Shivaji University, Kolhapur

Department of Technology

Vision
To be a leader in engineering and technology education, a research centre of global standards to provide valuable resources for industry and society through development of competent technical human resources.
Mission
1. To develop technocrats of national & international stature committed to the task of nation building. 2. To organize teaching learning programs to facilitate the development of competent and committed professionals for practice, research and academics. 3. To undertake collaborative research projects that offer opportunities for consistent interaction with industries.

Name of Programme: B.Tech. (Mechanical Engineering)

B. Tech. Programme in Mechanical Engineering

1. Program Educational Objectives (PEO)

Graduate should:

1. Demonstrate successful professional careers with strong fundamental knowledge in Science, Mathematics, English and Engineering Sciences so as to enable them to analyze the Mechanical Engineering related problems leading to leadership, entrepreneurship or pursuing higher education

2. Acquire technical knowledge in specialized areas of Mechanical Engineering such as Materials, Design, Manufacturing and Thermal Engineering with a focus on research and innovation and gaining

the technical skills in advanced software packages

3. Work with multidisciplinary field of engineering and technology to enlarge the ability among the students to understand the different industrial environments.

4. Continuously learn research and develop with strong professional, moral and ethical values and with a zeal for life-long learning.

2. Program Outcomes (PO)

An engineering graduate of Mechanical Engineering Programme at Department of Technology by the time of graduation will achieve and demonstrate:

a) An ability to apply basic knowledge of science, mathematics and engineering fundamentals in the field of Mechanical Engineering.

b) An ability to identify, formulates, review research literature and analyze mechanical engineering problems using basics principles of science, mathematics and engineering.

c) An ability to design for complex mechanical engineering problems using basic design concepts, analyze and process to meet the desired needs with in realistic constraints such as manufacturability , durability, sustainability and economy with appropriate consideration for the public health, safety, cultural, societal, and environmental considerations.

d) An ability to design and conduct experiments using research-based knowledge and methods including design of experiments, analyze, interpret the data and results with valid conclusion.

e) An ability to apply the modern tools and apply appropriate techniques to synthesize, model, design, analyze, verify and optimize to solve complex mechanical engineering problems within defined specification by using suitable modern tools to satisfy the needs of the society within realistic constraints such as social, economical, political, ethical, health, safety and manufacturing.

f) An ability to understand the impact of mechanical engineering solutions globally, in terms economic, societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g) An ability to understand the principles, commitment and practice to improve product sustainable development globally in mechanical engineering with minimal environmental effect.

h) An ability to understand and apply ethical principles and commitment to address professional ethical responsibilities of an engineer. i) An ability to function efficiently as an individual and as a group member in a team in multidisciplinary activities

j) An ability to communicate, comprehend and present effectively with engineering community and the society at large on complex engineering activities by receiving clear instructions for preparing effective

reports and design documentation.

k) An ability to acquire and demonstrate the knowledge of contemporary issues related to finance and managerial skills to bring up entrepreneurs and entrepreneurship.

l) An ability to recognize and adapt to emerging field of application in engineering and technology by developing self-confidence for continuing education and lifelong learning process.

3. Programme Specific Outcomes (PSO)

The Mechanical Engineering Graduates will be

m) able to function in various domains of Mechanical Engineering related with production engineering, thermal engineering and design engineering and do the analysis and design of basic mechanical system using relevant tools and techniques for applying the knowledge of mechanical engineering for the solution of industry problem.

n) able to model, simulate, analyze and optimize mechanical systems / processes through application of software.

o) acquainted with the platforms, tools, research and development in mechanical engineering.

Class	Sem.	Course Title	Course Objectives	Course Outcomes
FY	I	**ENGINEERING MATHEMATICS – I 67895**	1. To teach Mathematical methodologies and models. 2. To develop mathematical skills and enhance logical thinking power of students. 3. To provide students with skills in matrix, differential calculus , complex numbers & curve fitting which would enable them to devise engineering solutions for given situations they may encounter in their profession. 4. To produce graduates with mathematical knowledge, computational skills and the ability to deploy these skills effectively in the solution of problems, principally in the area of	1. Students in this course will apply the Procedure and methods to solve technical problems. 2. Student can understand how to model real world scenario using Mathematics 3. Students will be able to solve computational problems using Scilab/Matlab

