Vidya Jyothi Institute of Technology

(An Autonomous Institution)

(Accredited by NAAC & NBA, Approved by AICTE New Delhi & Permanently Affiliated to JNTUH)

Aziznagar Gate, C.B. Post, Hyderabad-500 075

B.Tech Mechanical Engineering

R15 Course Outcomes

After completing the course, the student will be able to …

I YEAR I SEM		
English-I/A11001	CO1	Demonstrate real life skills in the light of literature.
	CO2	Understand influential personalities, and practice human and professional values
	CO3	Explain new versions of technology for effective usage of human resources towards development and to avoid risks
	CO4	Identify principles and values to build collaborative knowledge and to cultivate social responsibility
	CO5	Enhance communication skills through grammar, vocabulary with emphasis on LSRW skills.
Mathematics-I/ A11002	CO1	Understand the term rank and Elementary Transformations of a Matrix, System of Equations.
	CO2	Compute Eigen values and corresponding Eigen vectors of a square matrix, finding Inverse and method of Diagonalization
	CO3	Evaluate the Mean value theorems and maxima and minima of functions of two variables
	CO4	Evaluate of improper integrals by using beta gamma functions and evaluation of double and triple integrals by tracing the region of integration
	CO5	Apply Laplace transform of various functions and solve the initial value problems by using Laplace transforms.
Engineering Physics-I/A11003	CO1	Analyze the crystal structures and identify defects in crystals
	CO2	Explain the diffraction, interference and polarization phenomenon of light

	CO3	Understand the basics of statistical mechanics and applications of LASERs in various fields
	CO4	Interpret the significance of Magnetic materials
	CO5	Explain fundamentals of Dielectrics and their applications
C Programming/ A11501	**CO1**	Explain the basics of computers and its Generations
	CO2	Solve problems using flowcharts, algorithms and programs
	CO3	Develop programs on control structures.
	CO4	Develop programs using Arrays, Strings and derived data types
	CO5	Design programs on functions
Electrical Graphics-I/ A11301	**CO1**	Analyze given solids and represent sectional views, developments and their intersections.
	CO2	Represent and differentiate Isometric and Orthographic projections
	CO3	Generate isometric and corresponding orthographic views of any given component.
	CO4	Visualize and draw the perspective view of a given solid.
	CO5	Appreciate the concepts of Computer Aided Drafting.
Engineering Mechanics -I/ A11302	**CO1**	Understand and apply the concepts of force, moment and their resolutions.
	CO2	Develop free body diagrams in system of forces.
	CO3	Analyze and apply the concepts of friction.
	CO4	Identify centroid for plane figures and centre of gravity for any given topology.
	CO5	Calculate area and mass Moment of Inertia for given cross-sections.
C Programming Lab/ A11581	**CO1**	Have Fundamental Concept On Basic Commands In Linux.
	CO2	Write, Compile And Debug Programs in C Language
	CO3	Formulate Problems and Implement in C Language.

	CO4	Choose Control Structures and Arrays to Solve Computing Problems in Real-World
	CO5	Implement Functions and Recursion
English Language Communication Skills Lab-I/ A11081	**CO1**	Facilitate computer-aided multimedia instruction enabling individualized and independent language learning.
	CO2	Improve accent and intelligibility in pronunciation of English through Ice breaking and JAM sessions
	CO3	Use vocabulary, glosses and pronunciation for appropriate usage of the target language.
	CO4	Develop learners' communicative ability through frequent exchange of ideas and discussions.
	CO5	Explain the concepts of verbal and non-verbal skills of communication useful in day-to- day life
Engineering Physics Lab /A11082	**CO1**	Understand the practical concept of stationary waves using Melde's apparatus
	CO2	Study the mechanical properties of material using Torsional pendulum
	CO3	Visualize the fundamental optical phenomenon like Interference, diffraction and Dispersion
	CO4	Study the basic Electrical characteristics of LED, RC circuits
	CO5	Identify the variation of magnetic field by Stewart and Gee's apparatus experimentally
Engineering Workshop/ A11381	**CO1**	Study and practice on workshop tools and their operations.
	CO2	Manufacture wooden and metallic components using carpentry and foundry respectively.
	CO3	Join two or materials using welding equipment.
	CO4	Fabricate ferrous components using blacksmithy technique
	CO5	Demonstrate skills on plumbing and machine shops trades.

