SE MECHANICAL SEMESTER-I	
Name Of Subject:	**Solid Mechanics**
Course Objectives:	
1	To acquire basic knowledge of stress, strain due to various types of loading.
2	To draw Shear Force and Bending Moment Diagram for transverse loading.
3	To determine Bending, Shear stress, Slope and Deflection on Beam.
4	To solve problems of Torsional shear stress for shaft and Buckling for the column.
5	To apply the concept of Principal Stresses and Theories of Failure.
6	To utilize the concepts of Solid Mechanics on application based combined mode of loading.
Course Outcomes:	
CO1	DEFINE various types of stresses and strain developed on determinate and indeterminate members.
CO2	DRAW Shear force and bending moment diagram for various types of transverse loading and support.
CO3	COMPUTE the slope & deflection, bending stresses and shear stresses on a beam.
CO4	CALCULATE torsional shear stress in shaft and buckling on the column.
CO5	APPLY the concept of principal stresses and theories of failure to determine stresses on a 2-D element.
CO6	UTILIZE the concepts of SFD & BMD, torsion and principal stresses to solve combined loading application based problems.
Name Of Subject:	**Solid Modeling and Drafting**
Course Objectives:	
1	To understand basic structure of CAD systems and their use to create geometric models of simple engineering parts
2	To introduce the curves and surfaces and their implement in geometric modeling
3	To apply basic concepts of 3D modeling, viewing and evaluate mass properties of components and assemblies
4	To apply geometrical transformations in CAD models
5	To understand data exchange standards and translators for various applications
6	To create engineering drawings, design documentation and use in manufacturing activities
Course Outcomes:	
CO1	UNDERSTAND basic concepts of CAD system, need and scope in Product Lifecycle Management
CO2	UTILIZE knowledge of curves and surfacing features and methods to create complex solid geometry
CO3	CONSTRUCT solid models, assemblies using various modeling techniques & PERFORM mass property analysis, including

CO4	APPLY geometric transformations to simple 2D geometries
CO5	USE CAD model data for various CAD based engineering applications viz. production drawings, 3D printing, FEA, CFD,
CO6	USE PMI & MBD approach for communication
Name Of Subject:	**Engineering Thermodynamics**
Course Objectives:	
1	To introduce the fundamentals of thermodynamics.
2	To understand the concepts of laws of thermodynamics.
3	To apply the concepts of thermodynamics towards open and closed systems.
4	To be acquainted with Entropy generation and Exergy Analysis.
5	To understand the behaviour of a Pure substance and to analyze Vapour power cycles.
6	To undertake the performance analysis of a steam generator.
Course Outcomes:	
CO1	DESCRIBE the basics of thermodynamics with heat and work interactions.
CO2	APPLY laws of thermodynamics to steady flow and non-flow processes.
CO3	APPLY entropy, available and non available energy for an Open and Closed System,
CO4	DETERMINE the properties of steam and their effect on performance of vapour power cycle.
CO5	ANALYSE the fuel combustion process and products of combustion.
CO6	SELECT various instrumentations required for safe and efficient operation of steam generator.
Name Of Subject:	**Engineering Materials and Metallurgy**
Course Objectives:	
1	To impart fundamental knowledge of material science and engineering.
2	To establish significance of structure property relationship.
3	To explain various characterization techniques.
4	To indicate the importance of heat treatment on structure and properties of materials.
5	To explain the material selection process.
Course Outcomes:	
CO1	COMPARE crystal structures and ASSESS different lattice parameters.
CO2	CORRELATE crystal structures and imperfections in crystals with mechanical behaviour of materials.

CO3	DIFFERENTIATE and DETERMINE mechanical properties using destructive and non-destructive testing of materials.
CO4	IDENTIFY & ESTIMATE different parameters of the system viz., phases, variables, component, grains, grain boundary, and
CO5	ANALYSE effect of alloying element & heat treatment on properties of ferrous & nonferrous alloy.
CO6	SELECT appropriate materials for various applications.
Name Of Subject:	**Electrical and Electronics Engineering**
Course Objectives:	
1	To understand Arduino IDE; an open source platform and its basic programming features
2	To interface Atmega328 based Arduino board with different devices and sensors
3	To study principle of operation of DC machines and speed control of DC motors
4	To know about three phase induction motor working and its applications
5	To get acquainted with Electric Vehicle (EV) technology and subsystems
6	To get familiar with various energy storage devices and electrical drives
Course Outcomes:	
CO1	APPLY programming concepts to UNDERSTAND role of Microprocessor and Microcontroller in embedded systems
CO2	DEVELOP interfacing of different types of sensors and other hardware devices with Atmega328 based Arduino Board
CO3	UNDERSTAND the operation of DC motor, its speed control methods and braking
CO4	DISTINGUISH between types of three phase induction motor and its characteristic features
CO5	EXPLAIN about emerging technology of Electric Vehicle (EVs) and its modular subsystems
CO6	CHOOSE energy storage devices and electrical drives for EVs
Name Of Subject:	**Geometric Dimensioning and Tolerancing Lab**
Course Objectives:	
1	To understand requirements of industrial drawings
2	To read, understand and explain basic Geometric Dimensioning & Tolerancing concepts
3	To apply various geometric and dimension tolerances based on type of fit
4	To include surface roughness symbols based on manufacturing process
5	To measure and verify position tolerances with applied material conditions
6	To understand requirements for manufacturing and assembly

Course Outcomes:	
CO1	SELECT appropriate IS and ASME standards for drawing
CO2	READ & ANALYSE variety of industrial drawings
CO3	APPLY geometric and dimensional tolerance, surface finish symbols in drawing
CO4	EVALUATE dimensional tolerance based on type of fit, etc.
CO5	SELECT an appropriate manufacturing process using DFM, DFA, etc.

