

I YEAR -Subject Name: English

I YEAR

CO1	Recall and reproduce the theme in a given context
CO2	Interpret the contextual meaning of words
CO3	Appraising renowned personalities by reading their biographies and identify their special contribution
CO4	Examine the given content and comprehend the writers opinion
CO5	Express the students view in the given context with justification
CO6	Develop coherent, cohesive technical report

ELCS LAB- COS

CO1:	Adopt active listening skills(Exercise:1,3,5)
CO2:	Acquire standard pronunciation(Exercise: 4)
CO3 :	Develop effective Reading Skills (Exercise : 5)
CO4:	Communicate language confidently ensuring fluency, accuracy and intelligibility. (EX: 2,4,5)
CO5:	Compose concise, clear and coherent write ups (Exercise: 3)

Subject : Mathematics I

CO1	Solve system of equations , interpret the rank of a matrix and employ Diagonalization method.
CO2	Apply the concept of eigen values and eigen vectors to reduce quadratic forms to canonical forms.
CO3	Apply mean value theorems to a given function and relate the concept of maxima and minima to real life problems.
CO4	Evaluate improper , double and triple integrals and calculate the area and volume of given regions.
CO5	Formulate certain mechanical, electrical, biological systems in terms of ordinary differential equations and solve them.
CO6	Apply Laplace Transforms to solve Ordinary Differential equations.

Subject Name: Engg. Physics

Branch:

CO1	Classify the various types of bonding in solids, List their properties and bond strengths.
CO2	Classify different types of crystals and analyze the structures of solids by X-Ray diffraction.
CO3	Compare the properties of different types of particles, their behavior and solve their wave functions.
CO4	Choose the Dielectric and Magnetic materials based on their properties and Evaluate the strength of dipoles.
CO5	Examine normal light and LASER and apply the Principles of light in construction of optical fiber cables.
CO6	Distinguish different types of Semiconductor devices and examine their properties, Categorize Nano materials by fabrication methods and Elaborate architectural acoustics.

Subject Name: Engineering Chemistry

CO1	Explain different types of conductance, electrode, electrode potential, corrosion and determine EMF of a cell using Nernst equation.
CO2	Identify the materials & methods that prevent corrosion in a particular environment.
CO3	<ul style="list-style-type: none"> • Compare and contrast the chemical behavior & physical properties of polymers • Explain the setting and hardening of cement, • Classify different types of refractories and lubricants and • Elaborate the importance of nanotechnology in several engineering field.
CO4	Identify different types of boiler troubles, choose appropriate method for softening and cleaning of water.
CO5	Explain different sources of energy and determine Calorific value of fuel
CO6	Elaborate the different phases in the formation of alloys, distinguish between adsorption, absorption.

Subject Name: Engineering Physics/Engineering Chemistry(Lab)

CO1	Analyze the various properties of light and Determine the related parameters of light.
CO2	Discuss working of electronic components and built the circuits by selecting the appropriate components
CO3	Select modern instruments to elucidate concentration of unknown solutions.
CO4	Explain chemical equation and to Determine the equivalence point in Acid-Base titration.

CO5	Conclude the results based on Interpretation of data and graph.
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Subject Name: COMPUTER PROGRAMMING&DATA STRUCTURES

CO1	Demonstrate/Define computer System and Software development.
CO2	Design and develop programs involving selection structures and looping structures.
CO3	Manage large programs using functions and arrays.
CO4	Implement memory management techniques and string processing
CO5	Organize heterogeneous data and large amount of data in storage devices.
CO6	Implement different data structures to develop applications.

Subject Name: ENGINEERING DRAWING

Branch: Mech

CO1	Construct engineering curves of conics sections, cycloid curves, involutes
CO2	Construct projections of points, straight lines & planes inclined to one or
CO3	Construct Projections of solids and sectional solids inclined to one or both
CO4	Construct intersections of solids or penetrations of solids.
CO5	Convert orthographic projections to isometric and vice versa. Develop isometric views for objects.
CO6	Develop surfaces for cones, cylinders, prisms and pyramid projections. Draw perspective projections of planes and solids.

Lab Name: EWS/ITWS

Branch: Mech

CO1	Make use of carpentry tools, Fitting tools, Black smithy tools and tin smithy
CO2	Build electrical circuits commonly used in house wiring.
CO3	Develop sand moulds, welding joints, using relevant tools.
CO4	Demonstrate the use of power tools used in construction and wood working.

