Department of Mechanical Engineering
Course Outcome (CO)

First Year -2015 Course		
Course Code	**Course Name**	**Course Outcomes**
Semester I		
102006	**Engineering Graphics I**	C102006.1 — Draw the fundamental engineering objects using basic rules and able to construct the simple geometries
		C102006.2 — Construct the various engineering curves using the drawing instruments
		C102006.3 — Apply the concept of orthographic projection of an object to draw several 2D views and its sectional views for visualizing the physical state of the object
		C102006.4 — Apply the visualization skill to draw a simple isometric projection from given orthographic views precisely using drawing equipment
		C102006.5 — Draw the development of lateral surfaces for cut section of geometrical solids

Semester II		
102013	**Basic Mechanical Engineering**	C102013.1 — Able to understand shafts keys and basic mechanical elements functions
		C102013.2 — Able to understand design fundamentals and mechanisms
		C102013.3 — Able to understand different manufacturing processes
		C102013.4 — Able to understand machine tools and uses
		C102013.5 — Able to understand thermal engineering concept
		C102013.6 — Able to understand power plants, power producing devices, power absorbing devices etc.

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Second Year -2015 Course		
Course Code	**Course Name**	**Course Outcomes**
Semester I		
207002	**Engineering Mathematics-III**	C2O1.1	Find General solution of higher-order linear differential equation with constant & Variable coefficient using different Methods
		C2O1.2	Find Laplace transform and Fourier transform of functions using definition & properties & solve Ordinary D.E. using L.T.
		C2O1.3	Discuss the different techniques of statistical Analysis, Use of probability and probability distribution
		C2O1.4	Identify nature of vector fields, use different vector differential operators.
		C2O1.5	Evaluate Line, surface & Volume integrals & its application.
		C2O1.6	Solve boundary value problems for Laplace's equation, heat equation, the wave equation by separation of variables.
202041	**Manufacturing Process-I**	C202.1	Understand & Analyze foundry practices like pattern making, mold making, core making & inspection of defects.
		C202.2	Understand & analyze the hot & cold working, rolling, forging, extrusion & drawing process.
		C202.3	Understand the different plastic molding processes, extrusion of plastic and thermoforming process
		C202.4	Understand the different welding & joining processes & its defects.
		C202.5	Understand, design & analyze the different sheet metal working processes.
202043	**Thermodynamics**	C204.1	Apply various laws of thermodynamics to various processes and real systems.
		C204.2	Apply the concept of entropy, Calculate heat and work transfer, entropy change for thermodynamic systems.
		C204.3	Analyze performance of various Thermodynamic gas power cycles and gas refrigeration cycle and availability in each case.
		C204.4	Estimate the condition of steam and performance of vapour power cycle and vapour compression cycle.
		C204.5	Estimate Stoichiometric air required for combustion, performance of steam generators and natural draught

			requirements in boiler plants.
		C204.6	Use Psychromertic charts and estimate various essential properties related to Psychrometry and processes
202044	**Material Science**	C205.1	Able to understand and apply the fundamentals of materials (structure, properties and processing), for selecting, developing new material and process for real world problems.
		C205.2	Analyze different types of crystal structure, crystal imperfections and its effect on material properties.
		C205.3	To understands and analyze mechanical properties using destructive and nondestructive material testing techniques.
		C205.4	To articulate, utilize corrosion prevention strategies, surface modification techniques to estimate behavior of materials and components for real engineering problems.
		C205.5	To recognize how metals can be strengthened by cold-working and hot working process and their applications
Semester II			
202045	**Fluid Mechanics**	C206.1	Determine various properties of fluid
		C206.2	Apply the laws of fluid statics and concepts of buoyancy
		C206.3	Identify types of fluid flow and terms associated in fluid kinematics
		C206.4	Apply principles of fluid dynamics to laminar flow
		C206.5	Estimate friction and minor losses in internal flows and Determine boundary layer formation over an external surface
		C206.6	Construct mathematical correlation considering dimensionless parameters, also ABLE to predict the performance of prototype using model laws
202047	**Soft Skills**	C207.1	To analyse strength, weaknesses, opportunities and threats.
		C207.2	To learn communication, interaction and presentation of ideas.
		C207.3	To frame resumes and to understand corporate etiquettes.
		C207.4	To develop right attitudinal and behavioural change.
		C207.5	To learn working in team and to achieve team goals.
202048	**Theory of Machines-I**	C208.1	Identify mechanisms in real life applications
		C208.2	Perform kinematic analysis of simple mechanisms
		C208.3	Perform static and dynamic force analysis of slider crank mechanism
		C208.4	Determine moment of inertia of rigid bodies experimentally
		C208.5	Analyze velocity and acceleration of mechanisms by vector and graphical methods
202049	**Engineering Metallurgy**	C209.1	Able to describe how metals and alloys formed & how the properties change due to microstructure