			engineering.	
		ENGINEERING PHYSICS 67896	1 To study the basic concepts of physics and engineering applications of physics. 2 To develop an ability to identify, formulate and solve physics and engineering problems.	1 The student would be able to apply the concepts of physics in various branches of engineering **2** The student would be able to use the techniques, skills, and modern tools necessary for physics and engineering careers
		ENGINEERING MECHANICS 67897	1. To introduce scope of mechanics, concepts and methods of mechanics needed for application in various branches of engineering problems. 2. To learn various branches of mechanics and distinguish between particle and rigid body 3. To develop the logic in such a way that student will able to draw free body diagram in solving in solving mechanics problems. 4. To recognize various types of static as well as dynamic problems. 5. To prepare students for future courses in Mechanics ,structural analysis and Structural Steel Design and Drawing	1. Differentiate between Scalar and Vector Quantities 2. Understand the characteristics of force, system of forces , learn to resolve forces. 3. Understand the moment and couple of forces and effect of moment on rigid body 4. Compute resultant of coplanar concurrent and non-concurrent force system. 5. Distinguish between C.G. and Centroid, Compute moment of inertia of plane figures and composite figures. 6. Understand and analyze beam as a structure and compute support reactions using Lami's theorem & equilibrium Conditions for concurrent, parallel and general force system. 7. Understand Truss as a structural member and analyze plane trusses by the method of joints and sections 8. Understand the concept of dynamic as applied to particle. 9. Introduce & define

				Kinematics of Rigid body ,get idea about translation, rotation, general plane motion 10.To Know principle of work & energy application
		FUNDAMENTALS OF MECHANICAL ENGINEERING 67898	1. Acquire basic knowledge of mechanical engineering. 2. Impart knowledge of basic concepts of thermodynamics applied to industrial application. 3. Understand principle of energy conversion system and power plants. 4. Understand and identify power transmission devices with their functions. 5. Learn and understand manufacturing process. 6. Describe the scope of mechanical engineering in multidisciplinary industries.	
		ELECTRONIC COMPONENTS AND DEVICES 67899	This course aims to equip the students with the basic understanding of electronics components and semiconductor diode. This course also equips students with an ability to understand basics of transducer and relays.	1) To understand the basics of Electronics component. 2) To understand the basics of transducer and connectors. 3)To understand construction , V-I characteristics and application of diode and thyristor 4) To understand the basics of relay and amplifier
	II	**ENGINEERING MATHEMATICS – II 67931**	1. To teach Mathematical methodologies and models. 2. To develop mathematical skills and enhance logical thinking power of students. 3. To provide students with skills in differential equations, integral calculus & complex variable which	1. Students in this course will apply the Procedure and methods to solve technical problems. 2. Student can understand how to model real world scenario using Mathematics 3. Students will be able to

			would enable them to devise engineering solutions for given situations they may encounter in their profession. 4. To produce graduates with mathematical knowledge, computational skills and the ability to deploy these skills effectively in the solution of problems, principally in the area of engineering.	solve computational problems using Scilab/Matlab
		ENGINEERING CHEMISTRY 67906	1. To apply the knowledge of basic science in engineering and technology disciplines 2. To impart technological aspects of modern chemistry 3. To understand the chemistry behind the development of engineering materials. 4. To develop an analytical ability of students.	1. Illustrate the basic parameters of water, different water softening processes and boiler troubles. 2. Describe the preparation and application of various polymers as engineering material. 3. Summarize the classification, properties and application of polymers in domestic and engineering areas. 4. Demonstrate the classification, mechanism and selection of lubricants and their applications. 5. Describe the principle, types and mechanism of corrosion and its control methods. 6. Use instrumental methods for the analysis of material.
		FUNDAMENTALS OF CIVIL ENGINEERING 67907	1. To introduce the necessity and use of civil engineering knowledge allied to other branches. 2. To introduce the fundamental knowledge required for any building construction. 3. To develop the ability of	1. Understand how civil engineering is related to other branches. 2. Find out linear and angular measurements required to prepare a plan or map by using traditional as well as modern instruments.

