



**ALL INDIA SHRI SHIVAJI MEMORIAL SOCIETY'S
COLLEGE OF ENGINEERING, PUNE - 1
Department of Mechanical Engineering
2.6.1 course outcomes**



S E MECHANICAL (2015 PATTERN)

YEAR	COURSE CODE	COURSE NAME	COURSE OUTCOMES
S E [SEMESTER -III, TERM-I]	207002	Engineering Mathematics-III	1. Solve higher order linear differential equations and apply to modeling and analyzing mass spring systems
			2. Apply Laplace transform and Fourier transform techniques to solve differential equations involved in Vibration theory, Heat transfer and related engineering applications
			3. Apply statistical methods like correlation, regression analysis in analyzing, interpreting experimental data and probability theory in testing and quality control
			4. Perform vector differentiation and integration, analyze the vector fields and apply to fluid flow problems.
			5. Solve various partial differential equations such as wave equation, one and two dimensional heat flow equations
	202041	Manufacturing Processes I	1. Understand and analyze foundry practices like pattern making, mold making, Core making and Inspection of defects
			2. Understand and analyze Hot and Cold Working, Rolling, Forging, Extrusion and Drawing Processes
			3. Understand different plastic molding processes, Extrusion of Plastic and Thermoforming
			4. Understand different Welding and joining processes and its defects
			5. Understand, Design and Analyze different sheet metal working processes
			6. Understand the constructional details and Working of Centre Lathe
	202042	Computer Aided Machine Drawing	1. Understand the importance of CAD in the light of allied technologies such as CAM, CAE, FEA, CFD, PLM
			2. Understand the significance of parametric technology and its application in 2D sketching
			3. Understand the significance of parametric feature-based modeling and its application in 3D machine components modeling

		4. Ability to create 3D assemblies that represent static or dynamic Mechanical Systems
		5. Ability to ensure manufacturability and proper assembly of components and assemblies
		6. Ability to communicate between Design and Manufacturing using 2D drawings
202043	Thermodynamics	1. Apply various laws of thermodynamics to various processes and real systems
		2. Apply the concept of Entropy, Calculate heat, work and other important thermodynamic properties for various ideal gas processes
		3. Estimate performance of various Thermodynamic gas power cycles and gas refrigeration cycle and availability in each case.
		4. Estimate the condition of steam and performance of vapour power cycle and vapour compression cycle
		5. Estimate Stoichiometric air required for combustion, performance of steam generators and natural draught requirements in boiler plants
		6. Use Psychrometric charts and estimate various essential properties related to Psychrometry and processes
202044	Material Science	1. Understand the basic concepts and properties of Material
		2. Understand about material fundamental and processing
		3. Select proper metal, alloys, nonmetal and powder metallurgical component for specific requirementDetect the defects in crystal and its effect on crystal properties.
		4. Detect the defects in crystal and its effect on crystal properties.
		5. Evaluate the different properties of material by studying different test
		6. Recognize how metals can be strengthened by cold-working and hot working
202051	Strength Of Materials	1. Apply knowledge of mathematics, science for engineering applications
		2. Design and conduct experiments, as well as to analyze and interpret data
		3. Design a component to meet desired needs within realistic constraints of health and safety
		4. Identify, formulate, and solve engineering problems
		5. Practice professional and ethical responsibility
		6. Use the techniques, skills, and modern engineering tools necessary for engineering practice
202055	Audit Course (Value Education)	1. Understood human values, their significance and role in life.
		2. Promote self-reflection and critical inquiry that foster critical thinking of one's value and the values of others

S E [SEMESTER –IV, TERM-II]			3. Practice respect for human rights and democratic principles.
			4. Familiarized with various living and non-living organisms and their interaction with environment.
			5. Understood the basics regarding the leadership and to become a conscious professional
	202045	Fluid Mechanics	1. To understand of various properties of fluids
			2. To learn fluid statics and dynamics.
			3. To understand of Boundary layer, Drag, and Lift
			4. To understand of Bernoulli's equation
			5. To Know of various applications of Bernoulli's equation
			6. Identify, formulate and solve engineering problems
	202047	Soft Skills	1. Improved communication, interaction and presentation of ideas.
			2. Right attitudinal and behavioural change
			3. Developed right-attitudinal and behavioral change
	202048	Theory Of Machine I	1. Identify mechanisms in real life applications.
			2. Perform kinematic analysis of simple mechanisms.
			3. Perform static and dynamic force analysis of slider crank mechanism.
			4. Determine moment of inertia of rigid bodies experimentally.
			5. Analyze velocity and acceleration of mechanisms by vector and graphical methods.
			6. Analyze velocity and acceleration of mechanisms involving Coriolis component of acceleration.
	202049	Engineering Metallurgy	1. To acquaint students with the basic concepts of metallurgy
			2. To Know Fundamentals of Metallography .
			3. To impart a fundamental knowledge of Ferrous Material , and their Alloys
			4. To Know Fundamentals of heat treatment and its use
			5. To acquaint alloys steels and designation
			6. To understand application of non ferrous metals
	202050	Applied Thermodynamics	1. Classify various types of Engines, Compare Air standard, Fuel Air and Actual cycles and make out various losses in real cycles.
			2. Understand Theory of Carburetion, Modern Carburetor, Stages of Combustion in S. I. Engines and Theory of Detonation, Pre-ignition and factors affecting detonation.