		C209.2	To select materials for design and construction.
		C209.3	Able to recognizes how metals can be strengthened by alloying, cold-working, and heat Treatment
		C209.4	apply core concepts in Engineering Metallurgy to solve engineering problems
202050	**Applied Thermodynamics**	C210.1	Classify various types of Engines, to compare Air standard, Fuel Air and Actual cycles also make out various losses in real cycles.
		C210.2	Understand theory of carburetion, types of carburetors, modern carburetor.
		C210.3	To understand the main theory behind Internal Combustion Engine along with the understanding of all the components and systems used in the automotive systems and carry out the performance and emission in IC Engines. To understand Stages of Combustion in S. I. Engines and Theory of Detonation, Pre-ignition and factors affecting detonation.
		C210.4	Understand Fuel Supply system, Types of Injectors and Injection Pumps, Stages of Combustion in CI Engines, Criteria for good combustion chamber and types.
		C210.5	Carry out testing of I. C. Engines and analyze its performance also various harmful gases Emitted from exhaust and different devices to control pollution and emission norms for pollution control.
		C210.6	Describe construction and working of various I. C. Engine systems (Cooling, Lubrication, ignition, Governing, and Starting) also various types of reciprocating and rotary compressors with performance calculations of positive displacement compressors.
202051	**Strength of Material**	C211.1	Determine various strength properties of Material
		C211.2	Apply the concept of stress and strain and understand various stress and strain
		C211.3	Identify various types of stress and terms associated in elastic constants.
		C211.4	Apply transverse force on beam and understand SFD, BMD, bending and shear stresses.
		C211.5	Estimate torsional stresses and Determine critical load on column.
		C211.6	Construct geometrical Mohr's circle to predict the Principal stresses and predict behaviour of material under complex load.
202052	**Electrical and Electronics Engineering**	C212.1	Understand and apply different types of DC Machines And Speed control Methods
		C212.2	Distinguish and Analyse between different types of 3 phase IM And Characteristics
		C212.3	Understand and apply different types of special Purpose Motor
		C212.4	Apply programming concept to understand role of

			Microprocessor and Microcontroller in embedded systems
		C212.5	Develop interfacing of different types of sensors and other hardware devices with Atmega 328 microcontroller Atmega 328 based Arduino Board
		C212.6	Develop interfacing of different types of sensors and other motor devices with Atmega 328 microcontrollerAtmega328 based Arduino Board
202053	**Machine Shop**	C213.1	Utilize the Engineering knowledge to Perform welding using TIG/ MIG/ Resistance/Gas welding technique
		C213.2	Make Fibre-reinforced Composites by hand lay-up process or spray lay-up techniques
		C213.3	Take a part in Performing cylindrical/surface grinding operation and Evaluate its machining time
		C213.4	Determine number of indexing movements required and acquire skills to Produce a spur gear on a horizontal milling machine.
		C213.5	Elaborate industry visit report
		C213.6	Understand procedure of plastic processing

