DEPARTMENT of MECHANICAL ENGINEERING

Vision

To be the centre for excellence and centre of learning for innovation, incubation and research in the domain of product design, thermal engineering and manufacturing technology thereby path finder for professionalism, entrepreneurship and new knowledge contributing to the common masses.

Mission

To educate and train undergraduate and post graduate students in Mechanical Engineering by inculcating the values for discipline, quality and transparency and profession development in the job and self-employment emphasis industry based practices.

Program Education Objectives (PEO's)

PEO1: To prepare technocrats that can satisfy the need of mechanical and allied industries.

PEO2: To develop critical thinking, problem solving skills, research aptitude and career and professionalism among the students.

PEO3: To improve and expand technical and professional skills of students through effective teaching-learning and industry interaction.

Programm Outcomes

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes(PSO's)

PSO1	Ability to design, analysis and problem solving skills using basic principle of mechanical engineering.
PSO2	Ability to impart technical and professional skills through industry institute interaction.
PSO3	Develop practical skills for the benefits of society.

Course Outcomes

Second Year (S.E.) Subjects Course Outcomes (2019 course)

Semester – I

After completion of course,

Subject Code	**Solid Mechanics (202041)**
C201.1	Students will be able to Calculate stress and strain developed on determinate and indeterminate members.
C201.2	Students will be able to Draw Shear force and bending moment diagram for various types of transverse loading and support
C201.3	Students will be able to Compute the slope & deflection, bending stresses and shear stresses on a beam.
C201.4	Students will be able to Calculate Torsional shear stress in shaft and buckling load on the column.
C201.5	Students will be able to Determine stresses on a 2-D element by applying the concept of principal stresses and theories of failure.
C201.6	Students will be able to Solve combined loading application based problems by using knowledge of Normal, Shear, Bending & Torsional stresses.

After completion of course,

Subject Code	Solid Modeling and Drafting (202042)
C202.1	Students will be able to understand basic concepts of CAD system, need and Product Lifecycle Management
C202.2	Students will be able to draw solid geometry by using knowledge of curves & surfaces
C202.3	Students will be able to construct solid models, assemblies using various modeling techniques
C202.4	Students will be able to apply geometric transformations to simple 2D geometries
C202.5	Students will be able to use CAD model data for various CAD based engineering applications viz. production drawings, 3D printing, FEA, CFD, MBD, CAE, CAM, etc.
C202.6	Students will be able to use Product & Manufacturing Information (PMI) and Model Based Definitions (MBD) approach for communication

After completion of course,

Subject Code	Engineering Thermodynamics (202043)
C203.1	Students should be able to describe the basics of thermodynamics with heat and work interactions
C203.2	Students should be able to apply laws of thermodynamics to steady flow and non-flow processes
C203.3	Students should be able to apply entropy, available and non-available energy for an open and closed system
C203.4	Students should be able to determine the properties of steam and their effect on performance of vapour power cycle
C203.5	Students should be able to analyse the fuel combustion process and products of combustion
C203.6	Students should be able to identify various instrumentations required for safe and efficient operation of steam generator

After completion of course,

Subject Code	Engineering Materials and Metallurgy (202044)
C204.1	Students should be able to determine miller indices and Identify imperfections in crystal.
C204.2	Students should be able to determine mechanical properties using destructive and non-destructive testing of materials.
C204.3	Students should be able to estimate different parameters of the system
C204.4	Students should be able to analyze effect of alloying element & heat treatment on properties of ferrous & nonferrous alloy
C204.5	Students should be able to identify appropriate ferrous materials for various applications
C204.6	Students should be able to identify appropriate non-ferrous materials for various applications.

After completion of course,

Subject Code	Electrical & Electronics Engineering (203152)
C205.1	Students will be able to APPLY programming concepts to UNDERSTAND role of Microprocessor and Microcontroller in embedded systems
C205.2	Students will be able to DEVELOP interfacing of different types of sensors and other hardware devices with Atmega328 based Arduino Board
C205.3	Students will be able to DEMONSTRATE working principle, speed control of DC machines and derive expression of torque for DC motor.
C205.4	Students will be able to DEMONSTRATE the working principle of Induction motor, its speed control methods and industrial applications.
C205.5	Students will be able to EXPLAIN different emerging technologies of Electric Vehicle (EV) and its modular subsystems
C205.6	Students will be able to IDENTIFY different energy storage devices and electrical drives for EVs

After completion of course,

Subject Code	Geometric Dimensioning and Tolerancing Lab (202045)
C206.1	Students should be able to SELECT appropriate IS and ASME standards for drawing
C206.2	Students should be able to ANALYZE variety of industrial drawings

C206.3	Students should be able to APPLY geometric and dimensional tolerance, surface finish symbols in drawing
C206.4	Students should be able to CALCULATE dimensional tolerance based on type of fit
C206.5	Students should be able to DESCRIBE DFM and DFA

Second Year(S.E.) Subjects Course Outcomes (2019 Course)

Semester – II

After completion of course,

Subject Code	**Engineering Mathematics -III (207002)**
C2O8.1	Students should be able to **solve** higher order linear differential equations.
C2O8.2	Students should be able to **apply** Laplace transform and Fourier transform to solve differential equations.
C2O8.3	Students should be able to **apply** Statistical methods (correlation, regression) for analyzing and interpreting experimental data pertaining to reliability engineering.
C2O8.4	Students should be able to **apply** Probability Distribution for testing and quality control.
C2O8.5	Students should be able to **solve** Vector fields by using vector differentiation and integration
C2O8.6	Students should be able to **apply** Partial differential equations for wave and 1D and 2D heat flow problems.

After completion of course,

Subject Code	**Kinematics of Machinery (202047)**
C209.1	Students should be able to demonstrate mechanisms in real life applications and calculate the degrees of freedom
C209.2	Students should be able to analyze velocity and acceleration of mechanisms by analytical methods
C209.3	Students should be able to analyze velocity and acceleration of mechanisms by graphical method
C209.4	Students should be able to synthesize a four bar and slider crank mechanism by analytical and graphical methods.