CO5	Identify the computer hardware and assemble the components.
CO6	Demonstrate the installation of windows and Linux operating system.

Subject Name: ENGINEERING MECHANICS

CO1	Analyse the system of forces and determine the resultant force
CO2	Apply Lami's theorem for bodies in equilibrium under a system forces
CO3	Describe the applications of friction and solve problems related to friction.
CO4	Determine centre of gravity and moment of inertia for different sections.
CO5	Describe the equations of motion for solid bodies and apply them to engineering problem solving.
CO6	Explain work-energy theorem and Apply it to various mechanics problems.

Year/Sem: II/I

Course Name: Mechanics of Solids

CO No.	Course Outcomes
CO1	Describe the concepts of stress and strain in solids.
CO2	Derive equations of shear force and bending moment in beams and solve them.
CO3	Derive Bending Equations and Determine Shear stress distribution across various beams sections.
CO4	Graphical methods and solve them.
CO5	Derive Equations of Theories of Failures.
CO6	Derive Torsion Equation & Explain stresses in thin seamless cylindrical shells and calculate their values.

Year/Sem: II/I

Course Name: Thermodynamics

CO No.	Course Outcomes
CO1	Define basic thermodynamics concepts like system, path process cycle etc.
CO2	Explain the laws of thermodynamics and apply them to closed, study flow systems.
CO3	Explain the properties of pure substance and their changes during phase transformations.
CO4	Apply the perfect gas laws in non-flow process
CO5	Apply the fundamentals of conservation of mass and energy, and properties of ideal gas mixtures in design and analysis of mechanical systems.
CO6	Evaluate the thermal performance of different heat engines and refrigeration cycles and calculate efficiency/coefficient of performance.

Year/Sem: II/I

Course Name: Metallurgy and Material Science

CO No.	Course Outcomes
CO1	Define different types of bonds and the relationship between structure and properties of metals and explain constitution of alloys and their phase diagrams.
CO2	Construct the equilibrium diagram and also identify various transformations taking place in different reactions.
CO3	Classify cast irons and steel based on the structure and properties.
CO4	Analyze the effect of heat treatment processes on various alloys and examine time-temperature transformations.
CO5	Compare non-ferrous metals with their alloys and explain the types of ceramic materials and their properties.
CO6	Recognize the important of composite materials that are widely used in present scenario and describe their characteristics.

Year/Sem: II/I

Course Name: Environmental Studies

CO No.	Course Outcomes
CO1	Relate the natural environment and its relationships with human activities.
CO2	Characterize and analyze human impacts on the environment.
CO3	Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.

CO4	Acquire practical skills for scientific problem-solving, including familiarity with laboratory and field instrumentation, computer applications, statistical and
CO5	Implement scientific research strategies, including collection, management, evaluation, and interpretation of environmental data.
CO6	Design and evaluate strategies, technologies, and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environments.

Year/Sem: II/I

Course Name: Probability and Statistics

CO No.	Course Outcomes
CO1	Calculate mean, median, mode and variance of a given random variable and by using Binomial, Poisson and Normal distribution.
CO2	Fit a regression line to data by using regression equations and also find the correlation between the variables.
CO3	List the samples by using sampling distribution with or without replacement and to find their mean and S.D of sampling distribution of means.
CO4	Test the hypothesis for large and small samples by using different tests.
CO5	Apply the Queuing theory to find idle time, service rate etc., of a system and queue
CO6	Classifies the states of Markov process and to understand about the random process, Markov process and Markov chains.

Year/Sem: II/I

Course Name: Electrical and Electronics Engineering

CO No.	Course Outcomes
CO1	Define conceptive knowledge on basics of electrical circuits, ohm's law, kirchoffs laws and basic instruments.
CO2	Explain the construction, operation and characteristics of DC machines
CO3	Explain the operation of the transformers the energy conversion process, AC machines and the constructional features.
CO4	Apply conceptive problems and apply knowledge on different semiconductor devices.
CO5	Describe the concepts, characteristics of diodes, transistors and discuss their applications.
CO6	Sketch electronic circuits with the various semiconductor devices and cathode ray oscilloscope.