		3. Understand Fuel Supply system, Types of Injectors and Injection Pumps, Stages of Combustion in CI Engines, Theory of Detonation in CI Engines and Comparison of SI and CI Combustion and Knocking and Factors affecting, Criteria for good combustion chamber and types. 4. Carry out Testing of I. C. Engines and analyze its performance. 5. Describe construction and working of various I. C. Engine systems (Cooling, Lubrication, Ignition, Governing, and Starting) also various harmful gases emitted from exhaust and different devices to control pollution and emission norms for pollution control. 6. Describe construction, working of various types of reciprocating and rotary compressors with performance calculations of positive displacement compressors
203152	Electrical & Electronics Engineering	1. Develop the capability to identify and select suitable DC motor / induction motor / special purpose motor and its speed control method for given industrial application. 2. Program Arduino IDE using conditional statements 3. Interfacing sensors with Arduino IDE

S E MECHANICAL SANDWICH (2015 PATTERN)

YEAR	COUR	COURSE NAME	COURSE OUTCOMES
S E [SEMESTER -III, TERM-I]	207002	Engineering Mathematics-III	1. Solve higher order linear differential equations and apply to modeling and analyzing mass spring systems
			2. Apply Laplace transform and Fourier transform techniques to solve differential equations involved in Vibration theory, Heat transfer and related engineering applications
			3. Apply statistical methods like correlation, regression analysis in analyzing, interpreting experimental data and probability theory in testing and quality control
			4. Perform vector differentiation and integration, analyze the vector fields and apply to fluid flow problems.
			5. Solve various partial differential equations such as wave equation, one and two dimensional heat flow equations
	202043	Thermodynamics	1. Apply various laws of thermodynamics to various processes and real systems 2. Apply the concept of Entropy, Calculate heat, work and other important thermodynamic properties for various ideal gas processes 3. Estimate performance of various Thermodynamic gas power cycles and gas refrigeration cycle and availability in each case.

		4. Estimate the condition of steam and performance of vapour power cycle and vapour compression cycle 5. Estimate Stoichiometric air required for combustion, performance of steam generators and natural draught requirements in boiler plants 6. Use Psychrometric charts and estimate various essential properties related to Psychrometry and processes
202051	Strength Of Materials	1. Apply knowledge of mathematics, science for engineering applications 2. Design and conduct experiments, as well as to analyze and interpret data 3. Design a component to meet desired needs within realistic constraints of health and safety 4. Identify, formulate, and solve engineering problems 5. Practice professional and ethical responsibility 6. Use the techniques, skills, and modern engineering tools necessary for engineering practice
202061	Material Science & Metallurgy	1. To acquaint students with the basic concepts and properties of Material Science 2. To impart the knowledge on mechanical behavior of materials 3. Selection and application of different Metals & Alloy 4. To Know Fundamentals of heat treatment 5. To acquaint students with Powder metallurgy and Nonferrous material 6. To apply knowledge for selection of material, Polymer, Ceramics
202062	Fluid Mechanics & Machinery	1. Use of various properties in solving the problems in fluids 2. Use of Bernoulli's equation for solutions in fluids 3. Determination head lost due to friction in pipes and between two parallel fixed plates. 4. Apply momentum principle and velocity triangle on various turbine like Pelton wheel for its analysis 5. Apply momentum principle and velocity triangle on various turbine like reaction turbine for its analysis 6. Apply momentum principle and velocity triangle concept of centrifugal pump for its analysis
202055	Audit Course (Value Education)	1. Understood human values, their significance and role in life. 2. Promote self-reflection and critical inquiry that foster critical thinking of one's value and the values of others 3. Practice respect for human rights and democratic principles. 4. Familiarized with various living and non-living organisms and their interaction with environment.

S E [SEMESTER –IV, TERM-II]	202063	Thermal Engineering	5. Understood the basics regarding the leadership and to become a conscious professional
			1. Understand different types of compressors and estimate isothermal and volumetric efficiency
			2. Aware of all refrigeration systems ,refrigerants ,P-h diagram and can estimate COP .
			3. To know gas turbines and jet propulsion systems and thermal efficiency of gas turbine.
			4. Aware of all IC engine systems their importance and methods of boosting performance of engine
			5. Able to test the engine and finding different performance parameters
	202064	Metrology & Quality Control	6. To know normal and abnormal combustion in SI and CI engine and different emission and control
			1. Apply knowledge of various manufacturing process.
			2. Understand Various machine tools & their application process parameter & their effect on process
			3. Design and analyze various manufacturing process and tooling
			4. Figure out application of modernization in machining
			5. Get knowledge of advanced machining processes
	202065	Manufacturing Engineering	6. Get knowledge of jigs and fixtures so as to utilize machine capability for variety of operation
			1. describe various casting methods and suggest appropriate method pertaining to the application
			2. understand basics of metal forming processes, selection of equipments and tooling
			3. classify, describe and configure the principles of various welding techniques
			4. describe with illustration mechanism of chip formation, differentiate between oblique and orthogonal cutting, estimate cutting forces in metal cutting
			5. demonstrate and configure the functions of milling, drilling and grinding machines and estimate machining time for various metal cutting operations
	202066	Computer Aided Machine Drawing	6. identify characteristics of non-conventional machining processes, describe basic mechanisms and list-out applications
			1. Understand the importance of CAD in the light of allied technologies such as CAM, CAE,FEA, CFD, PLM.
			2. Understand the significance of parametric technology and its application in 2D sketching.
			3. Understand the significance of parametric feature-based modeling and its application in 3D machine components modeling.
			4. Ability to create 3D assemblies that represent static or dynamic Mechanical Systems.
			5. Ability to ensure manufacturability and proper assembly of components and assemblies.
			6. Ability to communicate between Design and Manufacturing using 2D drawings.