I YEAR II SEM		
English-II/A12005	**CO1**	Acquire the real life skills in the light of literature.
	CO2	Develop managerial skills for successful careers. By making critical decisions
	CO3	Demonstrate physical and mental fitness with true sportsman spirit.
	CO4	Build collaborative knowledge and cultivate social responsibility.
	CO5	Enhance communication skills through grammar, vocabulary with emphasis on LSRW skills.
Mathematics-II/ A12006	**CO1**	Solve first order differential equations and their applications.
	CO2	Identify different types of higher order differential equations and their applications in engineering problems
	CO3	Apply Fourier series and defining it for various types of functions
	CO4	Evaluating the Fourier transforms of functions of single variable
	CO5	Justify integrals of functions or vector-related quantities over curves, surfaces, and domains in two- and three-dimensional space.
Engineering Physics-II/ A12007	**CO1**	Understand the principles of Quantum mechanics & free electron theory.
	CO2	Differentiate the types of solids based on band theory of solids and to understand the applications of optical fibers in various fields.
	CO3	Explain the basics of semiconductors and semiconductor devices
	CO4	Explain superconductivity and their applications in modern technology
	CO5	Identify the importance of Nanomaterials in various fields
Applied Chemistry/A12008	**CO1**	Understand the operating principles and the reaction mechanisms of batteries and fuel cells.
	CO2	Apply their knowledge for the protection of different metals from corrosion.
	CO3	Apply the concept of adsorption in various industries

	CO4	Apply the knowledge of fuels and lubricants in industry.
	CO5	Understand the various applications of advanced engineering materials.
Engineering Mechanics-II/ A12304	**CO1**	Analyze given system and find reaction forces in each member of Trusses.
	CO2	Identify the rigid body motion to compute velocity and acceleration.
	CO3	Understand the kinetics of rigid body in translation and rotation.
	CO4	Analyze the motion of bodies with and without considering cause of motion. Appreciate and apply the concept of Work-Energy method.
	CO5	Analyze the free vibration concepts from the fundamentals of Simple Harmonic Motion.
Engineering Graphics-II/ A12305	**CO1**	Analyze given solids and represent sectional views, developments and their intersections.
	CO2	Represent and differentiate Isometric and Orthographic projections
	CO3	Generate isometric and corresponding orthographic views of any given component.
	CO4	Visualize and draw the perspective view of a given solid.
	CO5	Appreciate the concepts of Computer Aided Drafting.
English Language Communication Skills Lab-II/ A12085	**CO1**	Build the language proficiency in English with emphasis on LSRW skills.
	CO2	Develop communication skills through various language learning activities.
	CO3	Summarize the nuances of English speech sounds, stress, rhythm, intonation and syllable division.
	CO4	Acquire and exhibit acceptable etiquette essential in social & professional settings.
	CO5	Improve the fluency in spoken English and neutralize mother tongue influence.

Engineering Physics /Applied Chemistry Lab/ A12086	**CO1**	Experiment on Melde's and Torsional pendulum with knowledge in waves and mechanics
	CO2	Visualize the fundamental optical phenomenon like Interference, diffraction and Dispersion
	CO3	Identify the basic Electrical characteristics of LED, RC circuits
	CO4	Apply Titrimetric analysis for estimating the quantity of the compound accurately.
	CO5	Handle instruments like conductometer and potentiometer for measuring conductance &emf value.
	CO6	Evaluate and record the physical properties like Viscosity and Surface tension

II YEAR I SEM		
Numerical Methods/ A13013	**CO1**	Develop skills in solving engineering problems involving Algebraic and transcendental equations.
	CO2	Acquires the knowledge of interpolation in predicting future out comes based on the present knowledge.
	CO3	Evaluating the Numerical Solutions for Integrals and Fitting of different types of curves to the given data
	CO4	Understand the various Numerical Methods to solve Initial Value Problems.
	CO5	To solve the initial and boundary value problems of differential equations which are essential in engineering applications
Electrical and Electronics Engineering/ A13207	**CO1**	Understand different electrical circuits and gain thorough knowledge about DC machines.
	CO2	Identify and formulate outcomes in the part of transformers.
	CO3	Appreciate the working of AC machines along with regulation and efficiency calculations. Know the working of different measuring instruments.
	CO4	Gain knowledge of PN junction diodes, transistor and rectifiers and analyzing characteristics.
	CO5	Understand the working principles of CRT and applications of CRO for measurement of voltage, current and frequency.
Mechanics of solids/A13308	**CO1**	Understand the concepts of stress, strain and material properties. Derive basic stress strain equations with appropriate assumptions.
	CO2	Appreciate the concepts of shear force and bending moments. Generate shear force and bending moment diagrams for any given beam problem.

