MECHANICAL ENGINEERIMG (R20)	
	1 YEAR - 1 SEMESTER
COURSE OUTCOMES	**CALCULUS & DIFFERENTIAL EQUATIONS-M1**
CO1	utilize mean value theorems to real life problems (L3)
CO2	solve the differential equations related to various engineering fields (L3)
CO3	familiarize with functions of several variables which is useful in optimization (L3)
CO4	apply double integration techniques in evaluating areas bounded by region (L3)
CO5	students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional and 3-dimensional
COURSE OUTCOMES	**ENGINEERING PHYSICS**
CO1`	Analyze the differences between interference and diffraction with applications. Illustrate the concept of polarization of light and its applications (L2)
CO2	Apply the concepts to learn the types of lasers (L3) . Identify the applications of optical fibers in various fields (L2)
CO3	Classify the magnetic materials based on susceptibility and their temperaturedependence(L2). Apply the concept of magnetism to magnetic devices (L3)
CO4	Recognize sound level disruptors and their use in architectural acoustics (L2)
CO5	Analyze the crystalline structure by Bragg's X-ray diffractometer (L4)
COURSE OUTCOMES	**PROGRAMMING FOR PROBLEM SOLVING USING C**
CO1	To write algorithms and to draw flowcharts for solving problems
CO2	To convert flowcharts/algorithms to C Programs, compile and debug programs
CO3	To use different operators, data types and write programs that use two-way/ multi-way selection
CO4	select the best loop construct for a given problem
CO5	To design and implement programs to analyze the different pointer applications
CO6	To apply File I/O operations
COURSE OUTCOMES	**COMMUNICATIVE ENGLISH**
CO1	Understand social or transactional dialogues spoken by native speakers of English and identify thecontext, topic, and pieces of specific information
CO2	Ask and answer general questions on familiar topics and introduce oneself/others
CO3	Employ suitable strategies for skimming and scanning to get the general idea of a text and locatespecific information
CO4	Recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
CO5	Form sentences using proper grammatical structures and correct word forms
COURSE OUTCOMES	**ENGINEERING DRAWING**
CO1	The student will learn how to visualize 2D & 3D objects.
COURSE OUTCOMES	**PROGRAMMING FOR PROBLEM SOLVING USING C LABORATORY**

CO1	Gains Knowledge on various concepts of a C language.
CO2	Able to draw flowcharts and write algorithms.
CO3	Able design and development of C problem solving skills.
CO4	Able to design and develop modular programming skills.
CO5	Able to trace and debug a program
	1 YEAR - 2 SEMESTER
COURSE OUTCOMES	**LINEAR ALGEBRA AND NUMERICAL METHODS – M-II**
CO1	develop the use of matrix algebra techniques that is needed by engineers for practical applications(L6)
CO2	solve system of linear algebraic equations using Gauss elimination, Gauss Jordan, Gauss Seidel(L3)
CO3	evaluate the approximate roots of polynomial and transcendental equations by differentalgorithms (L5)
CO4	apply Newton's forward & backward interpolation and Lagrange's formulae for equal andunequal intervals (L3)
CO5	apply numerical integral techniques to different Engineering problems (L3)
COURSE OUTCOMES	**ENGINEERING CHEMISTRY**
CO1	Analyze the different types of composite plastic materials and interpret the mechanism ofconduction in conducting polymers.
CO2	Utilize the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and categorize the reasons for corrosion and study methods to control corrosion.
CO3	Summarize the techniques that detect and measure changes of state of reaction.
CO4	Differentiate petroleum, petrol, synthetic petrol and have knowledge how they are produced. Study alternate fuels and analyse flue gases.
CO5	Analyze the suitable methods for purification and treatment of hard water and brackish water.
COURSE OUTCOMES	**ENIGINEERING MECHANICS**
CO1	The student should be able to draw free body diagrams for FBDs for particles and rigid bodies in plane and space and problems to solve the unknown forces, orientations and geometric parameters.
CO2	He should be able to determine centroid for lines, areas and center of gravity for volumes and their composites.
CO3	He should be able to determine area and mass movement of inertia for composite sections
CO4	He should be able to analyze motion of particles and rigid bodies and apply theprinciples of motion, work energy and impulse – momentum.
COURSE OUTCOMES	**BASIC ELECTRICAL & ELECTRONICS ENGINEERING**
CO1	Analyse various electrical networks.
CO2	Understand operation of DC generators,3-point starter and DC machine testing by Swinburne'sTest and Brake test.
CO3	Analyse performance of single-phase transformer and acquire proper knowledge and working of3-phase alternator and 3-phase induction motors.