C209.5	Students should be able to apply fundamentals of gear theory as a prerequisite for gear design
C209.6	Students should be able to construct cam profile for given follower motions

After completion of course,

Subject Code	**Applied Thermodynamics (202048)**
C210.1	Students should be able to ANALYZE refrigeration system psychrometric processes
C210.2	Students should be able to DISCUSS basics of engine terminology, air standard, fuel air and actual cycles
C210.3	Students should be able to IDENTIFY factors affecting the combustion performance of SI and CI engines
C210.4	Students should be able to DETERMINE performance parameters of IC Engines and emission control
C210.5	Students should be able to EXPLAIN working of various IC Engine systems and alternative fuels
C210.6	Students should be able to CALCULATE performance of single and multi-stage reciprocating compressors

After completion of course,

Subject Code	**Fluid Mechanics (202049)**
C211.1	Students should be able to determine various properties of fluid
C211.2	Students should be able to apply the laws of fluid statics and concepts of buoyancy
C211.3	Students should be able to identify types of fluid flow and terms associated with fluid kinematics
C211.4	Students should be able to apply principles of fluid dynamics to laminar flow
C211.5	Students should be able to analyze friction and minor losses in internal flows and boundary layer formation over an external surface
C211.6	Students should be able to apply Buckingham's pi-theorem for dimensional analysis

After completion of course,

Subject Code	Manufacturing Processes (202050)
C212.1	Students should be able to explain casting processes.
C212.2	Students should be able to differentiate various metal forming processes.
C212.3	Students should be able to design dies and tools for sheet metal operations.
C212.4	Students should be able to identify different welding processes.
C212.5	Students should be able to describe polymer processing techniques.
C212.6	Students should be able to discuss composite manufacturing processes.

After completion of course,

Subject Code	Machine Shop (202051)
C213.1	Students should be able to produce spur gear on a milling machine using an indexing head.
C213.2	Students should be able to demonstrate surface grinding operation using surface grinder
C213.3	Students should be able to demonstrate sheet metal operations using die and press.
C213.4	Students should be able to prepare plastic components using molding operations.

After completion of course,

Subject Code	Project Based Learning - II (202052)
C214.1	Students should be able to identify the real-world problem (possibly of interdisciplinary nature) through a rigorous literature survey and formulate / set relevant aims and objectives.
C214 .2	Students should be able to analyze the results and arrive at valid conclusions.
C214 .3	Students should be able to propose a suitable solution based on the fundamentals of mechanical engineering by possibly integration of previously acquired knowledge.
C214 .4	Students should be able to contribute to society through proposed solutions by strictly following professional ethics and safety measures.
C214 .5	Students should be able to use of technology in proposed work and demonstrate learning in oral and written form.
C214 .6	Students should be able to develop ability to work as an individual and as a team member.

Third Year(T.E.) Subjects Course Outcomes (2019 Course)

Semester – I

After completion of course,

Subject Code	**Numerical & Statistical Methods (302041)**
C3O1.1	Students should be able to Solve a system of equations using direct and iterative numerical methods.
C3O1.2	Students should be able to Estimate solutions for differential equations using numerical techniques
C3O1.3	Students should be able to Develop solution for engineering applications with numerical integration
C3O1.4	Students should be able to Develop a mathematical equation using a curve fitting and regression analysis
C3O1.5	Students should be able to Apply statistical technique for quantitative data analysis
C3O1.6	Students should be able to Demonstrate the data, using the concepts of probability and linear algebra

After completion of course,

Subject Code	**Heat & Mass Transfer (302042)**
C302.1	Students should be able to understand the laws of Conduction, Convection and Radiation modes of heat transfer
C302.2	Students should be able to understand the properties and economics of thermal insulation and Analyze Heat transfer through fins and thermal systems with lumped heat capacitance.
C302.3	Students should be able to analyze the natural and forced convection heat transfer in various geometric configurations.
C302.4	Students should be able to realize various laws of radiation with their interrelations and analyze radiation heat transfer in black and grey bodies/surfaces with or without radiation shields
C302.5	Students should be able to understand the fundamentals and laws of mass transfer and its applications.
C302.6	Students should be able to analyze the heat exchanger equipments

After completion of course,

Subject Code	Design of Machine Elements (302043)
C303.1	Students should be able to design and analyze the cotter and knuckle Joints, levers and components subjected to eccentric loading.
C303.2	Students should be able to design shafts, keys and couplings under static loading conditions.
C303.3	Students should be able to analyze different stresses in power screws and apply those in the procedure to design screw jack.
C303.4	Students should be able to evaluate dimensions of machine components under fluctuating loads.
C303.5	Students should be able to evaluate the stress developed on the different type of welded and threaded joints.
C303.6	Students should be able to apply the design and development procedure for different types of springs.

After completion of course,

Subject Code	Mechatronics (302044)
C3O4.1	Students should be able to define key elements of mechatronics, principle of sensor and its characteristics.
C3O4.2	Students should be able to illustrate signal processing and interfacing systems such as ADC, DAC, digital I/O.
C3O4.3	Students should be able to determine the transfer function by using block diagram reduction technique.
C3O4.4	Students should be able to evaluate poles and zero, frequency domain parameter for mathematical modeling for mechanical system.
C3O4.5	Students should be able to apply the concept of different controller modes to an industrial application.
C3O4.6	Students should be able to develop the ladder programming for industrial application.

After completion of course,

Subject Code	Elective I - Machining Science & Technology (302045)
C3O5.1	Students should be able to analyze metal cutting Forces and mechanics of metal cutting and tool life.
C3O5.2	Students should be able to describe features of gear and thread manufacturing processes.