SE MECHANICAL SEMESTER-II	
Name Of Subject:	**Engineering Mathematics - III**
Course Objectives:	
1	To make the students familiarize with concepts and techniques in Ordinary & Partial differential equations, Laplace transform & Fourier transform, Statistical methods, Probability theory and Vector calculus.
2	The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines.
Course Outcomes:	
CO1	SOLVE higher order linear differential equations and its applications to model and analyze mass spring systems.
CO2	APPLY Integral transform techniques such as Laplace transform and Fourier transform to solve differential equations involved in vibration theory, heat transfer and related mechanical engineering applications.
CO3	APPLY Statistical methods like correlation, regression in analyzing and interpreting experimental data applicable to reliability engineering and probability theory in testing and quality control.
CO4	PERFORM Vector differentiation & integration, analyze the vector fields and APPLY to fluid flow problems.
CO5	CO5.SOLVE Partial differential equations such as wave equation, one and two dimensional heat flow equations.
Name Of Subject:	**Kinematics of Machinery**
Course Objectives:	
1	To make the students conversant with kinematic analysis of mechanisms applied to real life and industrial applications.
2	To develop the competency to analyze the velocity and acceleration in mechanisms using analytical and graphical approach.
3	To develop the skill to propose and synthesize the mechanisms using graphical and analytical technique.
4	To develop the competency to understand & apply the principles of gear theory to design various applications.
5	To develop the competency to design a cam profile for various follower motions.
Course Outcomes:	
CO1	APPLY kinematic analysis to simple mechanisms
CO2	ANALYZE velocity and acceleration in mechanisms by vector and graphical method
CO3	SYNTHESIZE a four bar mechanism with analytical and graphical methods
CO4	APPLY fundamentals of gear theory as a prerequisite for gear design
CO5	CONSTRUCT cam profile for given follower motion
Name Of Subject:	**Applied Thermodynamics**
Course Objectives:	

1	To determine COP of refrigeration cycle and study Psychrometric properties and processes.
2	To study working of engine, Actual, Fuel-Air and Air standard cycle and its Performance.
3	To understand Combustion in SI and CI engines and factors affecting performance parameters
4	To study emission from IC Engines and its controlling method, various emission norms.
5	To estimate performance parameters by conducting a test on I. C. Engines.
6	To determine performance parameters of Positive displacement compressor.
Course Outcomes:	
CO1	DETERMINE COP of refrigeration system and ANALYZE psychrometric processes.
CO2	CO2.DISCUSS basics of engine terminology,air standard, fuel air and actual cycles.
CO3	IDENTIFY factors affecting the combustion performance of SI and CI engines.
CO4	DETERMINE performance parameters of IC Engines and emission control.
CO5	EXPLAIN working of various IC Engine systems and use of alternative fuels.
CO6	CALCULATE performance of single and multi stage reciprocating compressors and DISCUSS rotary positive displacement compressors
Name Of Subject:	**Fluid Mechanics**
Course Objectives:	
1	To understand basic properties of fluids.
2	To learn fluid statics and dynamics
3	To study basics of flow visualization
4	To understand Bernoulli's theorem and its applications.
5	To understand losses in flow, drag and lift forces
6	To learn to establish relation between flow parameters.
Course Outcomes:	
CO1	DETERMINE various properties of fluid
CO2	APPLY the laws of fluid statics and concepts of buoyancy
CO3	IDENTIFY types of fluid flow and terms associated in fluid kinematics
CO4	APPLY principles of fluid dynamics to laminar flow
CO5	ESTIMATE friction and minor losses in internal flows and DETERMINE boundary layer formation over an external surface
CO6	CONSTRUCT mathematical correlation considering dimensionless parameters, also ABLE to predict the performance of prototype using model laws
Name Of Subject:	**Manufacturing Processes**
Course Objectives:	
1	Describe various sand and permanent mould casting methods, procedure and mould design aspects.