			reading, understanding plans required for construction. 4. To develop the logic required for carried out field work for surveying. 5. To introduce modern equipment required for surveying.	3. Find out vertical distances, reduced levels and angles by using total station. 4. Calculate area of irregular surface by using Mechanical and Digital Planimeter. 5. Identify building materials required for construction with current market rates. 6. Understand use, necessity of submission and working drawing. 7. Prepare site visit report.
		ENGINEERING GRAPHICS 67908	1. Students should be able to visualize the objects. 2. They should be able to understand and read drawing. 3. They should be able to present the same. 5. Learn to take data and transform it into graphic drawings. 6. Learn basic Auto Cad skills. 7. Prepare the student for future Engineering positions	
		FUNDAMENTALS OF ELECTRICAL ENGINEERING 67909	i) The objective of this course is to provide basic knowledge of Electrical Engineering to the student. ii) To provide knowledge about various electrical machines.	1)To understand relevance and basics of Electrical Engineering 2)To understand different electrical components and the basic Laws of electrical circuits 3) To understand electrical power generation, transmission and distribution system
SY	III	**NUMERICAL METHODS 70214**	1. To introduce various numerical methods for solving algebraic and transcendental equations. 2. To introduce numerical methods for solving partial	At the end of this course, student will be able to 1. To understand need of numerical methods in mechanical engineering 2. Apply numerical

			differential equations. 3. To introduce numerical methods for evaluation of derivatives and definite integrals. 4. To study fundamental tools of statistics	methods for solving problems in different areas of engineering. 3. Deploy skills effectively in the numerical solutions of problem, principally in the area of mechanical engineering. 4. Apply interpolation and approximation for mechanical engineering problems. 5. Use of statistics in Mechanical Engineering.
		ELECTRICAL TECHNOLOGY AND COMPUTER PROGRAMMING C++ **70215**	1. To study speed control methods and starters for DC and AC machine 2. To Study of different power factor correction techniques with their practical importance 3. To introduce the concept of object oriented programming, various elements used and their application in program development 4. To learn and apply concepts of inheritance and overloading with application in program development	At the end of course, student will able 1. To explain different types of electrical motors, their classification and control 2. To measure power factor and correct the power factor 3. To explain the concept of object oriented programming with the use of various elements 4. To write and execute the programs for variety of cases using the concepts of elements, inheritance and overloading.
		ENGINEERING THERMODYNAMICS **70216**	1. To state the First and Second Laws of Thermodynamics to understand the factors affecting the efficiency of thermal system. 2. To explain the thermodynamic properties of pure substances using tables, charts, and ideal gas law and apply them to thermodynamic analysis of a system 3. To learn fundamental	At the end of this course, students will be able to 1. Conceive and relate thermodynamic problems based on their fundamental knowledge and express them in mathematical terms. 2. Analyse a thermodynamic steam cycles and understand them in the working of boilers and condensers 3. Apply knowledge of

			concepts of classical thermodynamics and how to use them for solving realworld thermal systems and engineering problems. 4. To learn various important vapour power cycles such as Rankine and Carnot cycle.	thermodynamics concepts to understand the working heat pumps, refrigerator, entropy etc. 4. Apply knowledge of thermodynamics concepts to solve numerical problems using steam tables.
		MANUFACTURING ENGINEERING – I 70217	1. To study fundamental methods of manufacturing with reference to hot and cold forming. 2. To study various joining methods such as welding, adhesive joining. 3. To study foundry technology fundamentals with conventional and advanced casting methods. 4. To study construction, working and applications of various machine tools.	Student will able to 1. Distinguish between hot and cold working processes on fundamental and application part. 2. Numerically solve the problems on the welding processes. 3. Classify various casting processes and design the gating system for simple objects. 4. Summaries and correlate various machine tool for their applications for manufacturing of any component.
		FLUID MECHANICS 70218	1. To identify various properties of fluids and Pascal's Law. 2. To state and illustrate fundamentals of Fluid Statics, Kinematics and Dynamics. 3. To demonstrate Bernoulli's Equation for various applications. 4. To understand the physics of fluid flow and conversant with Internal, External flows and its applications.	At the end of course student will able to 1. Describe the significance of properties of fluid. 2. Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of mechanical engineering. 3. Estimate the discharge through a pipe or open channel. 4. Solve the practical problems in design of channels, openings.
	IV	**APPLIED MATHEMATICS 70225**	1. To describe solution of LDE and its applications in mechanical engineering. 2. To introduce Partial	At the end of course student will able to 1. Solve Linear Differential Equations and