C3O5.3	Students should be able to select appropriate grinding wheels and demonstrate the various surface finishing processes.
C3O5.4	Students should be able to select appropriate jigs/fixtures and to draw the process plan for a given component.
C3O5.5	Students should be able to select and evaluate various parameters of process planning.
C3O5.6	Students should be able to generate CNC programs for Turning / Milling processes and generate tool path using CAM software.

After completion of course,

Subject Code	**Digital Manufacturing Laboratory (302046)**
C3O6.1	Students should be able to develop a component using conventional machines, CNC machines and Additive Manufacturing Technique.
C3O6.2	Students should be able to analyze cutting tool parameters for machining a given job.
C3O6.3	Students should be able to demonstrate simulation of the manufacturing process using Digital Manufacturing Tools.
C3O6.4	Students should be able to select and design jigs and Fixtures for a given component.
C3O6.5	Students should be able to demonstrate different parameters for CNC retrofitting and reconditioning.

After completion of course,

Subject Code	**Skill Development (302047)**
C3O7.1	Students should be able to demonstrate the procedure of assembly & disassembly of various machines.
C3O7.2	Students should be able to develop a working/model of machine parts or any new product.
C3O7.3	Students should be able to evaluate fault with diagnosis on the machines, machine tools and home appliances.
C3O7.4	Students should be able to identify the various activities performed in an industry such as maintenance, design of components, material selection.

Third Year (T.E.) Subjects Course Outcomes(2019 Course)

Semester – II

After completion of course,

Subject Code	Artificial Intelligence & Machine Learning (302049)
C309.1	Students should be able to DEMONSTRATE fundamentals of artificial intelligence and machine learning.
C309.2	Students should be able to APPLY feature extraction and selection techniques.
C309.3	Students should be able to APPLY machine learning algorithms for classification and regression problems.
C309.4	Students should be able to DEVISE a machine learning model using various steps.
C309.5	Students should be able to EXPLAIN concepts of reinforced and deep learning.
C309.6	Students should be able to SIMULATE machine learning model in mechanical engineering problems.

After completion of course,

Subject Code	Computer Aided Engineering (302050)
C310.1	Students should be able to **DEFINE** the use of CAE tools and **DESCRIBE** the significance of shape functions in finite element formulations.
C310.2	Students should be able to **APPLY** the various meshing techniques for better evaluation of approximate results
C310.3	Students should be able to **APPLY** material properties and boundary conditions to SOLVE 1-D and 2-D element stiffness matrices to obtain nodal or elemental solution.
C310.4	Students should be able to **DETERMINE** stress and deformation of CST Element
C310.5	Students should be able to **SOLVE** non-linear and dynamic analysis problem by computational method
C310.6	Students should be able to **UNDERSTAND** the application of CAE in the Domain of Mechanical Engineering

After completion of course,

Subject Code	Design of Transmission Systems (302051)
C311.1	Students should be able to **Design** Spur & Helical gears for industrial application and prepare a manufacturing drawing.
C311.2	Students should be able to **Design** Bevel & Worm gears for industrial application and prepare a manufacturing drawing.

C311.3	Students should be able to **SELECT** & **DESIGN** Rolling and Sliding Contact Bearings from manufacturer's catalogue for a typical application considering suitable design parameters.
C311.4	Students should be able to **DESIGN** various types of Clutches, Brakes, used in automobile.
C311.5	Students should be able to **DESIGN** Machine Tool Gear box for different applications.
C311.6	Students should be able to **ELABORATE** various modes of operation, degree of hybridization and allied terms associated with hybrid electric vehicles.

After completion of course,

Subject Code	**Elective II - Composite Materials(302052)**
C312.1	Students should be able to Compare composites with traditional materials
C312.2	Students should be able to Estimate different parameters of the Polymer Matrix Composite
C312.3	Students should be able to Categories Metal Matrix Process from possessions landscape
C312.4	Students should be able to Determine volume/weight fraction and strength of Composites
C312.5	Students should be able to Select appropriate testing and inspection method for composite materials
C312.6	Students should be able to Select composites materials for various applications

After completion of course,

Subject Code	**Measurement Laboratory (302053)**
C313.1	Students should be able to EVALUATE causes of errors in Vernier calipers, micrometers by performing experiments in standard metrological conditions.
C313.2	Students should be able to ANALYZE strain measurement parameters by taking modulus of elasticity in consideration to acknowledge its usage in failure detection and force variations.
C313.3	Students should be able to EXAMINE surface Textures/ finish using Talysurf and analyze surface finish requirements of metrological equipments
C313.4	Students should be able to MEASURE the dimensional accuracy using Comparator and limit gauges and appraise their usage in actual measurement or comparison with standards set to reduce measurement lead time.
C313.5	Students should be able to COMPILE the information of opportunities of entrepreneurships / business in various sectors of metrology like calibrations, testing, coordinate and laser metrology etc in an industry visit report.

After completion of course,

Subject Code	Fluid Power & Control Laboratory (302054)
C314.1	Students should be able to compare hydraulic and pneumatic systems
C314.2	Students should be able to apply the application of hydraulic & pneumatic system in real world
C314.3	Students should be able to analyze the component of hydraulic and pneumatic systems
C314.4	Students should be able to simulate hydraulic and pneumatic circuits in software
C314.5	Students should be able to design of hydraulic and pneumatic systems
C314.6	Students should be able to design & analyze hydraulic & Pneumatic system for automation

After completion of course,

Subject Code	Internship/Mini project (302055)
C315.1	Students should be able to DEMONSTRATE professional competence through industry internship.
C315.2	Students should be able to APPLY knowledge gained through internships to complete academic activities in a professional manner.
C315.3	Students should be able to CHOOSE appropriate technology and tools to solve given problem
C315.4	Students should be able to DEMONSTRATE abilities of a responsible professional and use ethical practices in day to day life.
C315.5	Students should be able to DEVELOP network and social circle, and DEVELOPING relationships with industry people.
C315.6	Students should be able to ANALYZE various career opportunities and DECIDE career goals.