Year/Sem: II/I

Course Name: Metallurgy & Mechanics of Solids Lab

CO No.	Course Outcomes
CO1	Examine the micro structure of pure metal and alloys using microscope.
CO2	Determine the hardenability of steel by jominy end quench test.
CO3	Determine the mechanical strength properties in tension, compression and shear using UTM.
CO4	Estimate the hardness number for metals and alloys using Brinells hardness test and Rockwell Hardness test.
CO5	Estimate the impact strength of metal using izod and charpy test.
CO6	Calculate Torsional strength of a specimen using Torsion testing machine, and strength in a helical spring.

Year/Sem: II/I

Course Name: Electrical and Electronics Engineering Lab

CO No.	Course Outcomes
CO1	Able to study the basic electronics and electrical devices.
CO2	Find circuit currents and voltages using Kirchhoff's laws.
CO3	Determine characteristics & efficiency for different machines.
CO4	Calculate the efficiency and regulation of a transformer.
CO5	Model the behavior of passive and active electronic components.
CO6	Analyze simple amplifier circuits using BJT, FET.

Year/Sem: II/II

Course Name: Mechanics of Fluids and Hydraulic Machines

CO No.	Course Outcomes
CO1	Define various properties of fluids and analyze the effect of those properties on the behavior of fluids in rest and in motion.
CO2	Describe the types of fluid flow and flow patterns and the concepts of boundary layer.
CO3	Apply the concepts of fluid flow for the kinematic and dynamic analysis of flows and discuss the applications of Bernoulli's equation and momentum equation.
CO4	Solve the problems on fluid flow through closed conduits and also calculate the hydrodynamic forces exerted by fluid jets.
CO5	Describe the constructional details and working of hydraulic turbines and also calculate their performance parameters.

CO6	Discuss the constructional details and working of centrifugal pumps and reciprocating pumps and evaluate their performances.
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Year/Sem: II/II

Course Name: Kinematics of Machinery

CO No.	Course Outcomes
CO1	Describe various types of links, and apply the principles of various mechanisms in various types of chains.
CO2	Calculate the velocity and acceleration of motion of links and instantaneous center in various machines.
CO3	Analysis hook's joint applications and the slider crank chain for displacement, velocity and acceleration.
CO4	Distinguish the various types of straight line motion mechanisms and select proper conditions for correct steering.
CO5	Formulate maximum velocity and acceleration during outward and return stroke during different types of follower motion in cams.
CO6	Explain different types of gear, gear trains and conditions for minimum number of teeth to avoid interference and velocity ratio.

Year/Sem: II/II

Course Name: Thermal Engineering-I

CO No.	Course Outcomes
CO1	Describe the constructional details and working of 2-stroke, 4-stroke SI and CI engines and explain about valve timing and port timing diagrams, fuel supply.
CO2	Describe the factors affecting combustion in SI and CI engines and distinguish between normal combustion and abnormal combustion.
CO3	Define the performance parameters of IC engines and describe various testing methods to produce performance characteristics.
CO4	Classify the compressors and describe their constructional details, working and applications.
CO5	Explain the thermodynamic analysis of reciprocating, centrifugal, axial flow compressors and positive displacement structure compressors and calculate their.
CO6	Explain the vapor compression and perform calculation to obtained coefficient of performance and related parameters.

Year/Sem: II/II

Course Name: Production Technology

CO No.	Course Outcomes
CO1	Explain basic concepts of Casting related to Moulding and Solidification, melting and gating procedures.
CO2	Distinguish the different welding processes, gas flames used for fabrication techniques in manufacturing sector.
CO3	Describe advanced welding processes like TIG and MIG, Brazing and Soldering processes.

CO4	Distinguish between Hot and Cold working of metals with respect to Rolling, Forging and Drawing in manufacturing components.
CO5	Perform calculation on Extrusion, Coining and Deep Drawing operations.
CO6	Describe different methods of producing plastics.

Year/Sem: II/II

Course Name: Machine Drawing

CO No.	Course Outcomes
CO1	Recall the conventional representation of various materials and machine components.
CO2	Produce the orthographic projections of various elements like keys, cotters and couplings and recall their proportions and dimensions.
CO3	Sketch the various connections of machine parts like riveted joints, bearings.
CO4	Combine and construct the assemblies of various machine parts like connecting rod, stuffing box and draw bar, their orthographic views.
CO5	Draw the orthographic projection and assembly drawings of lathe machine parts.
CO6	Sketch the orthographic projections of various valves used in industry.