			Differential Equations and its Applications. 3. To introduce Laplace Transform & Inverse Laplace transform and its Applications. 4. To explain Vector Differentiation and Vector Integration 5. The student must be able to formulate a mathematical model of a real life and engineering	Apply them to realistic problems. 2. Solve Partial Differential Equations for solving problems in Mechanical Engineering fields. 3. Understand Application of Laplace Transform in Mechanical Engineering 4. Apply knowledge of Vector Calculus to solve engineering problems.
		MECHANICS OF MATERIALS 70226	1. Demonstrate knowledge of fundamental concepts and problem solving techniques associated with stress, strain, stress-strain diagram, bulk modulus applied to brittle and ductile materials. 2. Applications involving axial loading, torsion, and bending, including introductory-level statically indeterminate systems. 3. To have understanding of different loading conditions and its graphical representation to model design problem. 4. Accumulate significant practice in solving a variety of application problems in solid mechanics involving concepts of principle stress-strain, deflection of beams and strain energy.	At the end of course student will able to 1. Apply mathematics to obtain analytical solutions to design problems of mechanical components 2. Demonstrate knowledge of fundamental concepts to explain elastic and inelastic behavior, strain energy, and material properties. 3. Apply engineering principles toward solving power transmission problems of shaft, safe design of beams and to find deflection of beams 4. Recognize situations involving ethical considerations (safety through design) and be able to evaluate decisions 5. Compute and analyze stresses induced in mechanical components.
		THEORY OF MACHINES – I 70227	1. To represent kinematic behavior of different machine elements and mechanisms. 2. Study and analyze the problems on balancing of rotary and reciprocating	1. Understand different types of mechanisms and their applications. 2. Analyze kinematic theories of mechanism. 3. Do force analysis of

			masses. 3. Study force analysis of simple mechanisms. 4. Know the basic theory on gears. 5. Analyze the various types of gear trains used for transmission of motion and power. 6. To compare types of Governing mechanisms	mechanisms 4. Indentify the various types of gears. 5. Select a gear drive for practical purpose. 6. Select different governing mechanisms according to application.
		FLUID AND TURBO MACHINERY **70228**	1. To understand impulse momentum principle and its applications 2. To learn the working principles of impulse and reaction water turbines. 3. To illustrate the concept of different types of pumps and compressor. 4. Train the students to acquire the knowledge and skill of analyzing different turbo machines	1. To design and calculate different parameters for turbo machines. 2. To understand thermodynamics and kinematics behind turbo machines. 3. To formulate design criteria. 4. To understand the concept of centrifugal and axial compressors.
		MATERIAL SCIENCE AND METALLURGY **70229**	1. To acquaint students with the basic concepts of Metal Structure 2. To impart fundamental knowledge of Ferrous and Non Ferrous Metal Processing 3. To study applications of different Metals and Alloys 4. To Know Fundamentals of Metallography 5. To develop futuristic insight into Metals	At the end of this course, student will be able to 1. Understand basic concept of metal structure. 2. Understand fundamental knowledge of Ferrous and Non Ferrous Metal. 3. Selection of Metals and Alloys for different application. 4. Understand need of Heat treatment and various heat treatment processes.
TY	V	**MACHINE DESIGN - I** **70840**	1. To understand fundamental aspects of design. 2. To study design procedures of different mechanical components.	1. Formulate the problem by identifying customer need and convert into design specification. 2. Design of components like shaft, key, coupling,