2	Understand basics of metal forming processes, equipment and tooling.
3	Understand sheet metal forming operations and die design procedure.
4	Classify, describe and configure the principles of various welding techniques.
5	Understand plastic processing techniques.
6	To know about composites, its fabrication processes.
Course Outcomes:	
CO1	SELECT appropriate moulding, core making and melting practice and estimate pouring time, solidification rate and DESIGN riser size and location for sand casting process
CO2	UNDERSTAND mechanism of metal forming techniques and CALCULATE load required for flat rolling
CO3	DEMONSTRATE press working operations and APPLY the basic principles to DESIGN dies and tools for forming and shearing operations
CO4	CLASSIFY and EXPLAIN different welding processes and EVALUATE welding characteristics
CO5	DIFFERENTIATE thermoplastics and thermosetting and EXPLAIN polymer processing techniques
CO6	UNDERSTAND the principle of manufacturing of fibre-reinforce composites and metal matrix composites
Name Of Subject:	**Machine Shop**
Course Objectives:	
1	To understand the basic procedures, types of equipment, tooling used for sand casting and metal forming processes through demonstrations and/(or) Industry visits..
2	To understand TIG/ MIG/ Resistance/Gas welding welding techniques.
3	To acquire skills to handle grinding and milling machine and to produce gear by milling.
4	To acquire skills to produce a composite part by manual process.
Course Outcomes:	
CO1	PERFORM welding using TIG/ MIG/ Resistance/Gas welding technique
CO2	MAKE Fibre-reinforced Composites by hand lay-up process or spray lay-up techniques
CO3	PERFORM cylindrical/surface grinding operation and CALCULATE its machining time
CO4	DETERMINE number of indexing movements required and acquire skills to PRODUCE a spur gear on a horizontal milling machine
CO5	PREPARE industry visit report
CO6	UNDERSTAND procedure of plastic processing
Name Of Subject:	**Project Based Learning - II**
Course Objectives:	
1	To emphasize project based learning activities that are long-term, interdisciplinary and student-centric.

2	To inculcate independent and group learning by solving real world problems with the help of available resources.
3	To be able to develop applications based on the fundamentals of mechanical engineering by possibly applying previously acquired knowledge.
5	To be able to select and utilize appropriate concepts of mechanical engineering to design and analyze selected mechanical system.
4	To get practical experience in all steps in the life cycle of the development of mechanical systems: specification, design, implementation, and testing.
Course Outcomes:	
CO1	IDENTIFY the real-world problem (possibly of interdisciplinary nature) through a rigorous literature survey and formulate / set relevant aims and objectives.
CO2	ANALYZE the results and arrive at valid conclusions.
CO3	PROPOSE a suitable solution based on the fundamentals of mechanical engineering by possibly integration of previously acquired knowledge.
CO4	CONTRIBUTE to society through proposed solutions by strictly following professional ethics and safety measures.
CO5	USE of technology in proposed work and demonstrate learning in oral and written form.
CO6	DEVELOP ability to work as an individual and as a team member.

TE MECHANICAL SEMESTER-I	
Name Of Subject:	**Numerical Methods and Optimization**
Course Objectives:	
1	UNDERSTAND applications of systems of equations and solve mechanical engineering applications.
2	APPLY differential equations to solve the applications in the domain of fluid mechanics, structural, etc.
3	LEARN numerical integration techniques for engineering applications.
4	COMPARE the system's behavior for the experimental data.
5	INTERPRET Statistical measures for quantitative data.
6	ANALYZE datasets using probability theory and linear algebra.
Course Outcomes:	
CO1	SOLVE system of equations using direct and iterative numerical methods.
CO2	ESTIMATE solutions for differential equations using numerical techniques.
CO3	DEVELOP solution for engineering applications with numerical integration.
CO4	DESIGN and CREATE a model using a curve fitting and regression analysis.
CO5	APPLY statistical Technique for quantitative data analysis.
CO6	DEMONSTRATE the data, using the concepts of probability and linear algebra.
Name Of Subject:	**Heat and Mass Transfer**
Course Objectives:	
1	IDENTIFY the laws for different modes of heat transfer.
2	UNDERSTAND the properties and economics of thermal insulation and ANALYZE heat transfer through fins and thermal systems with lumped heat
3	ANALYZE the natural and forced convective mode of heat transfer in various geometric configurations.
4	UNDERSTAND AND REALIZE various laws with their interrelations and analyze Radiation heat transfer in black and grey bodies/surfaces with or
5	UNDERSTAND the fundamentals and laws of mass transfer and its applications.
6	ANALYZE various performance parameters for existing heat exchanger and DEVELOP methodologies for designing a heat exchanger under prescribed conditions and for a particular application, with references TEMA standards
Course Outcomes:	
CO1	ANALYZE & APPLY the modes of heat transfer equations for one dimensional thermal system.
CO2	DESIGN a thermal system considering fins, thermal insulation and & Transient heat conduction.
CO3	EVALUATE the heat transfer rate in natural and forced convection & validate with experimentation results.
CO4	INTERPRET heat transfer by radiation between objects with simple geometries, for black and grey surfaces.
CO5	ABILITY to analyze the rate of mass transfer using Fick's Law of Diffusion and understands mass diffusion in different coordinate systems.
CO6	DESIGN & ANALYSIS of heat transfer equipments and investigation of its performance.
Name Of Subject:	**Design of Machine Elements**
Course Objectives:	