Fourth Year (T.E.) Subjects Course Outcomes(2019 Course)

Semester – I

After completion of course,

Subject Code	Heating Ventilation Air-Conditioning and Refrigeration (402041)
C401.1	Students should be able to ANALYSE different air-craft refrigeration systems and Explain the properties, applications and environmental issues of different refrigerants.

C401.2	Students should be able to UNDERSTAND Multi-stage compression cycles and multistage evaporator systems.
C401.3	Students should be able to DISCUSS types of compressors, condensers, evaporators and expansion valves along with regulatory and safety controls and DESCRIBES Transcritical and ejector refrigeration systems.
C401.4	Students should be able to ESTIMATE cooling load for air conditioning systems used with concern of design conditions and indoor quality of air.
C401.5	Students should be able to DESIGN air distribution system along with consideration of ventilation and infiltration.
C401.6	Students should be able to EXPLAIN the working of types of desiccants, evaporative, thermal storage, radiant cooling, clean room and heat pump systems.

After completion of course,

Subject Code	**Dynamics of Machinery (402042)**
C402.1	Students should be able to Apply balancing technique for static and dynamic balancing of multi cylinder inline and radial engines.
C402.2	Students should be able to Analyze the gyroscopic couple or effect for stabilization of Ship, Airplane and Four wheeler vehicles.
C402.3	Students should be able to Estimate natural frequency for single DOF un-damped & damped free vibratory systems.
C402.4	Students should be able to Determine response to forced vibrations due to harmonic excitation, base excitation and excitation due to unbalance forces.
C402.5	Students should be able to Estimate natural frequencies, mode shapes for 2 DOF un-damped free longitudinal and torsional vibratory systems.
C402.6	Students should be able to Describe noise and vibration measuring instruments for industrial / real life applications along with suitable method for noise and vibration control.

After completion of course,

Subject Code	**Turbomachinery (402043)**
C403.1	Students should be able to **VALIDATE** impulse momentum principle using flat, inclined and curved surfaces and **INVESTIGATE** performance characteristics of hydraulic turbines

C403.2	Students should be able to **DETERMINE** performance parameters of impulse and reaction steam turbine along with discussion of nozzles, governing mechanism & losses.
C403.3	Students should be able to **MEASURE** performance parameters of single & multistage centrifugal pumps along with discussion of cavitation and selection.
C403.4	Students should be able to **EXPLAIN** performance parameters of centrifugal compressor along with discussion of theoretical aspects of axial compressor.

After completion of course,

Subject Code	**Elective – III Industrial Engineering (402044D)**
C404D.1	Students will be able to evaluate productivity and Implement various productivity improvement techniques.
C404D.2	Students will be able to apply work study techniques and Understand its importance for better productivity.
C404D.3	Students will be able to demonstrate the ability to select plant location, appropriate layout and material handling equipment.
C404D.4	Students will be able to use production planning and control tools for effective planning, scheduling and managing the shop floor control.
C404D.5	Students will be able to plan inventory requirements and Exercise effective control on manufacturing requirements.
C404A.6	Students will be able to apply ergonomics and legislations for human comfort at work place and understand the role of value engineering in improving productivity.

After completion of course,

Subject Code	**Elective – IV - Product Design and Development - (402045)**
C405A.1	Students should be able to **UNDERSTAND** Product design and Product development processes.
C405A.2	Students should be able to **UNDERSTAND** Processes, tools and techniques for Market Survey & Product Specification Finalization
C405A.3	Students should be able to **UNDERSTAND** Processes, tools and techniques for Concept Inception, Verification and selection.
C405A.4	Students should be able to **UNDERSTAND** Processes, tools and techniques for Concept Exploration & Development
C405A.5	Students should be able to **UNDERSTAND** Processes, tools and techniques for Design Verification and Validation
C405A.6	Students should be able to **UNDERSTAND** Processes, tools and techniques for Robust Design and Development

After completion of course,

Subject Code	Data Analytics Laboratory (402046)
C406.1	Students should be able to **UNDERSTAND** the basics of data analytics using concepts of statistics and probability.
C406.2	Students should be able to **APPLY** various inferential statistical analysis techniques to describe data sets and withdraw useful conclusions from acquired data set.
C406.3	Students should be able to **EXPLORE** the data analytics techniques using various tools
C406.4	Students should be able to **APPLY** data science concept and methods to solve problems in real world context
C406.5	Students should be able to **SELECT** advanced techniques to conduct thorough and insightful analysis and interpret the results

After completion of course,

Subject Code	Project (Stage - I) (402047)
C407.1	Students should be able to Implement systems approach.
C407.2	Students should be able to Conceptualize a novel idea / technique into a product.
C407.3	Students should be able to Think in terms of a multi-disciplinary environment.

Subject Code	Project (Stage - II) (402053)
C413.1	Students should be able to Take on the challenges of teamwork, and document all aspects of design work.
C413.2	Students should be able to Understand the management techniques of implementing a project.
C413.3	Students should be able to Demonstrate the final product for Functionality, Design ability, and Manufacturability.

Final Year (B.E.) Subjects Course Outcomes (2019 Course)

Semester – II

After completion of course,

Subject Code	Computer Integrated Manufacturing (402048)
C408.1	Students should be able to Explain CIM and factory automation.
C408.2	Students should be able to Understand the integration of hardware and software elements for CIM.
C408.3	Students should be able to Apply CNC program for appropriate manufacturing techniques.
C408.4	Students should be able to Analyze processes planning, quality and MRP integrated with computers.
C408.5	Students should be able to Interpret flexible, cellular manufacturing and group technology.
C408.6	Students should be able to Analyze the effect of IOT, industry-4.0 and cloud base manufacturing.