CO4	Analyse operation of half wave, full wave bridge rectifiers and OP-AMPs.
CO5	Understanding operations of CE amplifier and basic concept of feedback amplifier.
COURSE OUTCOMES	**THERMODYNAMICS**
CO1	Basic concepts of thermodynamics
CO2	Laws of thermodynamics
CO3	Concept of entropy
CO4	Property evaluation of vapors and their depiction in tables and charts
CO5	Evaluation of properties of perfect gas mixtures.
COURSE OUTCOMES	**ENGINEERING CHEMISTRY LABORATORY**
CO1	The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis
CO2	redox titrations with different indicators
CO3	EDTA titrations
CO4	Thus at the end of the lab course, the student is exposed to different methods of chemical analysis and use of somecommonly employed instruments.
CO5	They thus acquire some experimental skills.
COURSE OUTCOMES	**BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB**
CO1	Compute the efficiency of DC shunt machine without actual loading of the machine.
CO2	Estimate the efficiency and regulation at different load conditions and power factors for singlephase transformer with OC and SC tests.
CO3	Analyse the performance characteristics and to determine efficiency of DC shunt motor &3- Phaseinduction motor..
CO4	Draw the characteristics of PN junction diode & transistor
CO5	Determine the ripple factor of half wave & full wave rectifiers.
COURSE OUTCOMES	**CONSTITUTION OF INDIA**
CO1	Understand the concept of Indian constitution
CO2	Explain the role of President and Prime Minister
CO3	Analyze the role Governor and Chief Minister
CO4	Compare and contrast district administration role and importance
CO5	Evaluate various commissions of viz SC/ST/OBC and women
CO6	Analyze the decentralization of power between central, state and local self-government.
	2 YEAR - 1 SEMESTER
COURSE OUTCOMES	**VECTOR CALCULUS FOURIER TRANSFORMS and PDE (M-III)**
CO1	Interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
CO2	Estimate the work done against a field, circulation and flux using vector calculus (L5)
CO3	Apply the Laplace transform for solving differential equations (L3)
CO4	Find or compute the Fourier series of periodic signals (L3)

CO5	Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3)
COURSE OUTCOMES	**MECHANICS OF SOLIDS**
CO1	Model & Analyze the behavior of basic structural members subjected to various loading and support conditions based on principles of equilibrium.
CO2	Understand the apply the concept of stress and strain to analyze and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment.
CO3	Students will learn all the methods to analyze beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components. Students are able to analyse beams and draw correct and complete shear and bending moment diagrams forbeams.
CO4	Students attain a deeper understanding of the loads, stresses, and strains acting on a structure and their relations in the elastic behavior
CO5	Design and analysis of Industrial components like pressure vessels.
COURSE OUTCOMES	**FLUID MECHANICS & HYDRAULIC MACHINES**
CO1	The basic concepts of fluid properties.
CO2	Boundary layer theory, flow separation and dimensional analysis.
CO3	The mechanics of fluids in static and dynamic conditions.
CO4	Hydrodynamic forces of jet on vanes in different positions.
CO5	Working Principles and performance evaluation of hydraulic pump and turbines.
COURSE OUTCOMES	**PRODUCTION TECHNOLOGY**
CO1	Able to design the patterns and core boxes for metal casting processes
CO2	Able to design the gating system for different metallic components
CO3	Know the different types of manufacturing processes
CO4	Learn about the different types of welding processes used for special fabrication.
CO5	Be able to use forging, extrusion processes
COURSE OUTCOMES	**KINEMATICS OF MACHINERY**
CO1	Contrive a mechanism for a given plane motion with single degree of freedom.
CO2	Suggest and analyze a mechanism for a given straight line motion and automobile steering motion.
CO3	Analyze the motion (velocity and acceleration) of a plane mechanism.
CO4	Suggest and analyze mechanisms for a prescribed intermittent motion like opening and closing of IC engine valves etc.
CO5	Select a power transmission system for a given application and analyze motion of different transmission systems
COURSE OUTCOMES	**COMPUTER AIDED ENGINEERING DRAWING PRACTICE**