1	UNDERSTAND the various design considerations, design procedure and select materials for a specific application
2	CALCULATE the stresses in machine components due to various types of loads and failure
3	ANALYZE machine components subjected to variable loading for finite and infinite life
4	DESIGN various machine components such as shafts, couplings, keys, screws, joints, springs
Course Outcomes:	
CO1	DESIGN AND ANALYZE the cotter and knuckle Joints, levers and components subjected to eccentric loading.
CO2	DESIGN shafts, keys and couplings under static loading conditions.
CO3	ANALYZE different stresses in power screws and APPLY those in the procedure to design screw jack.
CO4	EVALUATE dimensions of machine components under fluctuating loads.
CO5	EVALUATE & INTERPRET the stress developed on the different type of welded and threaded joints.
CO6	APPLY the design and development procedure for different types of springs.
Name Of Subject:	**Mechatronics**
Course Objectives:	
1	UNDERSTAND the key elements of mechatronics, principle of sensor and its characteristics.
2	UNDERSTAND the concept of signal processing and use of interfacing systems such as ADC, DAC, Digital I/O.
3	UNDERSTAND the block diagram representation and concept of transfer function.
4	UNDERSTAND the system modeling and analysis in frequency domain.
5	UNDERSTAND the system modeling and analysis in time domain, controller modes and its industrial applications..
6	UTILIZE the concepts of PLC system and its ladder programming and significance of PLC system in industrial application.
Course Outcomes:	
CO1	DEFINE key elements of mechatronics, principle of sensor and its characteristics.
CO2	UTILIZE concept of signal processing and MAKE use of interfacing systems such as ADC, DAC, Digital I/O.
CO3	DETERMINE the transfer function by using block diagram reduction technique.
CO4	EVALUATE Poles and Zero, frequency domain parameter for mathematical modeling for mechanical system.
CO5	APPLY the concept of different controller modes to an industrial application.
CO6	DEVELOP the ladder programming for industrial application.
Name Of Subject:	**Advanced Forming & Joining Processes (Elective I)**
Course Objectives:	
1	UNDERSTAND advances in sheet metal forming operations
2	UNDERSTAND the advanced special metal forming processes.
3	UNDERSTAND weld metallurgy and weld characterization techniques.
4	UNDERSTAND and describe various advanced solid state welding processes.
5	CLASSIFY AND DESCRIBE various advanced welding processes.
6	KNOW about sustainable manufacturing and its role in manufacturing industry

Course Outcomes:	
CO1	ANALYSE the effect of friction in metal forming deep drawing and IDENTIFICATION of surface defects and their remedies in deep drawing operations
CO2	ASSESS the parameters for special forming operation and SELECT appropriate special forming operation for particular applications
CO3	ANALYSE the effect of HAZ on microstructure and mechanical properties of materials
CO4	CLASSIFY various solid state welding process and SELECT suitable welding processes for particular applications
CO5	CLASSIFY various advanced welding process and SELECT suitable welding processes for particular applications.
CO6	CO6.INTERPRET the principles of sustainable manufacturing and its role in manufacturing industry.
Name Of Subject:	**Digital Manufacturing Laboratory**
Course Objectives:	
1	ACQUIRE skills to handle conventional machines and CNC machine for manufacturing of a component.
2	PREPARE manual part program for given component as per ISO standards.
3	ACCUSTOM skills of Additive manufacturing technology.
4	APPRECIATE the influence of cutting tool parameters on the performance.
5	APPLY Digital Manufacturing tools for process simulation of manufacturing processes.
6	SELECT appropriate type of jigs and fixtures for a given component
Course Outcomes:	
CO1	DEVELOP a component using conventional machines, CNC machines and Additive Manufacturing Techniques.
CO2	ANALYZE cutting tool parameters for machining given job.
CO3	DEMONSTRATE simulation of manufacturing process using Digital Manufacturing Tools.
CO4	SELECT and DESIGN jigs and Fixtures for a given component.
CO5	DEMONESTRATE different parameters for CNC retrofitting and reconditioning.
Name Of Subject:	**Skill Development**
Course Objectives:	
1	INTRODUCE the skills required in an industry such as design, development, assembly & disassembly.
2	DEVELOP the skills required for fault diagnose of engine and transmission of different automotive and various home appliances.
3	ESTABLISH the skills required for maintenance of any machine tool.
4	CREATE awareness about industrial environment.
Course Outcomes:	
CO1	APPLY& DEMONSTRATE procedure of assembly & disassembly of various machines.
CO2	DESIGN & DEVELOP a working/model of machine parts or any new product.
CO3	EVALUATE fault with diagnosis on the machines, machine tools and home appliances.
CO4	IDENTIFY & DEMONSTRATE the various activities performed in an industry such as maintenance, design of components, material selection.