After completion of course,

Subject Code	Energy Engineering (402049)
C409.1	Students should be able to Describe power generation scenario and analyze Rankine cycle and Cogeneration cycle.
C409.2	Students should be able to Analyze steam condensers and illustrate the methods to control environmental impact of thermal power plant.
C409.3	Students should be able to Analyze hydroelectric power plant andexplain nuclear power plant.
C409.4	Students should be able to Analyze the performance of diesel power plant and gas power plant.
C409.5	Students should be able to Discuss various non-conventional power plants.
C409.6	Students should be able to Describe power plant instruments and to estimate the power plant economics.

After completion of course,

Subject Code	Elective - V (402050)
C410.1	Students should be able to EXPLAIN the energy need and role of energy management
C410.2	Students should be able to CARRY OUT an energy audit of the Institute/Industry/Organization
C410.3	Students should be able to ASSESS the ENCON opportunities using energy economics

C410.4	Students should be able to ANALYSE the energy conservation performance of Thermal Utilities
C410.5	Students should be able to ANALYSE the energy conservation performance of Electrical Utilities
C410.6	Students should be able to EXPLAIN the energy performance improvement by Cogeneration and WHR method

After completion of course,

Subject Code	**Elective - VI (402051)**
C411.1	Students should be able to DEMONSTRATE fundamental knowledge about need and scope of industrial - organizational psychology and behavior
C411.2	Students should be able to ANALYZE the job requirement, have understanding of fatigue, boredom and improve the job satisfaction
C411.3	Students should be able to UNDERSTAND the approaches to enhance the performance
C411.4	Students should be able to KNOWLEDGE of theories of organizational behavior, learning and social-system
C411.5	Students should be able to UNDERSTAND the mechanism of group behavior, various aspects of team, leadership and conflict management
C411.6	Students should be able to EVALUATE the organizational culture, manage the change and understands organizational development approaches

After completion of course,

Subject Code	**Mechanical Systems Analysis Laboratory (402052)**
C412.1	Students should be able to DEVELOP an understanding of the Systems Engineering Process and the range of factors that influence the product need, problem-specific information collection, Problem Definition, Task Specification, Solution Concept inception, Concept Development, System's Mathematical Modelling, Synthesis, Analysis, final solution Selection, Simulation, Detailed Design, Construction, Prototyping, Testing, fault-finding, Diagnosis,Performance Analysis, and Evaluation, Maintenance, Modification, Validation, Planning,Production, Evaluation and use of a system using manual calculation, computational tools to automate product development process, redesign from customer feedback and control of technological systems.

C412.2	Students should be able to ILLUSTRATE the concepts and USE the developed skill-set of use of computational tools (FEA, CFD, MBD, FSI, CAE) to automate the complete product development process.
C412.3	Students should be able to EVALUATE the knowledge of new developments and innovations in technological systems to carry forward to next stage of employment after passing your Undergraduate Degree Examination.
C412.4	Students should be able to APPRAISE how technologies have transformed people's lives and can be used to SOLVE challenges associated with climate change, efficient energy use, security, health, education and transport, which will be coming your ways in the coming future.
C412.5	Students should be able to PRIORITIZE the concept of quality and standards, including systems reliability, safety and fitness for the intended purpose.
C412.6	Students should be able to INVENT yourself to face the challenges of future technologies and their associated Problems.

After completion of course,

Subject Code	**Project (Stage - II) (402053)**
C413.1	Students should be able to Implement systems approach
C413.2	Students should be able to conceptualize a novel idea / technique into a product
C413.3	Students should be able to think in terms of a multi-disciplinary environment
C413.4	Students should be able to take on the challenges of teamwork, and document all aspects of design work
C413.5	Students should be able to understand the management techniques of implementing a project

Second Year (S.E.) Subjects(2015 course)

Semester – I

After completion of course,

Subject Code	**Engineering Mathematics-III (207002)**
C201.1	Students should be able to Solve higher order linear differential equations.
C201.2	Students should be able to Compute Laplace transform, fourier transform and use it to solve differential equation by using laplace transform method.

C201.3	Students should be able to Apply statistics methods like correlation, regression analysis in analyzing, interpreting experimental data and probability theory in testing.
C201.4	Students should be able to Use Vector differentiation to solve vector identities and directional derivatives, check irrotational and solenoidal vector fields.
C201.5	Students should be able to Apply Vector Integration to compute Line, surface and Volume Integrals.
C201.6	Students should be able to Solve partial differential equations such as wave equation, one and two dimensional heat flow equations.

After completion of course,

Subject Code	**Manufacturing Process-I (202041)**
C202.1	Students should be able to Describe casting processes and analyze gating system.
C202.2	Students should be able to Analyze metal forming processes.
C202.3	Students should be able to Describe plastic moulding processes.
C202.4	Students should be able to Describe metal joining processes.
C202.5	Students should be able to Analyze sheet metal working processes.
C202.6	Students should be able to Describe construction and Working of Centre Lathe.

After completion of course,

Subject Code	**Computer Aided Machine Drawing (202042)**
C203.1	Students should be able to demonstrate the need of different 3D modeling software used in industry.
C203.2	Students should be able to sketch 2-D drawing with proper constraints and dimensions
C203.3	Students should be able to sketch 3D parts using free form feature modeling.
C203.4	Students should be able to describe geometrical dimensioning and tolerances using ASME Y14.5.
C203.5	Students should be able to analyze the relationship between various components to sketch an assembly using proper constraints.
C203.6	Students should be able to sketch 2D production drawings of parts / assembly with appropriate dimension and tolerances.