	202067	Soft Skills	1. Improved communication, interaction and presentation of ideas.
			2. Right attitudinal and behavioural change
			3. Developed right-attitudinal and behavioral change
	202068	Theory Of Machines	1. Identify mechanisms in real life applications.
			2. Perform kinematic analysis of simple mechanisms.
			3. Perform static and dynamic force analysis of slider crank mechanism.
			4. Determine moment of inertia of rigid bodies experimentally.
			5. Analyze velocity and acceleration of mechanisms by vector and graphical methods.
	203152	Electrial & Electronics Engineering	1. Develop the capability to identify and select suitable DC motor / induction motor / special purpose motor and its speed control method for given industrial application.
			2. Program Arduino IDE using conditional statements
			3. Interfacing sensors with Arduino IDE

T E MECHANICAL (2012 PATTERN)

YEAR	COUR	COURSE NAME	COURSE OUTCOMES
T E [SEMESTER -V, TERM-I]	302041	Design Of Machine Elements I	1. Ability to analyze the stress and strain of mechanical components and understand, identify and quantify failure modes for mechanical part.
			2. Ability to decide optimum design parameters for mechanical systems.
			3. Enhancement in proficiency of CAD software for designing Mechanical systems and to generate production drawing.
			4. Ability to design mechanical system for fluctuating loads.
	302042	Heat Transfer	1. Formulate basic equations for heat transfer problems
			2. Apply heat transfer principles to design and evaluate performance of thermal systems
			3. Calculate the effectiveness and rating of heat exchangers
			4. Calculate heat transfer by radiation between objects with simple geometries
			5. Calculate and evaluate the impact of boundary conditions on the solutions of heat transfer
			6. Evaluate the relative contributions of different modes of heat transfer
	302043	Theory Of Machines II	1. The students will understand the gear theory which will be the prerequisite for gear design.
			2. The student will understand torque transmitting capacity in gear trains which will be the prerequisite for gear box design.
			3. The student will conversant with working principle of control mechanism.

			4. The student will understand design of mechanism and cam profile.
	302044	Metrology & Quality Control	1. apply knowledge of various tools and techniques used to determine geometry and dimensions of components in engineering applications
			2. design gauges to meet desired needs within realistic constrain and measure surface roughness
			3. measure various parameters in Thread and gears
			4. understand Quality control tools and techniques applicable to engineering industry
			5. conduct process capability study
			6. understand concept of Total Quality Management
	302045	Hydraulic & Pneumatics	1. Working principle of various components used for hydraulic & pneumatic systems.
			2. Identify various components of hydraulic & pneumatic systems.
			3. Ability to select appropriate components required for hydraulic and pneumatic systems.
			4. Ability to design hydraulic and pneumatic system for industrial applications.
			5. Ability to understand industrial applications of hydraulic and pneumatic system.
			6. Troubleshooting of hydraulic & pneumatic circuits
T E [SEMESTER –VI, TERM-II]	302047	Numerical Methods & Optimization	1. Solve an algebraic or transcendental equation using an appropriate numerical method
			2. Apply numerical methods to obtain approximate solutions to mathematical problems
			3. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
			4. Analyze and evaluate the accuracy of common numerical methods.
			5. Write efficient, well-documented Matlab code and present numerical results in an informative way.
			6. Implement numerical methods in Matlab
	302048	Design Of Machine Elements II	1. To apply the knowledge and fundamental concept for designing a spur gear.
			2. To apply the knowledge and fundamental concept for designing a Helical and Bevel gear.
			3. To apply the knowledge and fundamental concept for designing a Rolling Contact Bearing.
			4. To apply the knowledge and fundamental concept for designing a Worm gear.
			5. To apply the knowledge and fundamental concept for designing a Belt, Chain and Rope Drives.
			6. To apply the knowledge and fundamental concept for designing a Slider Contact Bearing.
	302049	Turbo Machines	1. Apply momentum principle and velocity triangle on various turbine like Pelton wheel for its analysis
			2. Apply momentum principle and velocity triangle on various turbine like reaction turbine for its analysis
			3. Apply momentum principle and velocity triangle on steam turbines for its analysis

		4. apply momentum principle and velocity triangle concept of centrifugal pump for its analysis
		5. Apply thermodynamic concept using T S diagram and used of velocity triangle on centrifugal compressor for its analysis
		6. Apply thermodynamic concept using T S diagram and used of velocity triangle on axial compressor for its analysis
302050	Mechatronics	1 Identification of key elements of mechatronics system and its representation in terms of block diagram
		2 Understanding the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O
		3 Interfacing of Sensors, Actuators using appropriate DAQ micro-controller
		4 Time and Frequency domain analysis of system model (for control application)
		5 PID control implementation on real time systems
		6. Development of PLC ladder programming and implementation of real life system
302051	Manufacturing Process II	1. Apply knowledge of various manufacturing process.
		2. Understand Various machine tools & their application process parameter & their effect on process
		3. Design and analyze various manufacturing process and tooling
		4. Figure out application of modernization in machining
		5. Get knowledge of advanced machining processes
		6. Get knowledge of jigs and fixtures so as to utilize machine capability for variety of operation

