	**17ME754**
CO1	Understand and characterize the single and multi degrees of freedom systems subjected to free and forced vibrations with and without damping.
CO2	Understand the method of vibration measurements and its controlling.
CO3	Understand the concept of dynamic vibrations of a continuous systems.

SUBJECT	**DESIGN LABORATORY**
SUBJECT CODE	17MEL76

CO1	To understand the working principles of machine elements such as Governors, Gyroscopes etc.,
CO2	To identify forces and couples in rotating mechanical system components.
CO3	To identify vibrations in machine elements and design appropriate damping methods and to determine the critical speed of a rotating shaft.
CO4	To measure strain in various machine elements using strain gauges
CO5	To determine the minimum film thickness, load carrying capacity, frictional torque and pressure distribution of journal bearing.

SUBJECT	**COMPUTER INTEGRATED MANUFACTURING LAB**
SUBJECT CODE	17MEL77
CO1	Generate CNC Lathe part program for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning, Circular interpolation
CO2	Generate CNC Mill Part programming for Point to point motions, Line motions, Circular interpolation, Contour motion, Pocket milling-circular, rectangular, Mirror commands etc.
CO3	Use Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing,Taper turning Thread cutting etc.
CO4	Simulate Tool Path for different Machining operations of small components using CNC Lathe & CNC Milling Machine.
CO5	Use high end CAM packages for machining complex parts; use state of art cutting tools and related cutting parameters

SUBJECT	OPERATIONS RESEARCH
SUBJECT CODE	**17ME81**
CO1	Understand the meaning, definitions, scope, need, phases and techniques of operations research.
CO2	Formulate as L.P.P and derive optimal solutions to linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method.
CO3	Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems.
CO4	Solve problems on game theory for pure and mixed strategy under competitive environment.
CO5	Solve waiting line problems for M/M/1 and M/M/K queuing models.

SUBJECT	**Green Manufacturing**
SUBJECT CODE	**17ME834**
CO1	Understand the basic design concepts, methods, tools, the key technologies and the operation of sustainable green manufacturing.
CO2	Apply the principles, techniques and methods to customize the learned generic concepts to meet the needs of a particular industry/enterprise.
CO3	Identify the strategies for the purpose of satisfying a set of given sustainable green manufacturing requirements.
CO4	Design the rules and processes to meet the market need and the green manufacturing requirements by selecting and evaluating suitable

	technical, managerial / project management and supply chain management scheme

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