TE MECHANICAL SEMESTER-II	
Name Of Subject:	**Artificial Intelligence & Machine Learning**
Course Objectives:	
1	ACQUAINT with fundamentals of artificial intelligence and machine learning.
2	LEARN feature extraction and selection techniques for processing data set.
3	UNDERSTAND basic algorithms used in classification and regression problems.
4	OUTLINE steps involved in development of machine learning model.
5	FAMILIARIZE with concepts of reinforced and deep learning.
6	IMPLEMENT AND ANALYZE machine learning model in mechanical engineering problems.
Course Outcomes:	
CO1	DEMONSTRATE fundamentals of artificial intelligence and machine learning.
CO2	APPLY feature extraction and selection techniques.
CO3	APPLY machine learning algorithms for classification and regression problems.
CO4	DEVISE AND DEVELOP a machine learning model using various steps.
CO5	EXPLAIN concepts of reinforced and deep learning.
CO6	SIMULATE machine learning model in mechanical engineering problems.
Name Of Subject:	**Computer Aided Engineering**
Course Objectives:	
1	UNDERSTAND the basic concepts of Computer Aided Engineering (CAE) and CHARACTERISTICS of various elements required for
2	NURTURE students about the discretization process and criteria for quality mesh.
3	UNDERSTAND the approaches of Finite Element Method (FEM) and to find displacement and stresses over the body.
4	DEVELOP the knowledge and skills needed to effectively evaluate the results using Finite Element Analysis (FEA).
5	APPLY computational technique to solve complex solid mechanics problems and its loading states.
6	STUDY the applications of CAE in the various domains of the Mechanical Engineering.
Course Outcomes:	
CO1	DEFINE the use of CAE tools and DESCRIBE the significance of shape functions in finite element formulations.
CO2	APPLY the various meshing techniques for better evaluation of approximate results.
CO3	APPLY material properties and boundary condition to SOLVE 1-D and 2-D element stiffness matrices to obtain nodal or elemental solution.
CO4	ANALYZE and APPLY various numerical methods for different types of analysis.
CO5	EVALUATE and SOLVE non-linear and dynamic analysis problems by analyzing the results obtained from analytical and computational method.
CO6	GENERATE the results in the form of contour plot by the USE of CAE tools.

Name Of Subject:	**Design of Transmission Systems**
Course Objectives:	
1	APPLY fundamentals for the design and/or selection of elements in transmission systems.
2	UNDERSTAND the philosophy that real engineering design problems are open-ended and challenging.
3	DEMONSTRATE design skills for the problems in real life industrial applications.
4	DEVELOP an attitude of team work, critical thinking, communication, planning and scheduling through design projects.
5	PERCEIVE about safety, ethical, legal, and other societal constraints in execution of their design projects.
6	BUILD a holistic design approach to find out pragmatic solutions to realistic domestic and industrial problems
Course Outcomes:	
CO1	APPLY the principle of Spur & Helical gear design for industrial application and PREPARE a manufacturing drawing with the concepts of GD&T.
CO2	EXPLAIN and DESIGN Bevel & Worm gear considering design parameters as per design standards.
CO3	SELECT&DESIGN Rolling and Sliding Contact Bearings from manufacturer's catalogue for a typical application considering suitable design parameters.
CO4	DEFINE and DESIGN various types of Clutches, Brakes, used in automobile.
CO5	APPLY various concept to DESIGN Machine Tool Gear box, for different applications
CO6	ELABORATE various modes of operation, degree of hybridization and allied terms associated with hybrid electric vehicles.
Name Of Subject:	**Composite Materials (Elective II)**
Course Objectives:	
1	DESCRIBE what are composite materials and their differences with respect to conventional materials.
2	COMPREHEND the challenges associated with Polymer Matrix composites.
3	UNDERSTAND the requirement of Metal Matrix Composites
4	RECOGNIZE design and properties aspect of composites
5	UNDERSTAND the testing, inspection and standard in Composites
6	ORIENT to the specific Application of Composites
Course Outcomes:	
CO1	DEFINE & COMPARE composites with traditional materials.
CO2	IDENTIFY & ESTIMATE different parameters of the Polymer Matrix Composite
CO3	CATEGORISE and APPLY Metal Matrix Process from possessions landscape.
CO4	DETERMINE volume/weight fraction and strength of Composites.
CO5	SELECT appropriate testing and inspection method for composite materials.

CO6	SELECT composites materials for various applications.
Name Of Subject:	**Measurement Laboratory**
Course Objectives:	
1	DEVELOP necessary skills for calibration and testing of instruments
2	APPLY fundamentals of measuring methods by collecting data ,analysis and interpretation
3	APPLY knowledge of Designing limiting gauges
4	APPLY knowledge of Electronic/Electrical measuring instruments
Course Outcomes:	
CO1	EVALUATE causes of errors in Vernier calipers, micrometers by performing experiments in standard metrological conditions, noting deviations at actual and by plotting cause and effect diagram, to reduce uncertainty in measurement.
CO2	ANALYZE strain measurement parameters by taking modulus of elasticity in consideration to acknowledge its usage in failure detection and
CO3	EXAMINE surface Textures, surface finish using equipment's like Talysurf and analyze surface finish requirements of metrological equipment's like gauges, jaws of vernier calipers, micrometers, magnifying glasses of height gauge and more, to optimize surface finish accuracy requirements and cost of measurement.
CO4	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.
CO5	PERFORM Testing of Flow rate, speed and temperature measurements and their effect on performance in machines and mechanisms like hydraulic or pneumatic trainers, lathe machine etc. to increase repeatability and reproducibility.
CO6	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.
Name Of Subject:	**Fluid Power & Control Laboratory**
Course Objectives:	
1	UNDERSTAND working principles of control devices and accessories.
2	SELECT different components from manufactures' catalogues.
3	DEMONSTRATE the capabilities to simulate and design fluid power systems.
4	UNDERTAKE digitalization of fluid power system.
Course Outcomes:	
CO1	DEFINE working principle of components used in hydraulic and pneumatic systems.
CO2	IDENTIFY & EXPLAIN various applications of hydraulic and pneumatic systems.
CO3	SELECT an appropriate component required for hydraulic and pneumatic systems using manufactures' catalogues.
CO4	SIMULATE & ANALYSE various hydraulic and pneumatic systems for industrial/mobile applications.
CO5	DESIGN a hydraulic and pneumatic system for the industrial applications.