Year/Sem: II/II

Course Name: Mathematics-II

CO No.	Course Outcomes
CO1	Find the root of an equation and obtain numerical solution for a given differential equation.
CO2	Solve a system of linear equations and determine the intermediate value of an univariate function.
CO3	Implement least square methods in curve fitting.
CO4	Evaluate integrals using Trapezoidal, Simpson's $1/3^{\text{rd}}$ and $3/8^{\text{th}}$ rules.
CO5	Find the numerical solutions of ODE by using Taylor's, Picard's, Euler's, Runge Kutta and various methods.
CO6	Formulate a partial differential equation for an unknown function and obtain its solution.

Year/Sem: II/II

Course Name: Production Technology Lab

CO No.	Course Outcomes
CO1	Make different types of patterns with consideration of design parameters using wood working lathe.
CO2	Making use of Arc, Butt, Spot and Gas welding techniques to produce joints.

CO3	Develop plastic components making use of plastic injection & blow moulding machines.
CO4	Develop sheet metal components using Hydraulic press.
CO5	Produce a casting of any machine component.
CO6	Make welded joints using TIG welding.

Year/Sem: II/II

Course Name: Mechanics of Fluids and Hydraulic Machines Lab

CO No.	Course Outcomes
CO1	Analyze the performance of Pelton wheel, Francis turbine and Kaplan turbine by drawing its performance curves.
CO2	Analyze the performance of centrifugal pump and reciprocating pump by drawing its performance curves.
CO3	Determine the coefficient of discharge for orifice meter, venturimeter by applying Bernoulli's equation.
CO4	Estimate the major and minor losses in a pipeline.
CO5	Apply momentum equation to determine impact of jet on vanes.
CO6	Verify Bernoulli's theorem and explain the equation.

Year/Sem: III/I

Course Name: Design of Machine Members-I

CO No.	Course Outcomes
CO1	Describe engineering design considerations and relate them to manufacturing
CO2	Choose proper materials for different machine elements depending on their physical and mechanical properties in the design process.
CO3	Describe different types of failure modes and various failure theories and apply in the design process.
CO4	Design fasteners, shafts, couplings, rivets, weld joints, gear belt drives in engineering application.
CO5	Determine the size of shaft for complex loading condition.
CO6	Design helical springs for static, fatigue and tensional loadings.

Year/Sem: III/I

Course Name: Metrology & Surface Engineering

CO No.	Course Outcomes
CO1	Explain the concepts of Limits, Fits and Tolerances and describe different standards of measurement.
CO2	Describe different instruments like sine bars and bevel protractor, microscope and gauges used in Linear and Angular measurements.
CO3	Distinguish between surface roughness and waviness of surfaces.
CO4	Evaluate errors in threads and wire size for measuring effective diameter of a thread.
CO5	Classify the comparators and describe their working.
CO6	Determine the surface texture, cleaning methods, coating procedures for corrosion-resistance and electroplating.

Year/Sem: III/I

Course Name: Dynamics of Machinery

CO No.	Course Outcomes
CO1	Describe the principle of gyroscope and analyze the stability of moving vehicles, cars, planes and ships.
CO2	Explain the effects of friction in machine components like screws and nuts clutches and perform design calculations and classify.
CO3	Determine the static and dynamic forces in planar mechanism.
CO4	Determine the size of flywheel in Engine components and select proper governor for the speed regulation of machines.
CO5	Distinguish different types of brakes and dynamometers and determine balancing of rotating and reciprocating masses using different methods.
CO6	Explain different types of vibrations and its effects in machine components.

Year/Sem: III/I

Course Name: Machine Tools

CO No.	Course Outcomes
CO1	Describe the metal cutting process and identify various cutting tools angles, tool materials.
CO2	Explain the constructional details of conventional and automatic lathe machines and illustrate the operations performed on them, tool attachments used.

CO3	Describe the principle of working and operations performed on machine tools like shaping, planing, slotting, drilling and boring etc.
CO4	Select the milling cutters for various operations, and compare various milling machines.
CO5	Compare the various surface finishing machines and their operations and explain constructional features and working of various grinding machines.
CO6	Classify the jigs and fixtures and describe their design principles with examples.