CO1	Student get exposed on working of sheet metal with help of development ofsurfaces.
CO2	Student understands how to know the hidden details of machine components with the help of sections and interpenetrations ofsolids.
CO3	Student shall exposed to modeling commands for generating 2D and 3D objects using computer aided drafting tools which are useful to create machine elements for computer aidedanalysis.
COURSE OUTCOMES	**ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE**
CO1	Understand the concept of Traditional knowledge and itsimportance
CO2	Know the need and importance of protecting traditionalknowledge
CO3	Know the various enactments related to the protection of traditionalknowledge
CO4	Understand the concepts of Intellectual property to protect the traditionalknowledge
	2 YEAR - 2 SEMESTER
COURSE OUTCOMES	**MATERIALS SCIENCE & METALLURGY**
CO1	Understand the crystalline structure of different metals and study the stability of phases in different alloy systems.
CO2	Study the behavior of ferrous and non ferrous metals and alloys and their application in different domains
CO3	Grasp the methods of making of metal powders and applications of powder metallurgy
CO4	Able to understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals.
CO5	Comprehend the properties and applications of ceramic, composites and other advanced methods.
COURSE OUTCOMES	**COMPLEX VARIABLES AND STATISTICAL METHODS**
CO1	apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic (L3)
CO2	find the differentiation and integration of complex functions used in engineering problems (L5)
CO3	make use of the Cauchy residue theorem to evaluate certain integrals (L3)
CO4	apply discrete and continuous probability distributions (L3)
CO5	design the components of a classical hypothesis test (L6)
COURSE OUTCOMES	**DYNAMICS OF MACHINERY**
CO1	To compute the frictional losses and transmission in clutches, brakes anddynamometers
CO2	To determine the effect of gyroscopic couple in motor vehicles, ships andaeroplanes
CO3	To analyze the forces in four bar and slider crank mechanisms and design aflywheel
CO4	To determine the rotary unbalanced mass in reciprocatingequipment
CO5	To determine the natural frequencies of discrete systems undergoing longitudinal, torsional and transverse vibrations.

COURSE OUTCOMES	THERMAL ENGINEERING - I
CO1	Derive the actual cycle from fuel-air cycle and air- standard cycle for all practical applications.
CO2	Explain working principle and various components of IC engine
CO3	Explain combustion phenomenon of CI and SI engines and their impact on engine variables.
CO4	Analyze the performance of an IC engine based on the performance parameters.
CO5	Explain the cycles and systems of a gas turbine and determine the efficiency of gas turbine.
CO6	Explain the applications and working principle of rockets and jet propulsion.
COURSE OUTCOMES	**INDUSTRIAL ENGINEERING AND MANAGEMENT**
CO1	Design and conduct experiments, analyse, interpret data and synthesize validconclusions
CO2	Design a system, component, or process, and synthesize solutions to achieve desiredneeds
CO3	Use the techniques, skills, and modern engineering tools necessary for engineering practice with appropriate considerations for public health and safety, cultural, societal, and environmental constraints
CO4	Function effectively within multi-disciplinary teams and understand the fundamental precepts of effective project management
COURSE OUTCOMES	**MACHINE DRAWING PRACTICE**
CO1	Draw and represent standard dimensions of different mechanical fasteners and joints and Couplings.
CO2	Draw different types of bearings showing different components.
CO3	Select and represent fits and geometrical form of different mating parts in assembly drawings.
CO4	Assemble components of a machine part and draw the sectional assembly drawing showing the dimensions of all the components of the assembly as per bill of materials
CO5	To prepare manufacturing drawings indicating fits, tolerances, surface finish and surface treatment requirements
COURSE OUTCOMES	**PYTHON PROGRAMMING LAB**
CO1	Learn the PYTHON Programming language
CO2	Solve the different methods for linear, non-linear and differential equations
CO3	Familiar with the strings and matrices in PYTHON
CO4	Write the Program scripts and functions in PYTHON to solve the methods
	3 YEAR - 1 SEMESTER
COURSE OUTCOMES	**THERMAL ENGINEERING - II**
CO1	To understand the basic concepts of thermal engineering and boilers.
CO2	To gain knowledge about the concepts of steam nozzles and steam turbines.