			3. To understand stresses and strain induced in the component. 4. Study of component behavior and failure criteria"s of different mechanical components subjected to loads.	spring, power screw, Knuckle joint, Cotter joint and turn buckleetc. 3. Analyze the stresses and strain induced in the component. 4. Understand component behavior subjected to loads and identify failure criteria.
		THEORY OF MACHINES - II 70841	1. Study and identify type of belt and rope drive for a particular application 2. Analyze cam geometry and select appropriate cam 3. Study clutches, brake and dynamometer 4. Study gyroscopic effects in ships, aero planes, and road vehicles. 5. Study Understand free and forced vibrations of single degree freedom systems	1. Identify and select type of belt and rope drive for a particular application 2. Evaluate cam geometry and select appropriate cam 3. Define clutches, brake and dynamometer and suggest an appropriate use. 4. Characterize balancing as per application requirement. 5. Understand gyroscopic effects in ships, aero planes, and road vehicles. 6. Understand free and forced vibrations of single degree freedom systems
		ENERGY ENGINEERING 70842	1. Identify the present status of energy scenario. 2. Acquire the knowledge of renewable sources of energy and utilization. 3. Explaining the basic concept of solar radiation 4. Understand the new trends in energy sectors.	1. Identify renewable energy sources and their utilization. 2. Describe the components of a wind turbine and their functions 3. Explain the concepts and applications of fuel cell, bio gas plant, Tidal energy, etc. 4. Interpreting the solar radiation geometry and determine sun position and angles. 5. Analyze the present energy scenario.
		MANUFACTURING ENGINEERING – II 70843	1. Study of metal cutting technology including the process, measurements,	1. understand the metal cutting action with single point cutting tool and

			design and selection of various cutting tools. 2. Introduce the students to design practices of toolings (Jigs and Fixtures) and die design for presswork. 3. Introduce the students to various non conventional machining processes. . 4. Introduce to advanced manufacturing.	demonstrate cutting tool geometry 2. design jigs and fixtures for simple components 3. design press tool die for simple components. 4. justify the need of various non conventional machining processes
		HEAT AND MASS TRANSFER 70844	1. To introduce the various mechanisms of heat and mass transfer that characterizes a given physical system. 2. To make the students familiarize conservation equations along with models for heat transfer processes. 3. To prepare the students for analysis of one-dimensional steady and unsteady partial differential equations. 4. To train the students to develop representative models of real-life heat transfer processes and systems.	1. Demonstrate the basic laws of heat and mass transfer and compute the transfer rate. 2. Analyse problem involving steady and transient state heat transfer. 3. Asses the heat exchanger performance by using the LMTD and NTU.
	VI	**MACHINE DESIGN – II 70851**	1. To study design against fluctuating load. 2. To study bearing selection procedure. 3. To study design procedure of spur gear, helical gear, bevel gear, worm and worm wheel. 4. To understand tribological considerations of bearing design.	1. Design of component for finite life and infinite life when subjected to fluctuating load. 2. Select bearings for a given applications from the manufacturers catalogue. 3. Design of elements like spur gears, helical gears, bevel gear, worm and worm wheel. 4. To study methods of lubrication and mounting of bearing.
		CONTROL ENGINEERING 70852	1. Study the control system, its type and applications. 2. Prepare mathematical	1. Understand control system, its type and applications.

			model of physical systems. 3. Study concept of system stability and system response. 4. Study various control actions.	2. Understand model of physical simple systems. 3. Determine system stability and system response. 4. Understand various control actions.
		INTERNAL COMBUSTION ENGINES 70853	1. Understand basics of thermodynamic cycles of I. C. engines 2. Study constructional details, nomenclature and classification of internal combustion engine 3. Understand fuel properties, alternative fuels, combustion phenomenon in S. I. engine and C. I. engines 4. Impart knowledge about various I. C. engines systems 5. Impart knowledge of engine testing and performance analysis	1. Analysis of Engine cycles and comparison between various engines. 2. Understand combustion process of SI and CI Engines. 3. Measure operating characteristics and Analyze engine performance parameters such as torque, brake power, mechanical efficiency, thermal efficiency and specific fuel consumption. 4. Demonstrate and compare engine systems 5. Demonstrate knowledge about the engine pollutants, its measurements, control system and emission norms
		METROLOGY AND QUALITY CONTROL 70854	1. To identify techniques to minimize errors in measurement. 2. Study method and devices for measurement of length, angle and gear and thread parameters, surface roughness and geometric features of parts. 3. Analyze and choose limits of plug and ring gauges 4. Study methods of measurement in modern machineries 5. Study quality control	1. Identify techniques to minimize the errors in measurement 2. Identify methods and devices for measurement of length, angle, and gear and thread parameters, surface roughness and geometric features of parts. 3. Choose limits for plug and ring gauges. 4. Explain methods of measurement in modern machineries 5. Select quality control