After completion of course,

Subject Code	Thermodynamics (202043)
C204.1	Students should be able to Apply laws of thermodynamics to processes and real systems
C204.2	Students should be able to Determine heat, work and thermodynamic properties for ideal gas processes by using concept of Entropy
C204.3	Students should be able to Determine the performance of Thermodynamic gas power cycles and gas refrigeration cycle.
C204.4	Students should be able to Determine the condition of steam and performance of vapour power and vapour compression cycle
C204.5	Students should be able to Estimate Stoichiometric air required for combustion and performance of steam generators
C204.6	Students should be able to Determine properties related to Psychrometry and processes

After completion of course,

Subject Code	Material Science (202044)
C205.1	Students should be able to describe the fundamentals of crystal structure and determine the Miller indices.
C205.2	Students should be able to identify defects in crystal structure and discuss work hardening theory.
C205.3	Students should be able to demonstrate destructive and nondestructive testing methods.
C205.4	Students should be able to describe corrosion and preventive techniques.
C205.5	Students should be able to discuss surface modification techniques.
C205.6	Students should be able to apply powder metallurgy process for industrial applications.

After completion of course,

Subject Code	Strength of Materials (202045)
C206.1	Students should be able to determine stress and strain in mechanical components.
C206.2	Students should be able to calculate shear force & Bending moment in beams and draw Shear force & Bending moment diagram.
C206.3	Students should be able to compute Shear stresses & Bending stresses for beam section.
C206.4	Students should be able to calculate slope and deflection of beam and strain energy of mechanical components.

C206.5	Students should be able to determine stresses due to combined torsion, bending and axial force on shafts and analyze buckling of columns.
C206.6	Students should be able to compute Principal Stresses & Strains and apply theories of elastic failures.

Second Year(S.E.) Subjects Course Outcomes (2015 Course)

Semester – II

After completion of course,

Subject Code	**Fluid Mechanics (202045)**
C207.1	Students should be able to describe fluid properties and statics.
C207.2	Students should be able to analyze kinematics of fluid motion.
C207.3	Students should be able to apply Bernoulli's equation for flow measurement.
C207.4	Students should be able to analyze internal flow.
C207.5	Students should be able to determine the energy losses in pipes and dimensionless numbers.
C207.6	Students should be able to analyze external flow.

After completion of course,

Subject Code	**Soft Skills (202047)**
C208.1	Students should be able to evaluate self using SWOT analysis
C208.2	Students should be able to communicate effectively through oral presentation
C208.3	Students should be able to listen and write a report
C208.4	Students should be able to participate effectively in individual and group activity

After completion of course,

Subject Code	**Theory of Machines (202048)**
C209.1	Students should be able to demonstrate mechanisms in real life applications and calculate the degrees of freedom
C209.2	Students should be able to analyze static and dynamic force of slider crank mechanism and determine moment of inertia of rigid bodies experimentally and analytically
C209.3	Students should be able to analyze clutches, brakes and dynamometers

C209.4	Students should be able to analyze velocity and acceleration of mechanisms by analytical methods and to analyze Hook's joint
C209.5	Students should be able to analyze velocity and acceleration of mechanisms by relative velocity and ICR graphically.
C209.6	Students should be able to analyze velocity and acceleration of mechanisms involving coriolis component of acceleration graphically and slider crank mechanism by using Klien's construction

After completion of course,

Subject Code	**Engineering Metallurgy (202049)**
C210.1	Students should be able to describe fundamentals of Engineering Metallurgy.
C210.2	Students should be able to demonstrate microscopic and macroscopic techniques
C210.3	Students should be able to illustrate Iron Carbon Diagram.
C210.4	Students should be able to describe heat treatment and surface hardening processes.
C210.5	Students should be able to identify & designate alloy steels.
C210.6	Students should be able to discuss nonferrous metals for industrial applications.

After completion of course,

Subject Code	**Applied Thermodynamics (202050)**
C211.1	Students should be able to classify types of Engines and compare Air standard, Fuel Air and Actual cycles
C211.2	Students should be able to describe combustion phenomena in SI Engine
C211.3	Students should be able to describe combustion phenomena in CI Engine
C211.4	Students should be able to analyze performance of IC Engine
C211.5	Students should be able to illustrate I. C. Engine systems, emissions measurement and control
C211.6	Students should be able to analyze performance of reciprocating compressors

After completion of course,

Subject Code	**Electrical and Electronics Engineering (203152)**

C212.1	Students should be able to Demonstrate working principle, speed control of DC machines and derive expression of torque for DC motor.
C212.2	Students should be able to Demonstrate working principle of Induction motor, its speed control methods and industrial applications.
C212.3	Students should be able to Develop the capability to identify and select suitable special purpose motors and its speed control method for given industrial applications.
C212.4	Students should be able to Identify the features of microcontroller Atmega328P and Arduino IDE.
C212.5	Students should be able to Design program for LED, LCD and keypad interfacing using Arduino IDE.
C212.6	Students should be able to Demonstrate interfacing of temperature sensors, accelerometer and DC motor with Arduino.

After completion of course,

Subject Code	**Machine Shop I (202053)**
C213 .1	Students should be able to produce spur gear on a milling machine using an indexing head.
C213 .2	Students should be able to demonstrate surface grinding operation using surface grinder
C213 .3	Students should be able to demonstrate sheet metal operations using die and press.
C213 .4	Students should be able to prepare plastic components using molding operations.

Third Year(T.E.) Subjects Course Outcomes (2015 Course)

Semester – I

After completion of course,

Subject Code	**Design of Machine Elements (302041)**
C301.1	Students should be able to identify failure modes for mechanical elements and design of machine elements based on strength

C301.2	Students should be able to design shaft, keys and couplings and prepare design report and detail drawings
C301.3	Students should be able to design machine elements subjected to fluctuating loads
C301.4	Students should be able to design power screw for screw jack and C- clamp and prepare design report and detail drawings
C301.5	Students should be able to design fasteners and welded joints subjected to different loading conditions
C301.6	Students should be able to design various Springs for strength and stiffness

After completion of course,

Subject Code	**Heat Transfer (302042)**
C302.1	Students should be able to Analyze one dimensional steady state without internal heat generation thermal system.
C302.2	Students should be able to Analyze fins and one dimensional steady state with internal heat generation thermal system.
C302.3	Students should be able to Analyze transient heat conduction systems and discuss thermal insulation.
C302.4	Students should be able to Analyze natural and forced convection heat transfer.
C302.5	Students should be able to Illustrate radiation heat transfer phenomenon.
C302.6	Students should be able to Analyze heat exchanger equipment's.