T E MECHANICAL SANDWICH (2012 PATTERN)

YEAR	COUR	COURSE NAME	COURSE OUTCOMES
T E [SEMESTER -V, TERM-I]	302061	Numerical Methods & Computational Techniques	1. Understand the concept of roots of equation and numerical integration ,matlab Programme
			2. Understand the concept of Interpolation and matlab programming
			3. Understand the concept to solve simultaneous equation using matlab and numerical method
			4. Understand the concept of errors and approximation and curve fitting techniques
			5. Understand the concept to solve Ordinary differential equation using matlab and numerical method
			6. Understand the concept to solve partial differential equation using matlab and numerical method
	302042	Heat Transfer	1. Formulate basic equations for heat transfer problems
			2. Apply heat transfer principles to design and evaluate performance of thermal systems
			3. Calculate the effectiveness and rating of heat exchangers
			4. Calculate heat transfer by radiation between objects with simple geometries
			5. Calculate and evaluate the impact of boundary conditions on the solutions of heat transfer

		6. Evaluate the relative contributions of different modes of heat transfer
302050	Mechatronics	1 Identification of key elements of mechatronics system and its representation in terms of block diagram
		2 Understanding the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O
		3 Interfacing of Sensors, Actuators using appropriate DAQ micro-controller
		4 Time and Frequency domain analysis of system model (for control application)
		5 PID control implementation on real time systems
		6. Development of PLC ladder programming and implementation of real life system
302043	Theory Of Machine II	1. The students will understand the gear theory which will be the prerequisite for gear design.
		2. The student will understand torque transmitting capacity in gear trains which will be the prerequisite for gear box design.
		3. The student will conversant with working principle of control mechanism.
		4. The student will understand design of mechanism and cam profile.
302062	Machine Design	1. Design shafts, keys and couplings
		2. Design mechanical components under fluctuating loads for finite and infinite life
		3. Design springs, power screws and welded joints
		4. Design spur and helical gear drives, rope belt and chain drives
		5. Select standard rolling contact bearings from manufacturer's catalogue
		6. Select standard machine parts from design data and generate drawing of mechanical systems using CAD software with proficiency.

B E MECHANICAL (2012 PATTERN)

YEAR	COUR	COURSE NAME	COURSE OUTCOMES
B E [SEMESTER –VII, TERM-I]	402041	Refrigeration and Air Conditioning	1. Illustrate the fundamental principles and applications of refrigeration and air conditioning system
			2. Obtain cooling capacity and coefficient of performance of vapor compression refrigeration system
			3. Present the properties, applications and environmental issues of different refrigerants
			4. Calculate cooling load for air conditioning systems used for various applications
			5. Operate and analyze the refrigeration and air conditioning systems
			6. Analyse pressure drop and design air distribution system
	402042	CAD/ CAM Automation	1. Ability to solve problem on geometric transformation, analytically and also using MATLAB
			2. Ability to develop parametric equation of analytic and synthetic curves, surface and solids.
			3. Analyze and design real world components, analytical and using FEM software.

		4. Ability to generate Tool path for manufacturing process for CNC m/c manually and using CAM software.
		5. Ability to design different types of robot gripper.
		6. Understand the working principle of rapid prototyping methods and can select suitable advanced manufacturing method for complex components.
402043	Dynamics of Machinery	1. Solutions to balancing problems of machines
		2. Ability to understand the fundamentals of vibration and Noise
		3. Ability to develop analytical competency in solving vibration problems.
		4. Ability to understand measurement and control of vibration and noise.
		5. Ability to calculate natural frequencies, Eigen values & Eigen vectors
		6. Ability to measure vibrations, vibration characteristics and understand various methods for vibration control for real life problem.
402044 A	Elective I (Energy Audit Management)	1. Apply knowledge of importance of energy management
		2. Carry out Energy Audit of their residence/society/ college where there are studying
		3. Carry out electrical tariff calculation & accurately predict the electricity bill required for the installation
		4. Suggest various methods to reduce energy consumption of the equipment/office / premises
		5. Apply the knowledge of Electrical Energy Management & Lighting
		6. Significance of waste heat recovery & cogeneration
402044 C	Elective I (Reliability Engineering)	1. Calculate failure rate, Hazard rate, MTTF, MTBF and reliability
		2. Analyze series, parallel and mixed reliability system
		3. Evaluate and improve system reliability
		4. Understand maintainability and evaluate availability of an equipment or machine
		5. Use different techniques FMEA, FMECA, DOE and TAGUCHI Analysis
		6. Understand reliability test methods
402045 C	Elective II (Operation Research)	1. Ability to understand and apply the single objective function by Linear programming and Decision theory
		2. Ability to understand and apply the concept of transporation model and assignment tool to optimised the transporation and assignment problem.
		3. Ability to understand and apply the concept of Theory of Games and Investment Analysis in the real life problem .
		4. Ability to understand and apply the concept of Inventory control and Replacement Analysis in the realistic