CO6	DESIGN & DEMONESTRATE various IoT, PLC based controlling system using hydraulics and pneumatics.
Name Of Subject:	**Internship/Mini project**
Course Objectives:	
1	To encourage and provide opportunities for students to get professional/personal experience through internships.
2	To learn and understand real life/industrial situations.
3	To get familiar with various tools and technologies used in industries and their applications.
4	To nurture professional and societal ethics.
5	To create awareness of social, economic and administrative considerations in the working environment of industry organizations.
Course Outcomes:	
CO1	DEMONSTRATE professional competence through industry internship.
CO2	APPLY knowledge gained through internships to complete academic activities in a professional manner.
CO3	CHOOSE appropriate technology and tools to solve given problem.
CO4	DEMONSTRATE abilities of a responsible professional and use ethical practices in day to day life.
CO5	DEVELOP network and social circle, and DEVELOPING relationships with industry people.
CO6	ANALYZE various career opportunities and DECIDE career goals.

BE MECHANICAL SEMESTER-I	
Name Of Subject:	Heating, Ventilation, Air Conditioning and Refrigeration
Course Objectives:	
1	To understand and compare different refrigerants with respect to properties, applications and Environmental issues and air refrigeration systems.
2	To understand Multi stage compression cycles and multistage evaporator systems.
3	To understand various components, operating and safety controls employed in Refrigeration and air conditioning systems and advanced refrigeration systems.
4	To understand the basic air conditioning processes on psychometric charts, human comfort and to provide the knowledge of indoor and outdoor air
5	To study the ventilation and infiltration in air conditioning and duct design for various comfort conditions and industrial air conditioning systems.
6	To understand advanced A/C systems and heat pump.
Course Outcomes:	
CO1	ANALYSE different air-craft refrigeration systems and EXPLAIN the properties, applications and environmental issues of different refrigerants.
CO2	ANALYSE multi pressure refrigeration system used for refrigeration applications.
CO3	DISCUSS types of compressors, condensers, evaporators and expansion valves along with regulatory and safety controls and DESCRIBES Transcritical and ejector refrigeration systems.
CO4	ESTIMATE cooling load for air conditioning systems used with concern of design conditions and indoor quality of air.
CO5	DESIGN air distribution system along with consideration of ventilation and infiltration.
CO6	EXPLAIN the working of types of desiccants, evaporative, thermal storage, radiant cooling, clean room and heat pump systems.
Name Of Subject:	Dynamics of Machinery
Course Objectives:	
1	To conversant with balancing problems of machines.
2	To understand mechanisms for system control – Gyroscope.
3	To understand fundamentals of free and forced vibrations.
4	To develop competency in understanding of vibration in Industry.
5	To develop analytical competency in solving vibration problems.
6	To understand the various techniques of measurement and control of vibration and noise.
Course Outcomes:	
CO1	APPLY balancing technique for static and dynamic balancing of multi cylinder inline and radial engines.
CO2	ANALYZE the gyroscopic couple or effect for stabilization of Ship, Airplane and Four wheeler vehicles.
CO3	ESTIMATE natural frequency for single DOF un-damped & damped free vibratory systems.
CO4	DETERMINE response to forced vibrations due to harmonic excitation, base excitation and excitation due to unbalance forces.

CO5	ESTIMATE natural frequencies, mode shapes for 2 DOF un-damped free longitudinal and torsional vibratory systems.
CO6	DESCRIBE noise and vibration measuring instruments for industrial / real life applications along with suitable method for noise and vibration control.
Name Of Subject:	**Turbomachinery**
Course Objectives:	
1	To provide the knowledge of basic principles, governing equations and applications of Turbomachines.
2	To provide the students with opportunities to apply basic thermos-fluid dynamics flow equations to Turbomachines.
3	To explain construction and working principles of Turbomachines.
4	To evaluate the performance characteristics of Turbomachines.
Course Outcomes:	
CO1	VALIDATE impulse moment principle using flat, inclined and curved surfaces and INVESTIGATE performance characteristics of hydraulic turbines.
CO2	DETERMINE performance parameters of impulse and reaction steam turbine along with discussion of nozzles, governing mechanism & losses.
CO3	MEASURE performance parameters of single & multistage centrifugal pumps along with discussion of cavitation and selection.
CO4	EXPLAIN performance parameters of centrifugal compressor along with discussion of theoretical aspects of axial compressor.
Name Of Subject:	Industrial Engineering (Elective III)
Course Objectives:	
1	To introduce the concepts, principles, and framework of Industrial Engineering and Productivity enhancement approaches.
2	To familiarize the students with different time study and work measurement techniques for productivity improvement.
3	To introduce various aspects of facility design.
4	To acquaint the students with various components and functions of Production Planning and Control.
5	To acquaint the student about inventory management and approaches to control.
6	To acquire the students with concepts of ergonomics, value engineering and job evaluation.
Course Outcomes:	
CO1	EVALUATE the productivity and IMPLEMENT various productivity improvement techniques.
CO2	APPLY work study techniques and UNDERSTANDS its importance for better productivity.
CO3	DEMONSTRATE the ability to SELECT plant location, appropriate layout and material handling equipment.
CO4	USE of Production planning and control tools for effective planning, scheduling and managing the shop floor control.
CO5	PLAN inventory requirements and EXERCISE effective control on manufacturing requirements.
CO6	APPLY Ergonomics and legislations for human comfort at work place and UNDERSTANDS the role of value engineering in improving productivity.