After completion of course,

Subject Code	**Theory of Machines - II (302043)**
C303.1	Students should be able to analyze spur gears kinematically.0
C303.2	Students should be able to analyze helical. Spiral. Bevel, and worm and worm gears.
C303.3	Students should be able to analyze epi-cyclic gear trains
C303.4	Students should be able to construct cam profile and analyze camp jump phenomenon for eccentric cam with flat faced follower.
C303.5	Students should be able to synthesize four bar and slider crank mechanism by analytical and graphical methods.

C303.6	Students should be able to determine the gyroscopic couple and its effect for Ship, Aero plane and automobile and able to choose appropriate drive for given application (stepped / stepless)

After completion of course,

Subject Code	**Turbo Machines (302044)**
C304.1	Students should be able to apply impulse- momentum principle to impact of jet.
C304.2	Students should be able to analyze the performance of impulse hydraulic turbines.
C304.3	Students should be able to analyze the performance of reaction hydraulic turbines.
C304.4	Students should be able to analyze the performance of steam turbines.
C304.5	Students should be able to analyze the performance of centrifugal pump.
C304.6	Students should be able to analyze performance of centrifugal and axial flow compressor.

After completion of course,

Subject Code	**Metrology and Quality Control (302045)**
C305.1	Students should be able to describe the basic concept of Metrology and apply knowledge of tolerance, limits & fits to gauge design.
C305.2	Students should be able to describe fundamentals of comparator, thread, gear and surface roughness.
C305.3	Students should be able to describe the advanced methods of measurement such as CMM, Laser M/C vision system.
C305.4	Students should be able to apply Quality Control techniques for Design Engineering and manufacturing
C305.5	Students should be able to plot a control chart for evaluating process & sampling inspection.
C305.6	Students should be able to describe the concept of Total Quality Management & ISO Standards.

After completion of course,

Subject Code	**Skill Development (302046)**
C306.1	Students should be able to identify different tools and tackles used in machine assembly shop

C306.2	Students should be able to understand practical aspect of each component in the assembly of machine
C306.3	Students should be able to assemble and disassemble machine components
C306.4	Students should be able to draw assembly and details of machine components.

Third Year(T.E.) Subjects Course Outcomes (2015 Course)

Semester – II

After completion of course,

Subject Code	**Numerical Methods and optimization (302047)**
C307.1	Students should be able to determine root of equation by Newton Raphson, bi-section and successive approximation method
C307.2	Students should be able to solve simultaneous equation by using Gauss elimination, Thomas algorithm ,Gauss Seidel and Jacobi iteration method
C307.3	Students should be able to determine optimum solution by using Graphical and Simplex method
C307.4	Students should be able to Solve ordinary and partial differential equation
C307.5	Students should be able to Evaluate appropriate numerical method to fit the best curve and solve complex interpolating mechanical problems.
C307.6	Students should be able to solve integration (single and double) by using Newton- cotes method and Gauss -Legendre quadrature method

After completion of course,

Subject Code	**Design of Machine Elements - II (302048)**
C308.1	Students should be able to apply principles of gear design to Spur gear and industrial Spur gear box.
C308.2	Students should be able to apply principles of gear design to Helical and Bevel gear and industrial Helical and Bevel gear box.
C308.3	Students should be able to analyse Rolling Contact Bearing and its selection from manufacturers catalogue.
C308.4	Students should be able to apply principles of gear design to Worm gear and industrial Worm gear box.

C308.5	Students should be able to design Belt drive and its selection from manufacturers' catalogue.
C308.6	Students should be able to design sliding contact Bearing.

After completion of course,

Subject Code	**Refrigeration and Air Conditioning (302049)**
C309.1	Students should be able to illustrate applications of refrigeration and air conditioning and describe different types of refrigerants
C309.2	Students should be able to analyze vapour compression and vapour absorption refrigeration systems
C309.3	Students should be able to analyze multiple pressure refrigeration systems
C309.4	Students should be able to analyze psychrometric processes and discuss human comfort.
C309.5	Students should be able to describe construction and working of air conditioning systems
C309.6	Students should be able to design and analyze the duct system

After completion of course,

Subject Code	**Mechatronics (302050)**
C310.1	Students should be able to understand working principle of sensors and actuators
C310.2	Students should be able to construct the block diagram of the mechatronics system.
C310.3	Students should be able to illustrate signal processing & interfacing systems
C310.4	Students should be able to develop the PLC ladder programming
C310.5	Students should be able to analyze the system in time and Frequency domain.
C310.6	Students should be able to implement PID control on real time systems

After completion of course,

Subject Code	**Manufacturing Process - II (302051)**
C311.1	Students should be able to construct Merchant's circle and compute process parameters for single point cutting tool
C311.2	Students should be able to describe construction and working of drilling, milling and broaching machines.
C311.3	Students should be able to illustrate grinding and super finishing processes..

C311.4	Students should be able to select appropriate advanced machining process for given application
C311.5	Students should be able to develop CNC program for turning and milling operations
C311.6	Students should be able to demonstrate jigs and fixture for variety of operations.

After completion of course,

Subject Code	**Machine Shop - II (302052)**
C312 .1	Students should be able to perform operations on lathe machine.
C312 .2	Students should be able to develop and execute turning job on CNC
C312 .3	Students should be able to draw and understand jigs and fixture drawings.
C312 .4	Students should be able to prepare process planning sheet for job.