Department of Mechanical Engineering
Course Outcome (CO)

Third Year -2015 Course			
Course Code	**Course Name**	**Course Outcomes**	
Semester I			
302041	**Design Of Machine Element-1**	C301.1	Students shall understand and apply the design steps ,its considerations ,and standards in designining of simple machine elements.
		C301.2	Students shall learn and understand selection of material , factor of safety and anyalise different failure modes and design criteria for different machine elements .
		C301.3	Students shall understand the stress concentration and fatigue failure in order to design the machine elements under cyclic loading.
		C301.4	students shall apply the design knowledge to evaluate the dimentions of machine elements such as -Knuckle joints, cotter joints ,shafts, couples, power screws , fasterners and springs.
		C301.5	students shall understand and apply the geometric, dimensional tolerences and create the assembly and detailed drawing of different machine elements like cotter and knuckle joints, couplings, screw jacks and springs,
302042	**Heat Transfer**	C302.1	Formulate basic equations of heat transfer and apply to heat transfer problems.
		C302.2	Apply heat transfer principles to design and evaluate performance of thermal systems.
		C302.3	Calculate the effectiveness and rating of heat exchangers.
		C302.4	Calculate heat transfer by radiation and apply between objects with simple geometries.
		C302.5	Calculate and evaluate the impact of boundary conditions on the solutions of heat transfer
		C302.6	Evaluate the contribution of different modes of heat transfer.
302043	**Theory of Machine- II**	C303.1	The students will understand the gear theory which will be the prerequisite for gear design.
		C303.2	Student will be able to perform force analysis of gear.
		C303.3	The students to analyze speed and torque in Epicyclic gear trains, which will be the prerequisite for gear box design
		C303.4	The student will able to design and draw Cam profile for given motions of the follower.
		C303.5	The students will synthsize a four bar mechanism with analytical and graphical method
		C303.6	Student will analyze the Gyroscopic couple for stabilization of ship, Aeroplane and four wheeler vehicle and can select

302044			appropriate drive for given application.
302044	**Turbo machines**	C304.1	To Apply fluid mechanics and thermodynamics principles to turbo machines
		C304.2	To Design and analyze the performance of turbo machines
		C304.3	To Select turbo machines for given application
		C304.4	To Predict performance of turbo machine using model analysis
		C304.5	To Identify and rectify the problem in turbo machines.
302045	**Metrology and Quality Control**	C305.1	Understand the methods of measurement, selection of measuring instruments / standards of measurement, carryout data collection and its analysis.
		C305.2	Explain tolerance, limits of size, fits, geometric and position tolerances and gauge design.
		C305.3	An ability to metrology of threads, gears and advanced metrology and to perform experiments, as well as to analyse and interpret data.
		C305.4	Understand and use/apply Quality Control Techniques/ Statistical Tools appropriately.
		C305.5	Develop an ability of problem solving and decision making by identifying and analyzing the cause for variation and recommend suitable corrective actions for quality improvement.
302046	**Skill Development**	C306.1	To understand & apply theoretical knowledge in practice.
		C306.2	To have knowledge of the different appropriate tools and tackles used in machine assembly shop.
		C306.3	To know & utilize practical aspect of the each component in the assembly of the machine
		C306.4	To learn & apply geometric dimensioning & tolerancing (GD &T) to mechanical components.
		C306.5	To develop the skills for holding, dismantling and assembly of mechanical systems.
		C306.6	To expose the students to leadership and team- building skills of shop floor activities with safe working practices and conducive environments.
Semester II			
302047	**Numerical Methods and Optimization**	C307.1	Evaluate the roots of equations and simultaneous equation by using numerical methods
		C307.2	Formulate and solve constrain and un constrain problems using optimization techniques
		C307.3	solve & apply numerical differential, partial differential & Integration equations.
		C307.4	Apply least square and interpolation technique for analysis of engineering problems
		C307.5	Develop flowchart and impliment using suitable