Year/Sem: III/I

Course Name: Managerial Economics and Financial Analysis

CO No.	Course Outcomes
CO1	Define the economic techniques in market dynamics and pricing methods.
CO2	Develop production function to carry out efficient productivity and cost analysis to determine price of a commodity
CO3	Organize basic resources of production function and value them for capital budget decisions
CO4	Decide an action for business objectives.
CO5	Evaluate the basic accounting functions & make use of accounting principles for financial analysis
CO6	Interpret the financial statement through ratio analysis for a company.

Year/Sem: III/I

Course Name: Thermal Engineering--II

CO No.	Course Outcomes
CO1	Describe a steam power cycle with its operational parameters and constraints, determine its heat input, power output and efficiency and be able to modify the cycle to
CO2	Classify steam boilers and also explain the thermodynamic analysis of nozzles
CO3	Analyze the working principle of impulse turbines and determine the work done and efficiency of the impulse turbines
CO4	Analyze the working of reaction turbines and determine the work done and efficiency of the reaction turbines
CO5	Compare the steam condensers and explain the working of different types of condensers
CO6	Discuss the principles of jet propulsion and rocket engineering and their thermodynamic analysis

Year/Sem: III/I

Course Name: Machine Tools & Metrology Lab

CO No.	Course Outcomes
CO1	Measure length, diameters, bores using micrometers.
CO2	Measure angles and tapers using bevel protractor and sine bar.
CO3	Measure surface roughness using taly surf.
CO4	Make use of lathe machine to perform step turning, taper turning, thread cutting and bending operations on specimens
CO5	Make of use milling machine to produce keyways and slots and drilling machine to produce holes
CO6	Make use of grinding machines to produce desired surface finish and tool angles.

Year/Sem: III/I

Course Name: Thermal Engineering Lab

CO No.	Course Outcomes
CO1	Analyse the performance of diesel engine, petrol engine and draw the performance curves by conducting load test
CO2	Prepare the heat balance sheet by experimenting with petrol/diesel engine.
CO3	Examine the components of fire tube and water tube boilers and compare their working principles
CO4	Experiment with reciprocating air compressor to determine its volumetric efficiency
CO5	Examine the working of two stroke and four stroke IC engine and draw its port timing and valve timing diagrams
CO6	Experiment with diesel engine/petrol to determine engine friction.

Year/Sem: III/II

Course Name: Heat Transfer

CO No.	Course Outcomes
CO1	Define modes of heat transfer and their basic and derive the governing equations.
CO2	Develop governing equations and solutions for transient heat conduction in simple geometries
CO3	Formulate and solve heat conduction equations with and without heat generation in composite walls and extended surfaces subjected to convective boundaries
CO4	Evaluate heat transfer coefficients for natural convection and forced convection in external and internal flows
CO5	Analyze heat exchanger performance by using LMTD method and NTU method.
CO6	Calculate radiation heat in space between black bodies and grey surfaces.

Year/Sem: III/II

Course Name: Finite Element Method

CO No.	Course Outcomes
CO1	Describe the concepts of stress and strain in solids and identify the necessary information required to conduct a structural analysis using finite element method
CO2	Assess the quality of finite element models of mechanical systems ex. Beams and trusses
CO3	Conducting a structural analysis using finite element method for tow dimensional system and axisymmetric problems
CO4	Applications of finite element methods in heat transfer problems
CO5	Dynamic analysis of mechanical systems by using finite element method
CO6	Describe the concepts of stress and strain in solids and identify the necessary information required to conduct a structural analysis using finite element method

Year/Sem: III/II

Course Name: Refrigeration and Air Conditioning

CO No.	Course Outcomes
CO1	Explain the bell Coleman cycle, vapor compression, vapor absorption cycle and perform calculation to obtained coefficient of performance and related
CO2	Describe the various types of evaporators, expansion valve, condensers and compressors used in refrigeration systems
CO3	Explain the working of steam jet refrigeration system, vortex refrigeration system and thermoelectric refrigeration systems
CO4	Identify the properties of air from psychrometric chart and perform load calculations on summer and winter air condition systems
CO5	Define psychrometric properties of air, human comfort conditions and effective temperature
CO6	An Ability to identify, formulate and solve engineering problems

Year/Sem: III/II

Course Name: Design of Machine Members-II

CO No.	Course Outcomes
CO1	Design machine elements and system of machine elements to successfully satisfy the function of the machine.
CO2	Analyze & design helical compression and tension springs with respect to static and dynamic radial loads design spur helical bevel & worm gears with respect to tooth
CO3	Compute equivalent radial loads for rolling contact bearing & select appropriate bearing for the application using printed & electronic catalog data.
CO4	Determine the speeds of gears in spur gear systems including planetary systems.
CO5	Determine stresses in a gear using the Lewis equation or the AGMA equation.
CO6	Calculate the life of ball or roller bearings.