CO3	To gain knowledge about the concepts of reaction turbine and steam condensers.
CO4	To understand the concepts of reciprocating and rotary type of compressors.
CO5	To acquire knowledge about the centrifugal and axial flow compressors.
COURSE OUTCOMES	**DESIGN OF MACHINE MEMBERS-I**
CO1	Judge about materials and their properties along with manufacturing considerations.
CO2	Gain knowledge about the strength of machine elements.
CO3	Apply the knowledge in designing the riveted and welded joints, keys, cotters and knuckle joints.
CO4	Apply the knowledge in designing the shafts and shaft couplings.
CO5	Apply the knowledge in designing the mechanical springs.
COURSE OUTCOMES	**MACHINING, MACHINE TOOLS & METROLOGY**
CO1	Discuss the concepts of machining processes.
CO2	Apply the principles of lathe, shaping, slotting and planning machines.
CO3	Apply the principles of drilling, milling and boring processes.
CO4	Analyze the concepts of finishing processes and the system of limits and fits.
CO5	Learn the concepts of surface roughness and optical measuring instruments.
COURSE OUTCOMES	**SUSTAINABLE ENERGY TECHNOLOGIES (OE-1)**
CO1	Apply the principles of wind energy and biomass energy.
CO2	Explain the importance of solar energy collection and storage.
CO3	Analyze knowledge on geothermal and ocean energy.
CO4	Justify the knowledge about energy efficient systems.
CO5	Discuss the concepts of green manufacturing systems.
COURSE OUTCOMES	**OPERATIONS RESEARCH (OE-1)**
CO1	Apply the basics of operations research and linear programming problems.
CO2	Apply the knowledge in solving problems of transportation, assignment and sequencing.
CO3	Judge the replacement and game theories and apply the knowledge to solve problems.
CO4	Discuss the waiting line models and project management techniques.
CO5	Apply the knowledge in solving problems of dynamic programming and simulation.
COURSE OUTCOMES	**NANO TECHNOLOGY (OE-1)**
CO1	Explain about nano-structured materials and their applications.
CO2	Apply knowledge about the nano crystalline materials, their properties and defects.
CO3	Justify various techniques of nanofabrication.
CO4	Apply the tools to characterize nano materials.
CO5	Analyze the applications of nano materials.
COURSE OUTCOMES	**THERMAL MANAGEMENT OF ELECTRONIC SYSTEMS (OE-1)**
CO1	Apply the basics of heat transfer and analyze heat transfer through fins

CO2	Analyze the basics of convection and radiation modes of heat transfer.
CO3	Analyze the basics of convection and radiation modes of heat transfer.
CO4	Explain the principles of two-phase cooling and heat pipes.
CO5	Justify knowledge about the thermoelectric coolers.
COURSE OUTCOMES	**FINITE ELEMENT METHODS (PE-1)**
CO1	Apply basic principles of finite element methods.
CO2	Analyze about discretization principles and apply to analyse the trusses.
CO3	Apply the finite element method to analyze and solve beam problems.
CO4	Judge the knowledge about two dimensional stress analysis.
CO5	Apply steady state and dynamic analysis.
COURSE OUTCOMES	**MACHINE TOOLS LABORATORY**
CO1	Demonstrate about general purpose machine tools in the machine shop.
CO2	Perform various operations on lathe machine.
CO3	Perceive different operations on drilling machine.
CO4	Experiment with basic operations on shaping machine.
CO5	Utilize slotting machine to make keyways.
COURSE OUTCOMES	**PROFESSIONAL ETHICS AND HUMAN VALUES**
CO1	Judge the concepts of human values.
CO2	Justify knowledge about the principles of engineering ethics.
CO3	Interpret engineering as social experimentation.
CO4	Realize engineers' responsibility for safety and risk.
CO5	Learn about the engineers' rights and responsibilities.
	3 YEAR - 2 SEMESTER
COURSE OUTCOMES	**HEAT TRANSFER**
CO1	Apply knowledge about mechanism and modes of heat transfer.
CO2	Understand the concepts of conduction and convective heat transfer.
CO3	Learn about forced and free convection.
CO4	Analyze the concepts of heat transfer with phase change and condensation along with heat exchangers.
CO5	Interpret the knowledge about radiation mode of heat transfer.
COURSE OUTCOMES	**DESIGN OF MACHINE MEMBERS-II**
CO1	Apply knowledge about the design of bearings.
CO2	Explain the concepts in designing various engine parts.
CO3	Utilize the knowledge to design curved beams and power screws.
CO4	Justify power transmission systems and to design pulleys and gear drives.
CO5	Apply the concepts in designing various machine tool elements.
COURSE OUTCOMES	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**
CO1	Discuss basic concepts of artificial intelligence, neural networks and genetic algorithms.
CO2	Apply the principles of knowledge representation and reasoning.