			solver software
302048	**Design of Machine Elements - II**	C308.1	Apply the knowledge and fundamental concept for designing a spur gear, helical gear, bevel gear and worm gear pair.
		C308.2	Select belt drive, wire ropes and chain drive from manufacturer's catalogue.
		C308.3	Select rolling contact bearing from manufacturer's catalogue and design sliding contact bearing.
		C308.4	Design a gear box for practical applications.
302049	**Refrigeration and Air Conditioning**	C309.1	Illustrate the fundamental principles and applications of refrigeration and air conditioning system
		C309.2	Obtain cooling capacity and coefficient of performance of vapour compression refrigeration systems
		C309.3	Understand the properties, applications and environmental issues of different refrigerants
		C309.4	Calculate cooling load for air conditioning systems used for various applications
		C309.5	Operate and analyze the refrigeration and air conditioning systems.
		C309.6	Understand, analyse and design of air distribution system
302050	**Mechatronics**	C310.1	Understand principles of sensors /Actuators, its characteristics also its interfacing with DAQ microcontroller & apply this knowledge for different industrial application
		C310.2	Recognize key elements of Mechatronics system, representation into block diagram & Understand concept of transfer function, block diagram reduction and analysis
		C310.3	Understand the concept of PLC system and its ladder programming, and significance of PLC systems in industrial application
		C310.4	Able to do the system modeling and analysis in time domain and frequency domain
		C310.5	Apply the knowledge of control actions such as Proportional, derivative and integral in different industrial Processes
302051	**Manufacturing Process II**	C311.1	Student will able to apply the knowledge of various manufacturing processes.
		C311.2	To understand the selection of machining process to manufacture any component.
		C311.3	To analyze the various process parameters and their effect on processes.
		C311.4	Student will able to understand the application of modern machining.
		C311.5	To learn and apply the knowledge of Jigs and Fixtures for variety of operations.
		C311.6	To create knowledge about the working and programming techniques for various machines and tools
302052	**Machine Shop II**	C312.1	Utilize the Engineering knowledge to Perform welding using TIG/MIG/ Resistance/Gas welding technique

		C312.2	Make Fibre-reinforced Composites by hand lay-up process or spray lay-up techniques
		C312.3	Take a part in Performing cylindrical/surface grinding operation and Evaluate its machining time
		C312.4	Determine number of indexing movements required and acquire skills to Produce a spur gear on a horizontal milling machine
		C312.5	Elaborate industry visit report
		C312.6	Understand procedure of plastic processing
302053	**Seminar**	C313.1	Identify topic of interest and develop a thought process for technical presentation.
		C313.2	Organize a detailed literature survey and build a document with respect to technical publications
		C313.3	Analysis and comprehension of proof-of-concept and related data
		C313.4	Effective presentation and improve soft skills
302054	**Audit course I :- Fire & Safety Technology**	C314.1	To create and sustain a community of learning in which students acquire knowledge in fire, safety and hazard management and learn to apply it professionally with due consideration for ethical, human life & property safety Issues.
		C314.2	To pursue research and development in fire safety engineering, hazard management and disseminate its findings
		C314.3	To meet the challenges of today and tomorrow in the most effective, efficient and contemporary educational manner.
		C314.4	To help in building national capabilities in fire safety engineering, disaster management, hazard management, industrial safety education through practical training to ensure a fire safe nation.