			techniques and its application 6. Study quality control charts and Statistical tools	techniques and its applications 6. Plot quality control charts and suggest measures to improve the quality of product and reduce cost using Statistical tools
		INDUSTRIAL ENGINEERING AND MANAGEMENT 70855	1. To acquaint students with the basic concepts of industrial engineering 2. To impart fundamental knowledge of productivity and its improvement 3. To impart understanding of work study 4. To impart understanding for applying various techniques involved in industrial engineering	1. apply the basic concept and importance of industrial engineering. 2. devise various ways of productivity improvement in given domain. 3. solve case studies on plant location and plant layout 4. perform motion study and work measurement.
Final Year	VII	**REFRIGERATION AND AIR CONDITIONING 74154**	1. Study the fundamental principles, applications of refrigeration cycles and psychrometry. 2. Analyze the vapour compression cycle and interpret the usage of refrigerants. 3. Performance evaluation of Refrigeration and Air Conditioning Systems. 4. Demonstrate the use of psychrometry and calculate cooling load for air conditioning systems used for various applications. 5. Enable the students to analyze and solve refrigeration related problems by applying principles of mathematics, science and engineering	1. Explain fundamentals, need and importance of HVAC systems. 2. Apply knowledge for various applications of refrigeration, air conditioning and cryogenics. 3. Analyze psychrometric terms its application in HVAC, comfort conditions and Design of refrigeration and air conditioning system. 4. Solve problems of heat transfer in buildings and its application to heating and cooling load estimation. 5. Explain duct design system , air-distribution system

				and commercial
				6. Applications of refrigeration and air conditioning system.
		MACHINE DESIGN III **74155**	1. Study the concept of aesthetics, ergonomics, innovation and creativity considerations in product design 2. Study design of various mechanical systems such as pressure vessel, brakes, clutches, machine tool gear box, I.C. Engine. 3. Study the concepts of optimization of mechanical systems /elements. 4. Study and apply various IS Codes, Design data books, Handbooks required for system design.	1. Incorporate aesthetic, ergonomic, innovation and creativity considerations in industrial product design. 2. Design different systems such as Pressure vessel, Brakes, Clutches, Machine tool Gear box and I. C. Engine. 3. Optimize design of various components/systems in mechanical engineering 4. Use IS Codes, Design data books, Handbooks required for system design.
		HYDRAULICS AND PNEUMATICS **74156**	1. Introduce industrial hydraulics and pneumatics their elements, function and their structure. 2. Apply physical laws and principles that governs the behavior of fluid power systems 3. Study different ISO/JIC symbol used in hydraulic and pneumatic system. 4. Explain various hydraulic and pneumatic circuit. 5. Explain troubleshooting caused in hydraulic	1. Identify, understand and select various components used in hydraulics system. 2. Develop efficient hydraulic circuits with their application. 3. Identify troubleshooting of fluid power system and suggest suitable remedial actions to correct it. 4. Explain fluidics and their application.

			and pneumatic system and general safety rule in fluid power system. 6. Identify application of hydraulic and pneumatic in various industries.	
		MANUFACTURING ENGINEERING III 74157	1. Study and develop integrated approach to improve the material handling system. 2. Identify and solve economical problems of machine tools by using analytical techniques involving comparison, selection and alternatives. 3. Study the cost accounting principles and techniques. 4. Understand the role and functions of ERP in carrying out business processes in an industry. 5. Study and utilize project management concepts, tools and techniques. 6. Study the modern approaches in the field of maintenance and reliability.	Illustrate and develop techniques to improve the material handling system. 2. Analyze and solve economical problems of machine tools using analytical techniques. 3. Illustrate various approaches and techniques for developing new products and forecasting. 4. Understand the role and functions of ERP in an industry. 5. Study and utilize the concept and techniques of project management, maintenance and reliability.
		Elective 1: **FINITE ELEMENT METHOD**	1. Understand the philosophy and general procedure of Finite Element Method as applied to solid mechanics and thermal analysis problems. 2. Develop the Finite element model for 1D, 2D and 3D problem. 3. Formulate and solve basic problem in Heat transfer, solid mechanics	1. Explain the fundamental concepts, equations of equilibrium, Stress-strain relations and the principle of potential energy and approximations of differentials equations. 2. Analyze mathematical model for solution of common engineering