Name Of Subject:	Additive Manufacturing (Elective IV)
Course Objectives:	
1	To know the principle, methods, possibilities and limitations as well as environmental hazards of Additive Manufacturing technologies.
2	To get familiar with the characteristics of the different materials used in Additive Manufacturing technologies
3	To explore the potential of additive manufacturing technologies in real life applications
Course Outcomes:	
CO1	USE and CLASSIFY the fundamentals of Additive Manufacturing Technologies for engineering applications.
CO2	IDENTIFY and CATEGORIZE the methodology to manufacture the products using light-based photo-curing, LASER based technologies and STUDY their applications, benefits.
CO3	SYNTHESIZE, RECOMMEND and DESIGN the suitable material and process for fabrication and build behavior of verities of product.
CO4	DESIGN and CONSTRUCT the AM equipment's for appropriate applications and the input CAD model.
CO5	DEVELOP the knowledge of additive manufacturing for various real-life applications.
Name Of Subject:	Data Analytics Laboratory
Course Objectives:	
1	To explore the fundamental concepts of data analytics.
2	To understand the various search methods and visualization techniques.
3	To apply various machine learning techniques for data analysis.
Course Outcomes:	
CO1	UNDERSTAND the basics of data analytics using concepts of statistics and probability.
CO2	APPLY various inferential statistical analysis techniques to describe data sets and withdraw useful conclusions from acquired data set.
CO3	EXPLORE the data analytics techniques using various tools
CO4	APPLY data science concept and methods to solve problems in real world context
CO5	SELECT advanced techniques to conduct thorough and insightful analysis and interpret the results

Name Of Subject:	Project (Stage I)
Course Objectives:	
1	To provide an opportunity of designing and building complete system or subsystems based on areas where the student likes to acquire specialized skills.
2	To obtain hands-on experience in converting a small novel idea / technique into a working model / prototype involving multi-disciplinary skills.
3	To embed the skill in a group of students to work independently on a topic/ problem/ experimentation selected by them and encourage them to think independently on their own to bring out the conclusion under the given circumstances of the curriculum period in the budget provided with the guidance of the faculty.
4	To encourage creative thinking processes to help them to get confidence by planning and carrying out the work plan of the project and to successfully complete the same, through observations, discussions and decision making process.

5	To get visibility in industry to Project and Project group
Course Outcomes:	
CO1	Implement systems approach.
CO2	To conceptualize a novel idea / technique into a product.
CO3	To think in terms of a multi-disciplinary environment.
CO4	To take on the challenges of teamwork, and document all aspects of design work.
CO5	To understand the management techniques of implementing a project.

BE MECHANICAL SEMESTER-II	
Name Of Subject:	**Computer Integrated Manufacturing**
Course Objectives:	
1	Understand and realize need of CIM and factory automation.
2	Learn to integrate hardware and software elements for CIM.
3	Generate and Integrate CNC program for appropriate manufacturing techniques.
4	Learn to integrate processes planning, quality and MRP with computers.
5	Know about flexible, cellular manufacturing and group technology.
6	Understand IOT, Industry-4.0 and cloud base manufacturing.
Course Outcomes:	
CO1	EXPLAIN CIM and factory automation.
CO2	UNDERSTAND the integration of hardware and software elements for CIM
CO3	APPLY CNC program for appropriate manufacturing techniques. manufacturing and group technology. CO6. ANALYZE the effect of IOT, Industry-4.0 and cloud base manufacturing.
CO4	ANALYZE processes planning, quality and MRP integrated with computers.
CO5	INTERPRET flexible, cellular
Name Of Subject:	**Energy Engineering**
Course Objectives:	
1	To study the energy scenario, the components of thermal energy based plant, improved Rankine cycle
2	To understand details of steam condensing plant, cooling tower system, analysis of condenser, the environmental impacts and methods to reduce various pollution from energy systems
3	To study layout, component details of diesel engine power plant, hydel and nuclear energy systems
4	To understand components; layout of gas and improved power cycles
5	To learn basic principles of energy management, storage and economics of power generation
6	To study the working principle , construction of renewable energy systems
Course Outcomes:	
CO1	EXPLAIN the power generation scenario, the layout components of thermal power plant and ANALYZE the improved Rankine cycle.
CO2	ANALYZE the performance of steam condensers, cooling tower system; RECOGNIZE an environmental impact of energy systems and methods to control the same.
CO3	EXPLAIN the layout, component details of diesel engine plant, hydel and nuclear energy systems.
CO4	ANALYZE gas and improved power cycles.
CO5	EXPLAIN the fundamentals of renewable energy systems.
CO6	EXPLAIN basic principles of energy management, storage and economics of power generation.