Department of Mechanical Engineering
Course Outcome (CO)

Course Code	Course Name	Course Outcomes	
Fourth Year -2015 Course			
Course Code	**Course Name**	**Course Outcomes**	
Semester I			
402041	**Hydraulics and Pneumatics**	C401.1	To understand working principle of components used in hydraulic & pneumatic system
		C401.2	Identify various applications of hydraulic & pneumatic systems
		C401.3	Selection of appropriate components required for hydraulic and pneumatic systems
		C401.4	Analyze hydraulic and pneumatic systems for industrial /mobile applications
		C401.5	To design a system according to the requirements
		C401.6	To develops and applies knowledge to various applications.
402042	**CAD/CAM and Automation**	C402.1	Apply geometrical transformations, mapping and projections for editing and manipulation of basic geometric entities and verify using MATLAB
		C402.2	Illustrate the mathematical representation of curves and surfaces and methods of solid modeling.
		C402.3	Evaluate the performance of simple mechanical elements like beams, trusses, plates etc. using analytical method and FEA software tool
		C402.4	Develop CNC part program for turning and milling operations manually and using CAM software.
		C402.5	Demonstrate the understanding of various rapid manufacturing techniques and apply it to produce suitable component
		C402.6	Understand the types of automation and robot system, group technology and their applications in manufacturing industries.
402043	**Dynamics of Machinery**	C403.1	Apply balancing techniques to solve the static and dynamic balancing problems of rotary system, single Cylinder engine and multi cylinder inline, radial and v engines.
		C403.2	Identify the type of vibration in the given system; formulate the equations to determine the natural frequencies and mode shapes of freely vibrating longitudinal and torsional vibration systems of single degree and two degrees of freedom.
		C403.3	Evaluate effect of damping; determine the response of forced vibration due to harmonic excitation, excitation Due to unbalanced forces and base excitation.
		C403.4	Explain the noise concepts, methods of measurement of vibration and noise; Demonstrate the techniques for

			Vibration control and noise control of the industrial as well as day today life problems.
		C403.5	Solve the balancing problem of a wheel using computerized balancing machine; utilize the FFT vibration analyzer tool for measurement and analysis of vibration and noise.
402044 A	Finite Element Analysis	C404A.1	Understand the concept of finite element method for solving machine design problems
		C404A.2	Formulate and solve manually problems in 1-D structural systems involving bars, trusses, beams.
		C404A.3	Develop 2-D finite element formulations involving triangular, quadrilateral elements and higher order elements.
		C404A.4	Apply the knowledge of FEM for stress analysis, modal analysis, heat transfer analysis.
		C404A.5	Develop algorithms and write finite element code for solving simple design problems and understand the use of commercial packages for complex problems.
402044 C	Elective – I Heating, Ventilation and Air Conditioning	C404C.1	To determine the performance parameters of trans-critical & ejector refrigeration systems.
		C404C.2	To estimate thermal performance of compressor, evaporator, condenser and cooling tower.
		C404C.3	Able to describe refrigerant piping design, capacity & safety controls methods and balancing of vapour compressor system.
		C404C.4	To explain importance IAQ, ventilation and air distribution system & To estimate heat transmission through building walls with energy-efficient and cost-effective measures for building envelope.
		C404C.5	To explain working of types of desiccant, evaporative, thermal storage, radiant cooling, clean room and heat pump air-conditioning systems.
402045 A	Elective-II Automobile Engineering	C405A.1	To compare and select the proper automotive system for the vehicle.
		C405A.2	To analyze the performance of the vehicle.
		C405A.3	To diagnose the faults of automobile vehicles.
		C405A.4	To apply the knowledge of EVs, HEVs and solar vehicles.
402045 B	Operation Research	C405B.1	Formulate linear programming problems and understand their limitations.
		C405B.2	Solve complicated problems of management science using appropriate techniques and models, interpret the results obtained and translate solutions into directives for action
		C405B.3	Construct variety of problems such as assignment, transportation, travelling salesman etc. and solve these problems using linear programming approach
		C405B.4	Select appropriate model for queuing situations and