			and fluid mechanics. 4. Provides some experience with a commercial FEM software packages.	problems by formulating into finite element. 3. Determine the element matrix equation by different methods by applying basic laws in mechanics and integration by parts. 4. Make use of commercial finite element analysis software to solve complex problems in solid mechanics and heat transfer
		ELECTIVE I: CRYOGENICS	1. Provide the information of fundamental concepts of cryogenics, and its importance and applications. 2. Articulate the gas liquefaction and Cryo cooler system. 3. Explore the gas separation, purification system and measurements it's of low temperature application. 4. Develop the Cryogenic fluid storage and components of transfer system.	1. Illustrate the applications and importance of Cryogenics. 2. Describe the gas liquefaction systems, and classify the Cryo-coolers. 3. Articulate Gas Separation, Purification and Low Temperature applications measurement systems. 4. Summarize Cryogenic Fluid Storage and Transfer Systems.
		ELECTIVE I: OPERATION RESEARCH 74160	1. To understand operation research principals. 2. To study the transportation and assignment model for industrial applications. 3. To understand Fundamentals of PERT/CPM Model. 4. Study of sequencing, replacement model, inventory model, decision	1. Formulate the problem by using operation research principals. 2. Evaluate problems of transportation and assignment model. 3. Analyze PERT/CPM models 4. Formulate and Analyze problems regarding sequencing, replacement model,

			theory and network analysis of industrial applications.	inventory model, decision theory and network analysis of industrial applications
		ELECTIVE I: TRIBOLOGY	1. Provide the knowledge and importance of Tribology in Design, friction, wear and lubrication aspects of machine components. 2. Identify the friction and wear characteristic of machine component and its lubrication. 3. Understand the principles of lubrication, lubrication regimes, theories of hydrodynamic and the advanced lubrication techniques. 4. Utilize the surface engineering techniques to improve the functionality of machine components.	1. Illustrate the importance of Tribology in Industry. 2. Analyze the basic concepts of Friction, Wear, Lubrications and their measurements 3. Apply the principles of lubrication and theories of hydrodynamic in machine components. 4. Make use of surface engineering techniques in machine components.
		ELECTIVE I: PRODUCTION MANAGEMENT	1. Understand basic aspects of Production Management. 2. Study various important planning, organizing and controlling aspects of Operations management. 3. Study efficient product design and development. 4. Study loading, scheduling and sequencing of machines for building capacity and aggregate planning. 5. Study management concepts like JIT, Lean manufacturing, Total productive maintenance, inventory management etc. for properly managing the production.	1. The students will have fair understanding of the role of Production / Operations Management played in business processes. 2. Streamline the production removing all the hindrances in its way by applying management techniques like JIT, TPM and inventory management etc. 3. Properly use capital, machine, inventory, tools and equipments to increase profit margin.

FINAL YEAR	VIII	AUTOMOBILE ENGINEERING 74272	1. Study and understand various components, sub assemblies and assembly of an automobile. 2. Study the design of various automobile systems. 3. Study and diagnose the effects of various factors on subassemblies of an automobile. 4. Evaluate the performance of an automobile.	1. Implement the knowledge obtained in theory towards design procedure of various automobile systems 2. Understand components and layout of automobile 3. Analyze the effect of various factors on subsystems of automobile and remedies can be proposed 4. Evaluate the performance of automobile
		POWER PLANT ENGINEERING 74273	1. Understand the different power generation methods, its economics and global energy situation 2. Familiarize with Equipment, Plant layout, principle of working of various Steam turbine, gas turbine and diesel power plants. 3. Interpret the working principles of various nuclear reactors. 4. Understand the types and capacity calculation of Hydroelectric Power Plant. 5. Understand Non-Convectional Power Plants and its commercialization. 6. Understand Economic analysis and environmental impact of Power Plants.	1. Explain the energy resources and energy systems available for the production of electric power in the India and the world. 2. Explain construction and working of steam power plants, Gas turbine power plant, Diesel power plant. 3. Explain the basic principles of nuclear power plants, 4. Explain hydroelectric power plant, major types of Non-conventional power plants and estimate power generation potential. 5. Discuss economic analysis and the environmental impact of electric power production on air quality, climate