Year/Sem: III/II

Course Name: Automobile Engineering

CO No.	Course Outcomes
CO1	Identify various Mechanical and Electrical components of automobile and explain their functions.
CO2	Describe the components of S.I and C.I engine fuel supply systems.
CO3	Illustrate the need for cooling system used in I.C engines and also describe the various ignition systems of C.I engines.
CO4	Outline the National and International pollution norms used in automotive engines.
CO5	Explain the working of clutches, gear boxes, propeller shafts, differential etc.
CO6	Analyze in suspension systems, steering and braking systems of automobile engines.

Year/Sem: III/II

Course Name: Heat Transfer Lab

CO No.	Course Outcomes
CO1	Determine experimentally the thermal conductivity of a metal rod, the overall heat transfer coefficient in a composite slab, lamp using and convection tubes.
CO2	Determine through experiment the heat transfer coefficient in natural and forced convection phenomena.
CO3	Measure the Stefan Boltzmann constant and emissivity using radiation principles.
CO4	Evaluate the performance of parallel flow and counter flow heat exchanges through experiments.
CO5	Demonstrate the working of a heat pipe and discuss its applications.

CO6	Experiment with tungsten/nichrome wire in a pool of boiling water to determine its critical heat flux.
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Year/Sem: III/II

Course Name: Advanced English Communication Skills Lab

CO No.	Course Outcomes
CO1	Accomplishment of sound vocabulary and its proper use contextually
CO2	Develop a flair for writing and a felicity with words and written expression especially in the professional context.
CO3	Enhance speaking ability to effectively take part in social and professional communication.
CO4	Gathering and organizing ideas relevantly and coherently for participation in debates and group discussions.
CO5	Preparing the students for facing interviews confidently & training them through mock interviews and face-to-face interviews, teleconferences & video conferences.
CO6	To enhance job prospects in today's competitive market.

Year/Sem: IV/I

Course Name: Power Plant Engineering

CO No.	Course Outcomes
CO1	Describe various sources of energy and resources available for power generation in India.
CO2	Describe the components, constructional details and plant layout for steam power plant and ash handling, coal handling methods in thermal power plants.
CO3	Describe the components, constructional details and plant layout for IC engine plant, Gas turbine plant and Hydro power plants.
CO4	Explain the operation, construction and working of various components of Hydro Electric plants.
CO5	Describes the various Non conventional sources and describe the components, constructional details and plant layout for extraction electrical energy from various Non
CO6	Define and formulate the various factors of plant load and economy and determine the performance parameters of Steam, Gas turbine, IC engine and Hydro electric power.

Year/Sem: IV/I

Course Name: Operations Research

CO No.	Course Outcomes
CO1	Formulate, differentiate and solve different types of Linear Programming Problems.

CO2	Distinguish between Transportation, Assignment and Travelling – Salesman problems and apply the appropriate methods to solve them.
CO3	Identify and evaluate problems related to Sequencing and Replacement
CO4	Correlate the concept of Game theory to industry
CO5	Model and solve problems using dynamic programming and Simulation techniques.
CO6	Demonstrate the knowledge and differentiate the various queuing models.

Year/Sem: IV/I

Course Name: CAD/CAM

CO No.	Course Outcomes
CO1	Describe the basic concepts and applications of CAD/CAM.
CO2	Model different objects in 2D and 3D by applying fundamentals of Computer Aided Modeling, Geometric modeling, Surface modeling and Solid modeling.
CO3	Write NC and CNC programming code by applying principles of Numerical Control systems.
CO4	Describe the concept of part family and methods of identifying the part families.
CO5	Describe computer aided process planning and various computer aided inspection methods in quality control.
CO6	Describe the basic components of computer integrated manufacturing and flexible manufacturing systems.