	402046	Project Phase I	5. Ability to understand and apply the concept of Queuing theory and Sequencing Model in the realistic problem .
			6. Ability to understand and apply the concept of CPM and PERT in the realistic problem .
			1. Demonstrate a sound technical knowledge of their selected project topic.
			2. Undertake problem identification, formulation and solution.
			3. Design engineering solutions to complex problems utilising a systems approach.
			4. Do thermodynamic feasibility, material and energy balance of process block diagram
			5. Design and optimize major equipments in the selceted project
B E [SEMESTER –VIII, TERM- II]	402047	Power Plant Engineering	6. Demonstrate the skills, knowledge, and attitudes of a professional engineer.
			1. Ability to have adequacy with Design, erection and development of energy conversion plants.
			2. Optimization of Energy Conversion plant with respect to the available resources
	402048	Mechanical System Design	3. Scope of alternative erection of optimized, suitable plant at the location depending upon geographical conditions
			1. Design of Machine Tool Gearbox
			2. Statistical Considerations in Design
			3. Design of Belt Conveyor for Bulk Materials Handling
			4. Design of Pressure Vessels as per IS:2825 of 1969
			5. Design of IC Engine Components
	402049 C	Elective III (Industrial Engineering)	6. Design for Manufacture & Optimum Design using Johnson's Method
			1. Able to apply concepts, principles and framework of contents of Industrial Engineering and productivity enhancement techniques.
			2. Able to describe and demonstrate different concepts involved in methods study and Work study
			3. Able to demonstrate work measurement and sampling techniques regards to industrial problems
			4. Able to illustrate different aspects of Production Planning and Control and Facility Design.
			5. Identity concepts of various cost accounting and financial management practices as applied in industries.
	402050 B	Elective IV (Finite Element Analysis)	6. Develop capability in integrating knowledge Human Resource activities and Industrial Safety rules applied to engineering economy
			1. Describe general steps involved in finite element analysis to model the problems
			2. Derive and use 1-D and 2-D element stiffness matrices and load vectors from various methods to solve for displacements and stresses.

			3. Formulation of elemental stiffness matrix and load vector for Plane stress/strain such as LSR, CST
			4. Ability to Understand and apply the concept of Isoparametric, super parametric, subparametric and higher order elements
			5. Develop the steady-state heat transfer formulation of 1D element for conduction and convection problem to solve temperature distribution problems
			6. Formulation of dynamic problems and solving Eigen value problems using lumped mass and consistent matrices methods.
	402051	Project Phase II	1. Demonstrate a sound technical knowledge of their selected project topic.
			2. Undertake problem identification, formulation and solution.
			3. Design engineering solutions to complex problems utilising a systems approach.
			4. Do thermodynamic feasibility, material and energy balance of process block diagram
			5. Design and optimize major equipments in the selected project
			6. Demonstrate the skills, knowledge, and attitudes of a professional engineer.

B E MECHANICAL SANDWICH (2012 PATTERN)

YEAR	COUR	COURSE NAME	COURSE OUTCOMES
B E Mech S/W [SEMESTER –VIII, TERM- II]	402066	Mechanical Vibrations	1. Explain the static and dynamic balancing of rotating masses in single and multi plane. Apply the principle of primary and secondary balancing in computing numerical based on single and multicylinder inline reciprocating engines graphically and analytically, also explain the primary and secondary crank in v-engines and radial engines.
			2. State the fundamentals of undamped free vibrations of single degree freedom system. Illustrate the modeling of vibratory single degree freedom system, able to compute the natural frequency of the system using equilibrium and Energy method.
			3. State the fundamentals of Damped single degree freedom system and solve the numerical based on damping.
			4. Explain the single degree freedom system with forced vibration, give examples and solve numerical based on forced vibration.
			5. Illustrate the two degree of freedom system; compute the Eigen value and Eigen vector.
			6. Explain the vibration measurement and control.
	402067	Industrial	1. Understand working principle of components used in hydraulic & pneumatic systems

	Hydraulics and Pneumatics	2. Identify various components of hydraulic & pneumatic systems 3. Select appropriate components required for hydraulic and pneumatic systems 4. Design hydraulic and pneumatic system for industrial applications 5. Employ hydraulic and pneumatic system in industrial applications 6. Analyse hydraulic and pneumatic circuits
402048	Mechanical System Design*	1. To apply the knowledge and fundamental concept for designing a Machine tool gear box. 2. To apply the knowledge and fundamental concept Statistical considerations in design 3. To apply the knowledge and fundamental concept for Belt conveyer system for material handling 4. To apply the knowledge and fundamental concept for designing a Cylinders and Pressure vessels 5. To apply the knowledge and fundamental concept for designing a I. C. Engine components 6. To apply the knowledge and fundamental concept of Optimum Design and DFMA
402068 D	Elective - I (CAD/CAM Automation)	1. Ability to solve problem on geometric transformation, analytically and also using MATLAB 2. Ability to develop parametric equation of analytic and synthetic curves, surface and solids. 3. Analyze and design real world components, analytical and using FEM software. 4. Ability to generate Tool path for manufacturing process for CNC m/c manually and using CAM software. 5. Ability to design different types of robot gripper. 6. Understand the working principle of rapid prototyping methods and can select suitable advanced manufacturing method for complex components.
402069 A	Elective - II (Energy Audit and Management)	1. Apply knowledge of importance of energy management 2. Carry out Energy Audit of their residence/society/ college where there are studying 3. Carry out electrical tariff calculation & accurately predict the electricity bill required for the installation 4. Suggest various methods to reduce energy consumption of the equipment/office / premises 5. Apply the knowledge of Electrical Energy Management & Lighting 6. Significance of waste heat recovery & cogeneration
402069 B	Elective - II (Operations Research)	1. Ability to understand and apply the single objective function by Linear programming and Decision theory 2. Ability to understand and apply the concept of transportation model and assignment tool to optimised the transportation and assignment problem. 3. Ability to understand and apply the concept of Theory of Games and Investment Analysis in the real life problem .