			replacement situations and find the optimal solutions using models for different situations
		C405B.5	Evaluate various situations of Games theory and Sequencing models and apply them to solve them in real life for decision making
		C405B.6	Plan optimum project schedule for network models arising from a wide range of applications.
402045 C	Elective – II Energy Audit and Management	C405C.1	Awareness about importance of Energy, its conservation, Renewable Energy and energy efficiency in day to day life as well as for future planning
		C405C.2	Understand and analyze the Indian and Global Energy Scenario and issues of concern like Climate Change and Energy Security
		C405C.3	Understand the Energy Audit and its importance in Industries. Carry out Energy Audit of their residence /society/college/Industry where they are studying & training.
		C405C.4	Carry out cost calculations for electricity, steam etc and accurately predict the electricity bill required for the installation.
		C405C.5	Carry out Energy performance assessment of thermal utilities and electrical utilities. Suggest various conservation measures to reduce energy consumption of the equipment /office/premises.
		C405C.6	To estimate the cost of operation of Thermal or Electrical Utilities, Co Generation and suggest proper WHR options. Career as Energy Auditor or Energy Manager in large & Small organizations.
402046	Project Stage I	C406.1	Ability to identify the community that shall benefit through the solution to the identified engineering problem and also demonstrate concern for environment.
		C406.2	Ability to engage in independent study to research literature in the identified domain and to consolidate the literature search to identify and formulate the engineering problem.
		C406.3	Ability to engage in independent study to identify the mathematical concepts, science concepts, engineering concepts, management principles and select the engineering tools/components necessary for solving the identified engineering problem.
		C406.4	Ability to apply the identified concepts and engineering tools to arrive at design solution(s) for the identified engineering problem.
		C406.5	Ability to prepare the Gantt Chart for scheduling the project work and designate responsibility of every member in the team.
		C406.6	Ability to perform in the team, contribute to the team and mentor/lead the team.
		C406.7	Ability to engage in effective oral communication through presentation of the project stage-1 work, demonstration of the project concept, effective written communication

			through the project stage-1 report.
Semester II			
402047	**Energy Engineering**	C407.1	To understand the Power generation scenario, components of thermal power plant and analyze the improved Rankine & cogeneration cycle.
		C407.2	To analyze the steam condenser and recognize the environmental impacts of thermal power plant and methods to control pollution.
		C407.3	To recognize the layout, component details of hydroelectric and Nuclear power plant.
		C407.4	To understand details of diesel & Gas power plant and able to prepare the layout and analyze gas and diesel power plant
		C407.5	To emphasis the fundamentals of non-conventional power plants.
		C407.6	Describe the different power plant instruments and able to do economics of power generation.
402048	**Mechanical System Design**	C408.1	To understand the difference between component level design and system level design.
		C408.2	To design various mechanical systems like pressure vessels, machine tool gear boxes, material handling systems, I.C. Engine Components for the specifications stated/ formulated.
		C408.3	Able to apply the statistical considerations in design and analyze the defects and failure modes in components.
		C408.4	To learn and apply the optimum design principles to mechanical components.
		C408.5	To handle system level projects from concept to product.
402049 A	**Tribology**	C409A.1	To understand the importance of tribology in industry.
		C409A.2	To create the mathematical model for friction and wear measurement.
		C409A.3	To apply the knowledge of different lubrication process in various industrial application.
		C409A.4	To evaluate the performance of different types of bearings and analysis thereof
		C409A.5	To apply the principles of surface engineering for different applications of tribology
402049 B	**Industrial Engineering (Elective - III)**	C409B.1	To apply the Industrial Engineering concept in the industrial environment.
		C409B.2	To manage and implement different concepts involved in work study and understanding of work content in various situations.
		C409B.3	To describe different aspects of work system design and facilities design related to Manufacturing and service industries
		C409B.4	To understand and apply Industrial safety standards, financial management practices and Human resource