CO3	Learn about bayesian and computational learning and machine learning.
CO4	Utilize various machine learning techniques.
CO5	Apply the machine learning analytics and deep learning techniques.
COURSE OUTCOMES	**AUTOMOBILE ENGINEERING (PE-2)**
CO1	Discuss various components of four wheeler automobile.
CO2	Apply the knowledge of different parts of transmission system.
CO3	Judge about steering and suspension systems.
CO4	Justify the braking system and electrical system used in automobiles.
CO5	Analyze the concepts about engine specifications and service, safety and electronic system used in automobiles.
COURSE OUTCOMES	**INDUSTRIAL ROBOTICS (OE-2)**
CO1	Explain the basic concepts and components of industrial robotics and automation.
CO2	Judge the knowledge about robot actuators and feedback components.
CO3	Analyze the motion of robot and manipulator kinematics.
CO4	Analyze the general considerations of path description and generation.
CO5	Utilize knowledge about the image processing, machine vision and robotic applications.
COURSE OUTCOMES	**HEAT TRANSFER LAB**
CO1	Determine the heat transfer rate and coefficient.
CO2	Determine the thermal conductivity, efficiency and effectiveness.
CO3	Determine the emissivity and Stefan-Boltzman constant.
CO4	Determine critical heat flux and investigate Lambert's cosine law.
CO5	Experiment with Virtual labs and investigate Lambert's laws.
COURSE OUTCOMES	**CAE & CAM Lab**
CO1	Experiment with trusses and beams to determine stress, deflection, natural frequencies, harmonic analysis, HT analysis and buckling analysis.
CO2	Create part programmes using FANUC controller.
CO3	Apply G-codes for automated tool path using CAM software.
CO4	Analyze about rapid prototyping machine and to print simple parts.
CO5	Experiment with virtual 3D printing simulation using Vlabs.
COURSE OUTCOMES	**Artificial Intelligence and Machine Learning Lab**
CO1	At the end of the course, student will be able to apply the knowledge of artificial intelligence and machine learning models along with image classifiers and automatic facial recognition using various software tools.
	4 YEAR - 1 SEMESTER
COURSE OUTCOMES	**MECHANICAL VIBRATIONS (PE-3)**
CO1	Understand the concepts of vibrational analysis
CO2	Understand the concepts of free and forced multi degree freedom systems

CO3	Summarize the concepts of torsional vibrations
CO4	Solve the problems on critical speed of shafts
CO5	Apply and Analyze the systems subjected to Laplace transformationsresponse to different inputs
COURSE OUTCOMES	**BIG DATA ANALYTICS (PE-4)**
CO1	Understand the characteristics of big data and concepts of Hadoop ecosystem.
CO2	Design programs for big data applications using Hadoop components
CO3	Apply Map reduce programming model to process big data.
CO4	Analyze Spark and its uses for big data processing.
CO5	Apply the concepts of NOSQL databases.
COURSE OUTCOMES	**ADVANCED MANUFACTURING PROCESSES (PE-5)**
CO1	Understand the working principles of various surface coating methods.
CO2	Discuss novel and promising techniques in the processing of ceramics and composites.
CO3	Select suitable fabrication methods for MEMS components.
CO4	Learn the concepts and principles of nano manufacturing methods.
CO5	Illustrate the working principles of RP and select appropriate RP process for the application.
COURSE OUTCOMES	**ADDITIVE MANUFACTURING (OE-3)**
CO1	Understand the principles of prototyping, classification of RP processes and liquid-based RP systems.
CO2	Understand and apply different types of solid-based RP systems.
CO3	Apply powder-based RP systems
CO4	Analyze and apply various rapid tooling techniques.
CO5	Understand different types of data formats and explore the applications of AM processes in various fields.
COURSE OUTCOMES	**OPTIMIZATION TECHNIQUES (OE-4)**
CO1	Understand classification of optimization problem and apply classical optimization techniques
CO2	Apply unconstrained optimization techniques using various methods
CO3	Understand the characteristics and approaches of constrained optimization techniques
CO4	Identify optimized solutions using constrained and unconstrained geometric programming
CO5	Understand integer programming methods
COURSE OUTCOMES	**MECHATRONICS LAB**
CO1	Understand the Characteristics of LVDT
CO2	Measure load, displacement and temperature using analogue and digital sensors.
CO3	Develop PLC programs for control of traffic lights, water level, lifts and conveyor belts.
CO4	Simulate and analyze PID controllers for a physical system using MATLAB
CO5	Develop pneumatic and hydraulic circuits using Automaton studio.