			4. Ability to understand and apply the concept of Inventory control and Replacement Analysis in the realistic problem .
			5. Ability to understand and apply the concept of Queuing theory and Sequencing Model in the realistic problem .
			6. Ability to understand and apply the concept of CPM and PERT in the realistic problem .
ME DESIGN (2013 PATTERN)			
YEAR	COUR	COURSE NAME	COURSE OUTCOMES
ME [SEMESTER –I I	507201	Advanced Mathematics	1.Solve the problems of Inner product spaces, orthogonality
			2.Solve complex variable, complex differentiation and complex integration
			3. Solve Problems of fourier transformation, laplace transforms and its inverses
			4. Solve numericals based on series solution of differential equations and matrix formulation for differntial equations in vibration theory
			5. Solve the problems of finite difference analysis, 1D diffusion equation & wave equations
			6. Solve the numericals based on approximate solution of boundary value problem, Rayleigh-Ritz method, Galerain's method and Lagranges principal.
	502202	Material Science & Mechanical Behaviour of Materials	1. Identify the crystallographic direction and planes and understand the defects and diffusion process in ionic and polymeric materials.
			2. Understand and solve the numerical on stress and strain transformation in three dimensions.
			3. Students are able to formulate the flow rule based upon the experimental results.
			4. Explain the theory of plasticity and compute the different parameters related to it.
			5. Describe the theory of Elastic-plastic equilibrium.
			6. Illustrate the theory of Elasto-Visco-Plasticity with different models.
	502203	Adavanced Stress Analysis	1. Analyse stress and strain of complicated structures of elastic materials.
			2. Analyse and provide solutions for failure of plastic component.
			3. Evaluate solutions for problems related to plate bending
			4. Identfy and formulate problems related to contact stresses
			5. Able to use experimental stress analysis by using strain gauges
	502204	Research Methodology	1. Understand the basic concepts of research, its methodologies and identify appropriate research topic.
			2. Perform statistical analysis of selected research problem
			3. Define appropriate parameters, formulate and test hypothesis.

ME [SEMESTER –II]			4. Prepare a mathematical model and verify the assumptions.
			5. Prepare and write a research proposal to funding agencies.
	502205	Elective I (Energy Audit and Management, Environmental Pollution and Control)	1. Understand the various aspects of Energy management and energy audit.
			2. Implement energy management programme in an industry.
			3. Carry out financial analysis of different energy projects.
			4. Evaluate the techno economic feasibility of the energy conservation technique identified.
			5. Understand different types of pollutants and their effects on environment.
	502206	Lab Practice I	1. Perform Computer program using numerical method for an engineering application
			2. Perform measurement of strain in cantilever beam using strain gauges
			3. Perform contact stress analysis using FEM software
			4. Perform elasto-plastic analysis of a tensile test specimen using FEM software
			5. Determination of full range stress strain curve for mild steel and aluminium specimen as per ASTM -E8M
			6. Prepare research proposal
	502207	Analysis & Synthesis of Mechanisms	1. Analyse the problems related to Simple and Complex Mechanisms.
			2. Gain knowledge of dynamic analysis of plainer mechanism.
			3. Identify and formulate problems related planer mechanisms.
			4. Learning of the graphical and analytical techniques commonly used in the synthesis of mechanisms.
			5. Analyse and provide solutions for spital mechanisms.
	502208	Advanced Mechanical Vibrations	1. Ability to model multi–dof vibration systems and understand the basics of modal analysis.
			2. Ability to model and analyze the continuous vibration systems.
			3. Ability to obtain the response of single dof systems to transient excitations.
			4. Ability to understand the principles and techniques of vibration control.
			5. Ability to understand the principles and techniques of vibration measurement and experimental modal analysis.
			6. Ability to analyze the vibration systems to random excitation.
	502209	Finite Element Method	1. Describe general steps involved in finite element analysis to model the problems.
			2. Develop stiffness matrices for spring, beam, truss and plane stress problems and explore the issues in convergence of solutions.

ME [SEMESTER –III]			3. Develop the finite element formulations for plate bending problems.
			4. Interpret the concept of non-linear analysis and its implementation for solving problems using finite element technique.
			5. Formulation of dynamic problems and solving Eigen value problems using lumped mass and consistent matrices methods.
			6. Understand linear buckling, adaptive and mesh refinement methods.
	502210	Elective II (Design Of Material Handling Equipments I & II)	1. Ability to analyze analytical techniques and procedure for selection of material handling equipment.
			2. Ability to understand the design of cranes.
			3. Analyze and design load lifting attachments in handling the material.
			4. Ability to develop and interpret automation and safety in design consideration
			5. Able to design process equipment with consideration of pressure, temperature, stress and efficiency.
			6. Ability to develop optimization techniques using various tools in designing process.
	502211	Lab Practice II	1. Perform analysis of inertia forces in slider crank mechanism using computer software
			2. Perform Coupler curve synthesis for a mechanism using computer software
			3. Determination of natural frequencies & modal analysis of a machine component using FFT Analyzer
			4. Perform stress and deflection analysis of plates/shells using FEM software
			5. Perform stress analysis of rotating disc (solid and hollow discs) using FEA software
			6. Perform buckling mode analysis of a thin shell cylinder using FEA software
	502212	Seminar I	1. Knew the advances in the areas of mechanical engineering
			2. Do literature survey and collection technical information
			3. Analyze data based on literature survey
			4. Develop the oral and written presentation skills
			5. Knew the concept of novelty of work
			6. Develop technical writing skills
	602213	Optimization Techniques	1. Ability to understand and apply the . Classical Optimization Techniques
			2. Ability to understand and apply the concept of Simplex algorithm, two phases of the simplex method.
			3. Ability to understand and apply the concept of Non-Linear Programming.
			4. Ability to understand and apply the concept of Modern Methods of Optimization.
			5. Ability to understand and apply the concept of Topology Optimization.