			management in organization
		C409B.5	To undertake the project work based on modeling & simulation area
402049 C	**Robotics**	C409C.1	Identify different type of robot configuration with relevant terminology.
		C409C.2	Select suitable sensors, actuators and drives for robotic systems stated/formulated.
		C409C.3	Understand kinematics in robotic systems.
		C409C.4	Design robot with desired motion with suitable trajectory planning
		C409C.5	Select appropriate robot programming for given application.
		C409C.6	Understand need of IOT, machine learning, simulation in robotics
402050 A	**Advanced Manufacturing Processes**	C410 A.1	To Classify and analyze special forming processes.
		C410 A.2	Analyze and identify applicability of advanced joining processes.
		C410 A.3	Understand and analyze the basic mechanisms of hybrid non-conventional machining techniques and select appropriate micro and nano fabrication techniques for engineering applications.
		C410 A.4	Understand and apply various additive manufacturing technology for product development.
		C410 A.5	Understand material characterization techniques to analyze effects of chemical composition, composition variation, crystal structure, etc.
402050 C	**Product design and Development**	C410C.1	Explain essential factors of product design, product testing and distinguish between product design and development
		C410C.2	Illustrate tool to identify customers need and satisfaction
		C410C.3	Explain various processes and concepts in product design and development
		C410C.4	Explain methods and processes in reverse engineering
		C410C.5	Apply design principles on product for excellence
		C410C.6	Explain product life cycle management and product data management
402051	**Project Stage II**	C411.1	Ability to transform the design solution(s) for the identified engineering problem into a full-scale model/prototype/virtual model using CAD tools by following manufacturing process sheets/CAD tool procedure for virtual model creation.
		C411.2	Ability to demonstrate compliance to the prescribed standards/ safety norms through implementation of the identified engineering problem.

		C411.3	Ability to analyze and interpret results of testing and validation of full-scale model/prototype/virtual model and to arrive at valid conclusions.
		C411.4	Ability to perform the budget analysis of the project through the utilization of resources (finance, power, area, bandwidth, weight, size, any other)
		C411.5	Ability to engage in effective oral communication through presentation of the project stage-II work, demonstration of the project full-scale model/prototype/virtual model, effective written communication through the project stage-II report, journal publication and the one-page poster presentation of the project work.
		C411.6	Ability to abide by the norms of professional ethics.

DEPARTMENT OF MECHANICAL ENGINEERING
M.E. DESIGN ENGINEERING (2017 Pattern) Course Outcomes

Course Code	Course Name	Course Outcomes-on the completion of this course student will be able to	
SEMESTER - I			
507201	Advanced Mathematics	CO1	Develop knowledge of numerical methods applicable for mechanical engineering.
		CO2	Formulate and obtain the numerical solution of mechanical engineering problems.
		CO3	Able to compare different numerical schemes.
		CO4	Understand the algorithms of mechanical engineering related software packages.
502202	Material Science and Mechanical Behaviour of Materials	CO1	Summarize ductile and brittle type fractures using different theories.
		CO2	Integrate design considerations in mechanical behaviour of advanced materials.
		CO3	Review strengthening mechanisms of materials and selection of materials
502203	Advanced Stress Analysis	CO1	Solve the problems related to the theory of elasticity.
		CO2	Analyze two dimensional problems in rectangular as well as polar co-ordinates.
		CO3	Find shear center for various cross section.
		CO4	Determine membrane stresses in shell and storage vessel.
		CO5	Interrupt torsion of bars with various cross sections.
		CO6	Solve problem based on contact stresses.
502104	Research Methodology	CO1	Conduct literature survey by using various research considerations.
		CO2	Formulate the problem statement using research considerations.
		CO3	Demonstrate knowledge and understanding of data analysis in relation to the research process.
		CO4	Interpret the analysis perfomed in relation to the research process.
502205	**Elective I**		
	Energy Audit & Management	CO1	Compare energy scenario of India and World.
		CO2	Carry out Energy Audit of the Residence / Institute/ Organization.
		CO3	Identify and evaluate energy conservation opportunities in Thermal Utilities.
		CO4	Identify and evaluate energy conservation opportunities in Electrical Utilities.
	Project Management	CO1	Understand the importance of projects and its phases.
		CO2	Analyse projects from marketing, operational and financial perspectives.
		CO3	Evaluate projects based on discount and non-discount methods.