After completion of course,

Subject Code	**Seminar (302053)**
C313.1	Students should be able to develop thought process for technical presentation
C313.2	Students should be able to review scientific research papers for the technical topic
C313.3	Students should be able to prepare technical report
C313.4	Students should be able to present technical report & work individually

Final Year (B.E.) Subjects Course Outcomes(2015 Course)

Semester – I

After completion of course,

Subject Code	**Hydraulics & Pneumatics (402041)**
C401.1	Students should be able to determine power & efficiency of hydraulic pumps
C401.2	Students should be able to analyse hydraulic actuators and power units.
C401.3	Students should be able to understand construction and working of fluid control valves.
C401.4	Students should be able to analyse hydraulic circuits.
C401.5	Students should be able to understand pneumatic systems.

C401.6	Students should be able to design hydraulic & pneumatic systems.

After completion of course,

Subject Code	**CAD CAM Automation (402042)**
C402.1	Students should be able to apply homogeneous transformation matrix for geometrical transformations for 2D CAD entities for basic geometrical transformations
C402.2	Students should be able to understand and apply parametric equations of curves and surfaces.
C402.3	Students should be able to understand and apply FEM for simple mechanical elements like beam, trusses etc
C402.4	Students should be able to generate CNC programme for turning/milling and generate tool path using CAM software.
C402.5	Students should be able to understand various advanced manufacturing techniques
C402.6	Students should be able to understand the basics and types of automation

After completion of course,

Subject Code	**Dynamics of Machinery (402043)**
C403.1	Students should be able to determine the natural frequency of a single degree of freedom free vibration system.
C403.2	Students should be able to evaluate vibration parameters of the forced vibration single degree of freedom system.
C403.3	Students should be able to estimate natural frequencies and mode shapes for free undamped two degree of freedom vibratory systems.
C403.4	Students should be able to apply balancing techniques for balancing problems of rotating and reciprocating machines.
C403.5	Students should be able to measure vibration characteristics and various methods of vibration control for real life problem.
C403.6	Students should be able to measure and control noise for industry and day today life problems.

After completion of course,

Subject Code	**Finite Element Analysis (402044)**
C404A.1	Students should be able to analyze different approaches used in FEA to solve engineering problems

C404A.2	Students should be able to determine displacements and stresses using 1D elements.
C404A.3	Students should be able to determine displacements and stresses using 2D elements.
C404A.4	Students should be able to Analyze isoparametric element and to solve numerical integration by using Gauss quadrature method
C404A.5	Students should be able to solve 1D steady state heat transfer problems using FEA methods
C404A.6	Students should be able to determine natural frequency of un-damped free vibration using FEA methods

After completion of course,

Subject Code	**Automobile Engineering (402045)**
C405A.1	Students should be able to select the transmission system like clutch, gearbox, differential based on necessity in vehicles
C405A.2	Students should be able to identify & select wheels, tyres & steering system
C405A.3	Students should be able to choose appropriate suspension & brake system for automobiles
C405A.4	Students should be able to analyze the performance of vehicle & identify safety requirement of vehicle
C405A.5	Students should be able to illustrate electrical system & accessories and diagnose the faults of automobile vehicles
C405A.6	Students should be able to describe construction and working of Electric vehicle, Hybrid electric vehicle & Solar Vehicle

After completion of course,

Subject Code	**Project 1 (402046)**
C406.1	Students should be able to Find out the gap between existing mechanical systems and develop new creative mechanical system
C406.2	Students should be able to learn about the literature review
C406.3	Students should be able to get the experience to handle various tools, tackles and machines

Final Year (B.E.) Subjects Course Outcomes (2015 Course)

Semester – II

After completion of course,

Subject Code	Energy Engineering (402047)
C407.1	Students should be able to describe power generation scenario and analyze Rankine cycle and Cogeneration cycle
C407.2	Students should be able to analyze steam condensers and illustrate the methods to control environmental impact of thermal power plant
C407.3	Students should be able to analyze hydroelectric power plant and explain nuclear power plant
C407.4	Students should be able to analyze the performance of diesel power plant and gas power plant
C407.5	Students should be able to discuss various non-conventional power plants
C407.6	Students should be able to describe power plant instruments and to estimate the power plant economics

After completion of course,

Subject Code	Mechanical System Design (402048)
C408.1	Students should be able to design machine tool gearboxes.
C408.2	Students should be able to apply the statistical considerations in design and analyze the defects and failure modes in components.
C408.3	Students should be able to design a belt conveyor for material handling systems.
C408.4	Students should be able to design cylinders and pressure vessels by using IS code.
C408.5	Students should be able to understand the selection of materials for design of I.C. engine components
C408.6	Students should be able to understand optimum design principles and apply it to mechanical components.

After completion of course,

Subject Code	Industrial Engineering (402049)
C409B.1	Students will be able to describe the role of industrial engineering and productivity improvement techniques.
C409B.2	Students will be able to implement concepts of method study
C409B.3	Students will be able to discuss work measurement techniques and determine standard time for a process.

C409B.4	Students will be able to analyze different aspects of production planning and control.
C409B.5	Students will be able to analyze facility design in manufacturing industries.
C409B.6	Students will be able to apply Industrial safety standards, financial management practices

After completion of course,

Subject Code	**Advanced Manufacturing Processes (402050)**
C410A.1	Students should be able to Select advanced metal forming processes for engineering application
C410A.2	Students should be able to Identify friction stir welding, coating and bonding processes
C410A.3	Students should be able to Analyze the basic mechanisms of hybrid non-conventional machining techniques
C410A.4	Students should be able to Select appropriate micro and nano fabrication techniques for engineering applications
C410A.5	Students should be able to Describe additive manufacturing technology for product development
C410A.6	Students should be able to Identify Material Characterization Techniques

After completion of course,

Subject Code	**Project II (402051)**
C411.1	Students should be able to understand the industrial project planning
C411.2	Students should be able to perform tests and analyze the results
C411.3	Students should be able to draw the conclusions and perform techno- commercial evaluation of the project