				change, water, and land.
		MECHATRONICS AND ROBOTICS 74274	1. Understand the various components of Mechatronics and Robotics system and sensors used in industrial application 2. Study the various signal conditioning process and its components 3. Understand the difference between the microprocessor and microcontroller 4. Study the functions of PLC programming and its applications. 5. Study the fundamentals of robotics.	1. Design and evaluate a Mechatronics and Robotics system based upon various sensors for industrial application. 2. Analyze the signals using signal conditioning process. 3. Implement the microprocessor or micro controller based upon the application 4. Evaluate the functions of PLC programming and its application. 5. Design a robotic system using the fundamental knowledge.
		TOTAL QUALITY MANAGEMENT 74275	1. Know the concept of Total Quality and role of Quality assurance. 2. Understand planning and controlling techniques for quality. 3. Understand the product and system reliability and Taguchi's Quality Philosophy. 4. Study principles and Approaches to TQM implementation. 5. Understand Essentials, tools and techniques of TQM. 6. Study TQM in service sector and ISO Standard series for TQM.	1. Identify and solve the quality related problems in manufacturing or service sector at various stages by using various TQM tools and techniques. 2. Apply Taguchi's Philosophy to reduce defects in process and product and maintain good Quality. 3. Train and bring awareness to the people working in manufacturing and service sector for implementation of TQM. 4. Successfully implement TQM and can save time, money, reduce scrap and

				produce quality product and service to satisfy customers.
		ELECTIVE II: COMPUTATIONAL FLUID DYNAMICS	1. Understand basic concept of thermodynamics law, energy equation and continuity equation. 2. To analyze the different numerical techniques used in CFD. 3. To develop skills in the analysis of fluid systems for lifelong learning	1. Explain the basic concept of thermodynamics law, energy equation and continuity equation. 2. Apply basic knowledge of one Dimensional Isentropic Flow: Adiabatic flow and reference speed to solve the problems. 3. Explain the basic concepts of normal shock and its relations. 4. Numerically solve the governing equations for fluid flow. 5. To analyze the different numerical techniques used in CFD.
		ELECTIVE II: VIBRATION AND NOISE	1. Understand the basics of vibrations in the body. 2. Analyze the vibration phenomenon, control of vibration in machine parts and balancing. 3. Understand the basic terminology of noise, its effect and control.	1. Describe the basic concept of vibration. 2. Explain free and forced vibration in single DOF and multi DOF system. 3. Explain different vibration measuring instrument. 4. Solve the numerical to determine various parameters of vibration such as amplitude, transmissibility, transmission force etc. 5. Determine natural frequency of mechanical vibrating system/element. 6. Explain the basic concept of sound, noise effects, rating and

				regulation of noise.
		ELECTIVE II: NANO TECHNOLOGY 74278	1. Understand the fundamentals of Nanotechnology. 2. Study various synthesis and characterization techniques involved in Nanotechnology. 3. Understand different classes of nanomaterials. 4. To provide an overview about the wide applications of nanotechnology in various technological fields. 5. To introduce students to inter-disciplinary science and engineering	1. Understand the fundamentals of nanotechnology 2. Understand various synthesis methods of nanomaterial. 3. Comprehend characterization techniques involved in nanotechnology 4. Recognize different classes of Nanomaterial 5. Identify application of nanotechnology in various technological fields
		ELECTIVE II: MACHINE TOOL DESIGN	1. Study design for drives based on power requirement. 2. Understand design procedure for machine tool structure, guide ways and slide ways. 3. Understand design of spindles, spindle supports and power screws. 4. Analyze the dynamics of machine tool. 5. Understand special features in machine tool.	1. Design the drives based on power requirement. 2. Design and analyze machine tool structure, guide ways and slide ways 3. Design spindles, spindle supports and power screws. 4. Study the dynamic characteristics of the machine tool. 5. Perform design and analyze consideration for CNC, SPM and micro-machining.
		ELECTIVE II: FLEXIBLE MANUFACTURING SYSTEM	1. Understand the basic concepts in flexible manufacturing system. 2. Design control structure, jig and fixtures for components. 3. Implement the database management system, material handling system in plant.	1. Explain the basic concepts of flexible manufacturing such as types, components, task selection in FMS. 2. Illustrate with example architecture of flexible manufacturing system. 3. Design the appropriate jig and fixture for

			4. Use various simulation softwares in FMS.	given components. 4. Apply the knowledge of database management system and material handling system to solve real life problems. 5. Use analysis and simulation software like ARENA, FLEXSIM.