Name Of Subject:	**Quality & Reliability Engineering (Elective V)**
Course Objectives:	
1	To analyze and apply Quality & Reliability Tools to solve real-life problems.
2	To plot control charts and calculate process capability.
3	To ascertain System reliability for sustainable product design.
4	To find out FMEA and understand reliability centered Maintenance.
Course Outcomes:	
CO1	UNDERSTAND basic concepts of quality and RELATE various quality tools
CO2	DEVELOP analytical competencies to SOLVE problems on control charts and process capability.
CO3	UNDERSTAND fundamental concepts of reliability.
CO4	EVALUATE system reliability.
CO5	IDENTIFY various failure modes and CREATE fault tree diagram.
CO6.	UNDERSTAND the concept of reliability centered maintenance and APPLY reliability tests methods.
Name Of Subject:	**Process Equipment Design (Elective VI)**
Course Objectives:	
1	Understand the process flow diagrams (PFD) and design codes
2	Understand the content of piping and instrument diagrams (P&ID)
3	Understand the design of Cylindrical and Spherical Vessels and Thick Walled High Pressure Vessels
4	To enable students to apply the requirements of the relevant industry standards to the mechanical design of equipment’s used in the process industry and above ground atmospheric storage
Course Outcomes:	
CO1	INTERPRET the different parameters involved in design of process Equipments.
CO2	ANALYZE thin and thick walled cylinder
CO3	DESIGN cylindrical vessel, spherical vessel, tall vessels and thick walled high pressure vessels
CO4	DESIGN different process Equipments and select pump, compressor etc. and auxiliary services
CO5	EVALUATE Process parameters and their correlation CO6. APPLY the concepts of process equipment design for specific applications
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Course Outcomes:	
CO1	INTERPRET the different parameters involved in design of process Equipments.
CO2	ANALYZE thin and thick walled cylinder
CO3	DESIGN cylindrical vessel, spherical vessel, tall vessels and thick walled high pressure vessels
CO4	DESIGN different process Equipments and select pump, compressor etc. and auxiliary services
CO5	EVALUATE Process parameters and their correlation CO6. APPLY the concepts of process equipment design for specific applications
Name Of Subject:	**Mechanical Systems Analysis Laboratory**
Course Objectives:	
1	Develop an understanding of the Systems Engineering Process and the range of factors that influence the product need, concept development, system's mathematical modelling, analysis, synthesis, simulation, design, validation, redesign, planning, production, evaluation and use of a system using manual calculation, mathematical modelling, computational tools to automate product development process.
2	Understand the concepts of and use the developed skills in last three and half year of engineering studies for the design, construction, fault-finding, diagnosis, performance analysis, maintenance, modification, and control of technological systems.
3	Acquire knowledge of new developments and innovations in technological systems to be carried forward to next stage of employment after passing your Undergraduate Degree Examination.
4	Develop an understanding of 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.
5	Gain an awareness of quality and standards, including systems reliability, safety and fitness for the intended purpose.
6	Build yourself to face the challenges of future technologies and their associated Problems.
Course Outcomes:	
CO1	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.
CO2	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.
CO3	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. CO4. 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. CO5. PRIORITIZE the concept of quality and standards, including systems reliability, safety and fitness for the intended purpose. CO6. INVENT yourself to face the challenges of future technologies and their associated Problems.

CO4	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.
CO5	PRIORITIZE the concept of quality and standards, including systems reliability, safety and fitness for the intended purpose.
CO6	INVENT yourself to face the challenges of future technologies and their associated Problems.
Name Of Subject:	**Project (Stage II)**
Course Objectives:	
1	To provide an opportunity of designing and building complete system or subsystems based on areas where the student likes to acquire specialized
2	To obtain hands-on experience in converting a small novel idea / technique into a working model / prototype involving multi-disciplinary skills.
3	To embed the skill in a group of students to work independently on a topic/ problem/ experimentation selected by them and encourage them to think independently on their own to bring out the conclusion under the given circumstances of the curriculum period in the budget provided with the guidance of the faculty.
4	To encourage creative thinking processes to help them to get confidence by planning and carrying out the work plan of the project and to successfully complete the same, through observations, discussions and decision making process.
5	To get visibility in industry to Project and Project group
Course Outcomes:	
CO1	Implement systems approach.
CO2	To conceptualize a novel idea / technique into a product.
CO3	To think in terms of a multi-disciplinary environment.
CO4	To take on the challenges of teamwork, and document all aspects of design work.
CO5	To understand the management techniques of implementing a project.