		6. Ability to understand and apply the concept of Evolutionary Structural Optimization (ESO) Methods.
602214	Mechanical Measurements & Controls	1. Gain knowledge of different types of instruments and their characteristics.
		2. Learn how to evaluate errors that accompany a measurement and its analysis.
		3. Gain knowledge about typical properties measured in mechanical systems such as temperature, force, pressure, strain, velocity and acceleration.
		4. Understand stability and control of system by different system.
		5. Analyse control system by using different controls.
602215	Elective III (Industrial Tribology –I,II, III)	1. Understand the genesis of friction and wear, consequences, mechanisms, theories and analysis of friction and wear problems
		2. Learn about the principles of lubrication, lubrication regimes, theories of hydrodynamic and hydrostatic lubrication, and ability to perform design calculations of hydrostatic and hydrodynamic lubrication for basic problems.
		3. Understand basic principles of squeeze film lubrication and solve numerical problems
		4. Understand elastohydrodynamic and the fundamental principles of high contact stresses (Hertz stresses)
		5. Understand derivation fundamental equations and applying it to solve numericals for air lubricated bearings
		6. Understand contact mechanics theory for rolling motions and apply it for road tyre contact
602216	Seminar II	1. Knew the advances in the areas of mechanical engineering
		2. Do literature survey and collection technical information
		3. Analyze data based on literature survey
		4. Develop the oral and written presentation skills
		5. Knew the concept of novelty of work
		6. Develop technical writing skills
602217	Project Stage I	1. Choose and evaluate the problem based on current interest of research at national and international level
		2. Collect the technical data
		3. Develop analyzing ability
		4. Procure the resources to required for project work
		5. Perform the research and development activities

ME [SEMESTER -IV]	602218	Seminar III	6. Write the scientific report and papers
			1. Knew the advances in the areas of mechanical engineering
			2. Do literature survey and collection technical information
			3. Analyze data based on literature survey
			4. Develop the oral and written presentation skills
			5. Knew the concept of novelty of work
	602219	Project Work- Stage II	6. Develop technical writing skills
			1. Choose and evaluate the problem based on current interest of research at national and international level
			2. Collect the technical data
			3. Develop analyzing ability
			4. Procure the resources to required for project work
			5. Perform the research and development activities
			6. Write the scientific report and papers

ME AUTOMOBILE (2013 PATTERN)

YEAR	COUR	COURSE NAME	COURSE OUTCOMES
ME [SEMESTER -I I]	507201	Advanced Mathematics	1. Solve the problems of Inner product spaces, orthogonality
			2. Solve complex variable, complex differentiation and complex integration
			3. Solve Problems of fourier transformation, laplace transforms and its inverses
			4. Solve numericals based on series solution of differential equations and matrix formulation for differential equations in vibration theory
			5. Solve the problems of finite difference analysis, 1D diffusion equation & wave equations
			6. Solve the numericals based on approximate solution of boundary value problem, Rayleigh-Ritz method, Galerain's method and Lagranges principal.
	502302	Automotive Engine Design	1. Analyse SI and CI engine cycles as well as performance of engines.
			2. Explain thermo chemistry of fuel and fluid motions in combustion chambers.
			3. Discriminate among different emissions from engines.
			4. Analyse mechanical and thermal loading of engine component.
			5. Design principal parts of engine.
			6. Explain and design main systems of engine.

ME [SEMESTER -II]	502303	Automotive Safety & Regulations	1. Describe active and passive safety and crashworthiness of vehicle structure
			2. Identify Ergonomics in automotive safety, Injury threshold and pedestrian safety.
			3. Write down Types of vehicle safety systems
			4. Demonstrate Automotive Lighting and Light Signalling Devices.
			5. Describe safety regulations as per AIS and CMVR rules.
	502304	Research Methodology	1. Understand the basic concepts of research, its methodologies and identify appropriate research topic.
			2. Perform statistical analysis of selected research problem
			3. Define appropriate parameters, formulate and test hypothesis.
			4. Prepare a mathematical model and verify the assumptions.
			5. Prepare and write a research proposal to funding agencies.
	502305	Elective I (Energy Audit and Management, Environmental Pollution and Control)	1. Understand the various aspects of Energy management and energy audit.
			2. Implement energy management programme in an industry.
			3. Carry out financial analysis of different energy projects.
			4. Evaluate the techno economic feasibility of the energy conservation technique identified.
			5. Understand different types of pollutants and their effects on environment.
	502306	Lab Practice I	1. Perform computer program to estimate dynamic forces on crankshaft of multi-cylinder engine.
			2. Perform dynamic force analysis of crank train assembly using suitable MDB software.
			3. Perform fatigue life estimation of crankshaft using suitable FEM software
			4. Perform complex analysis
			5. Perform numerical analysis
			6. Identify the latest manufacturing and assembly of System in automotive industry
ME [SEMESTER -II]	502307	Engine Combustion Technology	Explain combustion principles and analyse combustion equations.
			Distinguish between laminar and turbulent flame propagation in engines.
			Compare normal and abnormal combustion in SI engine.
			Discuss combustion in CI engine and combustion chambers.
			Explain combustion and combustion chambers in gas turbine.
	502308	Noise Vibration & Harshness	1. Understand the theory of vibrations related to Automotive Noise Vibration and Harshness; also illustrate ride comfort, noise and vibration control.
			2. Understand the basic Acoustical Quantities, Sound power Levels and Directivity of noise sources.