		CO4	Develop network diagrams for planning and execution of a given project.
	Intellectual Property Rights	CO1	Appreciate the significance of Intellectual Property as a very important driver of growth and development.
		CO5	Apply crashing procedures for time and cost optimization
		CO2	Statutorily acquire and use different types of intellectual property in their professional life.

SEMESTER-II			
502207	Analysis and Synthesis of Mechanisms	CO1	Synthesize and analyse four bar mechanisms.
		CO2	Use computers for mechanism animation and analysis.
		CO3	Apply kinematic theories to real-world problems of mechanism design and synthesis.
502208	Advanced Mechanical Vibrations	CO1	Knowledge of fundamentals of Vibrations
		CO2	Considerably more in-depth knowledge of the major subject and ability to solve problems on Two degree freedom system, Multi degree freedom system
		CO3	Knowledge of Experimental Methods in Vibration Analysis.
		CO4	Understand and apply the methodology for dynamic Analysis.
		CO5	Understand Non-Linear Vibrations and Random Vibrations.
502209	Finite Element Method	CO1	Identify the concepts of idealization, discretisation and able to define the boundary conditions.
		CO2	Formulate element and global stiffness matrices.
		CO3	Evaluate results of finite element analysis.
		CO4	Identify sources of computational and physical errors of finite element analysis and its scope applicability.
		CO5	Implement the methodology of finite element analysis and Interpret numerical results.
		CO6	Use commercial finite element analysis software.
502210	**Elective II**		
	Acoustics & Noise Control – I&II	CO1	Knowledge of design for noise and vibration.
		CO2	Knowledge of signal process.
		CO3	Understanding hydrostatic and hydrodynamic lubrication.
		CO4	Understanding of NVH control strategies.
	Process Equipment Design	CO1	Understand the basic concepts in process design, block diagrams for flow of processes, material flow balance, design pressures and temperatures
		CO2	Able to do cost and profitability estimation
		CO3	Able to use optimization technique such as Lagrange's multiplier and golden section method.
		CO4	Able to implement different design codes like IS-2825, ASME-SECT, EIGHT-DIV-II TEMA.API-650, BS-1500 & 1515 in various PED.

SEMESTER-III			
602213	Optimization Techniques	CO1	Develop the ability to obtain the optimal solution for engineering problems.
		CO2	Model engineering problems and pose it as an optimisation problem.
		CO3	Apply the optimisation methods to design a mechanical system.
602214	Mechanical Measurements and Controls	CO1	Classify various types of static characteristics and types of errors occurring in the system.
		CO2	Classify and select proper measuring instrument for linear and angular displacement.
		CO3	Classify and select proper measuring instrument for pressure and temperature measurement.
		CO4	Design mathematical model of system/process for standard input responses.
		CO5	Analyse error and differentiate various types of control systems and time domain specifications.
		CO6	Analyse the problems associated with stability.
602215	**Elective III**		
	Industrial Tribology-I & II	CO1	Understand the role of Tribology in mechanical system design.
		CO2	Understanding of friction and wear phenomenon.
		CO3	Apply the concepts of tribology for design and operations of bearings and lubrication requirements.
		CO4	Insights into performance of Hydrostatic (externally-pressurized) & Elasto-Hydrodynamic Lubrication
		CO5	Knowledge of Rheodynamic (static) Lubrication
	Product Life Cycle	CO1	Understanding of product structure and architecture of the product families and similar products.
		CO2	Integrate lifecycle management strategies and knowledge to develop new and/or formulate appropriate engineering design solutions in engineering environment.
		CO3	Acquired engineering knowledge related to each phase of the life cycle through which the product passes with the usage of integrated software for monitoring and management.
		CO4	Incorporate preventive approaches concentrating on minimizing waste, hazard and risk associated with product design, development and manufacturing.