Year/Sem: IV/I

Course Name: Instrumentation and Control Systems

CO No.	Course Outcomes
CO1	Describe the generalized measurement system and its performance characteristics.
CO2	Identify the devices for the measurement of temperature, pressure, displacement and describe their working principles.
CO3	Explain the working of different types of transducers and their applications and instrumentation usage.
CO4	Illustrate the working of level indicator flow measuring devices and speed measurement devices.
CO5	Describe the working of vibrometer and accelerometer pick-ups and various humidity measurement devices.
CO6	Define the open loop and closed loop control systems and describe their characteristics with examples

Year/Sem: IV/I

Course Name: Robotics

CO No.	Course Outcomes
CO1	Identify components of industrial robot and describe their functions.
CO2	Analyze different types of transformations in robot motions.
CO3	Solve basic robot forward and inverse kinematics and Robot dynamics problems.
CO4	Represent the motion of a robot, plan the trajectory for a robot to avoid obstacles to follow a specified path in terms of mathematical expressions.
CO5	Describe different types of actuators, servomotors and feedback components used in robots.
CO6	Demonstrate the robot applications in manufacturing sectors like material handling, assembly and inspection.

Year/Sem: IV/I

Course Name: Unconventional Machining Processes

CO No.	Course Outcomes
CO1	Distinguish between conventional and unconventional machining processes.
CO2	Explain the constructional details and working of USM, AJM, WJM and AWJ machining processes.
CO3	Describe the constructional details and working of ECG, ECM, ECH, EDM, EDG and EDMC machines and their processes.
CO4	Calculate the machining time and metal removal rate in unconventional machining processes.
CO5	Describe the working of EBM, LBM and Plasma arc cutting process.
CO6	Compare various finishing process in unconventional machining processes.

Year/Sem: IV/I

Course Name: CAD/CAM Lab

CO No.	Course Outcomes
CO1	Develop 2D and 3D models in a computer using model computer software like AutoCAD, CATIA /Pro E etc.
CO2	Determine the deflection, stresses and strains in loaded mechanical components using CAD software like Ansys.
CO3	Evaluate the heat transfer coefficient and estimate heat losses in conduction and convection phenomena using CAD software like Fluent, Ansys CFX etc.
CO4	Make use of CNC lathe and CNC milling machines to produce mechanical components by implementing CNC part programming.

CO5	Develop CNC part programs to perform various machining operations.
CO6	Make use of CAM software to develop process sheets and tool management

Year/Sem: IV/I

Course Name: ICS & PDP Lab

CO No.	Course Outcomes
CO1	Recall and label the conventional representation of machine parts used in
CO2	Construct the various types of fits, determine their limits and indicate their
CO3	Develop detailed and part drawings from assembled drawings of machine
CO4	Improve the accuracy in measurements through calibration of gauges, transducers
CO5	Make use of seismic pick up to study mechanical vibrations.
CO6	Calibrate the photo and magnetic speed pickups used for measurement of speed.

Year/Sem: IV/II

Course Name: Production Planning and Control

CO No.	Course Outcomes
CO1	Explain objectives and functions of Production planning and control (PPC) and
CO2	Solve various production problems in industry by using forecasting methods and
CO3	Describe and Compare various Management techniques like MRP, ERP and LOB etc.
CO4	Experiment with various production scheduling techniques in the industry.
CO5	Apply various production control aspects while working in industry.
CO6	Describe latest techniques and use of computer resources in production planning

Year/Sem: IV/II

Course Name: Plant Layout & Material Handling

CO No.	Course Outcomes
CO1	Describe the design procedures and analyze different types of plant layouts.

CO2	Describe selection and implementation of product, Process and Group layouts.
CO3	Describe Group layout, fixed position layout, heuristics for plant layout
CO4	Classify and describe various material handling systems and its selection methods.
CO5	Calculate cost of material handling systems and its minimization.
CO6	Analyze the safety of material handling system

Year/Sem: IV/II

Course Name: Renewable Energy Sources

CO No.	Course Outcomes
CO1	Describe the collection of Solar Energy using different techniques and its Storage methods
CO2	Identify wind energy potential and describe the generation of electricity using wind mills
CO3	Identify the Biomass as a potential Renewable energy Source and its various applications
CO4	Describe the methods of harnessing the Geothermal, tidal, wave Ocean thermal energies
CO5	Describe the direct conversion methods using thermoelectric generators, MHD generators, fuel cells etc.
CO6	Identify different laws regarding thermodynamics and Faraday's laws of Current in detail