		3. Understand the vibration and noise measurement in automobile.
		4. Illustrate the noise and vibration analysis technique.
		5. Understand the modal analysis; understand the different acoustic and geometric parameters of duct and mufflers. Understand parameters of acoustic materials.
		6. Explain the Noise Vibration Harshness Legislations in Automotive vehicles.
502309	Automotiv Chassis Design	1. Demonstrate Types of springs and spring design considerations.
		2. Understand Steering system and its characteristics
		3. Identify types of braking system and write down elementary theory of braking.
		4. writes down construction of tyre and tread patterns.
		5. Able to understand types of Multi wheeler vehicle and their technology.
502810	Elective II (Vehicle Aerodynamics I,II,III)	1. Analysis of aerodynamic drag and coefficient of car
		2. Determining shape of car and optimization of it
		3. Testing of vehicles using wind tunnels and test techniques
		4. Analysing aerodynamics of vehicle by application of CFD
		5. Development and simulation methods of cars, buses and trucks
		6. Identifying and utilizing various measuring instruments
502311	Lab Practice II	1. Study of ABS system and draw a complete system diagram with costing for a passenger vehicle
		2. Perform experiment on chassis dynamometer to study deflection, spring rate and stress analysis on various components
		3. Study of latest suspension system e.g. active suspension system and their application
		4. Perform experiment on actual sound and vibrations measurements on a vehicle mounted on a chassis dynamometer
		5. Perform experimental modal analysis of cantilever beam by using FFT analyzer
		6. Perform Mat lab programming for determination of natural frequency and mode shape of beam.
502312	Seminar I	1.Knew the advances in the areas of mechanical engineering
		2.Do literature survey and collection technical information
		3.Analyze data based on literature survey
		4.Develop the oral and written presentation skills
		5. Knew the concept of novelty of work
		6.Develop technical writing skills

ME [SEMESTER –III]	602313	Vehical Dynamics	1. Ability to understand the effect tire characteristics on the handling performance of vehicle.
			2. Ability to analyze the effect of various parameters on the performance characteristic of vehicles.
			3. Ability to understand the geometry of suspension and fundamentals of suspension kinematics.
			4. Ability to understand and analyze the handling characteristic of vehicle.
			5. Ability to understand the ride models and analyze the ride performance of vehicles.
			6. Ability to understand the fundamentals of modeling of road and suspension components.
	602314	Autotronics	1. Ability to apply knowledge of electronics in automobile
			2. Analyse and interpret computerised engine control system
			3. Ability to diagnosis faults, breakouts and apply safety considerations
			4. Ability to formulate automatic temperature control system and it's protocols.
	602315	Elective III (Industrial Tribology –I,II, III)	1. Understand the genesis of friction and wear, consequences, mechanisms, theories and analysis of friction and wear problems
			2. Learn about the principles of lubrication, lubrication regimes, theories of hydrodynamic and hydrostatic lubrication, and ability to perform design calculations of hydrostatic and hydrodynamic lubrication for basic problems.
			3. Understand basic principles of squeeze film lubrication and solve numerical problems
			4. Understand elastohydrodynamic and the fundamental principles of high contact stresses (Hertz stresses)
			5. Understand derivation fundamental equations and applying it to solve numericals for air lubricated bearings
			6. Understand contact mechanics theory for rolling motions and apply it for road tyre contact
	602316	Seminar II	1. Knew the advances in the areas of mechanical engineering
			2. Do literature survey and collection technical information
			3. Analyze data based on literature survey
			4. Develop the oral and written presentation skills
			5. Knew the concept of novelty of work
			6. Develop technical writing skills
	602317	Project Stage I	1. Choose and evaluate the problem based on current interest of research at national and international level
			2. Collect the technical data

ME [SEMESTER -IV]			3.Develop analyzing ability
			4.Procure the resources to required for project work
			5.Perform the research and development activities
			6.Write the scientfic report and papers
	602306	Seminar III	1.Knew the advances in the areas of mechanical engineering
			2.Do literature survey and collection technical information
			3.Analyze data based on literature survey
			4.Develop the oral and written presentation skills
			5.Knew the concept of novelty of work
			6.Develop technical writing skills
	602307	Project Work- Stage II	1.Choose and evaluate the problem based on current interest of research at national and international level
			2.Collect the technical data
			3.Develop analyzing ability
			4.Procure the resources to required for project work
			5.Perform the research and development activities
			6.Write the scientfic report and papers