	CO3	Determine the stresses and strains in the members subjected to bending and shear and interpret the stress distribution across various beams like rectangular, circular, triangular, I, T and angle sections.
	CO4	Calculate and analyze the slope and deflection of beams under different types of loadings.
	CO5	Analyze and compute stresses and strains in thin and thick cylinders.
Thermodynamics/ A13309	**CO1**	Identify thermodynamic systems, understand concepts of zeroth law, first law, work and heat interactions.
	CO2	State and illustrate second law of thermodynamics. Identify and explain concepts of entropy, enthalpy, specific energy, reversibility, availability and irreversibility
	CO3	Understand the concepts of phase transformation of pure substance.
	CO4	Appreciate the concepts of perfect gas laws. Analyze mixtures of perfect gases
	CO5	Understand power cycles and evaluate the performance
Metallurgy and Material Science/ A13310	**CO1**	Understand the structure of metals and constitution of alloys with phases.
	CO2	Understand the basic concepts of phase transformation during solidification and phase diagrams.
	CO3	Understand different heat treatment processes and their influence on properties of metals and alloys.
	CO4	Understand classifications of steels, cast irons and their alloys. Analyze the structure and properties of different non-ferrous metals.
	CO5	Know the classification, properties and applications of composite and ceramic materials.
Environmental Science/ A13011	**CO1**	Understanding the importance of Ecosystem and its Resources.
	CO2	Appreciate different types of natural resources and the means to utilize them.
	CO3	Identify diiferent root causes for pollution of environment and their control.
	CO4	Understand the impact of global environmental problems and their assessment.
	CO5	Know environmental policy, legislation, rules and regulations
Electrical and Electronics Engineering Lab/ A13282	**CO1**	Perform the tests on D.C. shunt machine, Single phase transformer and brake test on Three phase induction motor.
	CO2	Determination of regulation of alternator by synchronous impedance method.
	CO3	Perform brake test on D.C. shunt motor and determine the speed control methods on D.C. shunt motor.
	CO4	Perform input and output of CE characteristics and full wave rectifier with and without filters.

	CO5	Execute CE amplifiers, class A power amplifier and RC phase shift oscillator and micro processor
Metallurgy and Mechanics of solids Lab/ A13383	**CO1**	Understand the micro structures of pure metals, steels, cast irons, non-ferrous alloys and heat treated steels.
	CO2	Estimate the hardenability of steels by Jominy End Quench test.
	CO3	Determine the hardness of various treated and untreated steels by using Brinells hardness test &Rockwell hardness test.
	CO4	Conduct the direct tension test, torsion test, impact test and punch shear test on metal rod.
	CO5	Perform compression tests on spring and cube, bending test on Simply Supported and Cantilever Beam.

II YEAR II SEM		
Production Technology/ A14312	**CO1**	Understand the basic concepts of casting processes to make different engineering components of industrial applications
	CO2	Differentiate the types of welding processes and decide which type of process to be selected for any given industrial application.
	CO3	Recognize the differences between hot working and cold working processes and understand the processes of various forging operations.
	CO4	Understand the basic principles of sheet metal operations and known the principles of drawing and extrusion processes.
	CO5	Ability to know the processing of thermo setting and thermo plastics.
Kinematics of Machinery/ A14313	**CO1**	Understand working principles of different lower and higher pairs, mechanisms and their inversions.
	CO2	Mathematical modeling of mechanisms to compute velocity and accelerations of links.
	CO3	Understanding various steering gear mechanisms and Hooke's joint.
	CO4	Appreciate different cams and followers used in mechanical systems.
	CO5	Appreciate the concepts of velocity in gearing systems.
Thermal Engineering-I/ A14314	**CO1**	Understand the concepts of actual cycles and their analysis.
	CO2	Appreciate the working principles of four stroke and two stroke IC engines.
	CO3	Analyze the combustion phenomenon in SI & CI engines
	CO4	Understand the testing and performance of IC engines.
	CO5	Analyze the working of air compressors and evaluate their performance

Mechanics of Fluids and Hydraulic Machines/ A14315	**CO1**	Understand the basic mechanics of fluid statics.
	CO2	Understand the principles of flow and energy momentum equations.
	CO3	Analyze the losses in pipe flow, boundary layer, separation of flows, forces on different vanes. Able to quantify the flow of fluid in flow measurement instruments.
	CO4	Understand the working of hydraulic machinery and analyze their characteristic curves.
	CO5	Appreciate the working principles of pumps and their applications.
Machine Drawing/ A14316	**CO1**	Understand the conventional representation of materials used in machine drawing.
	CO2	Know various methods of dimensioning and general rules.
	CO3	Draw the machine elements including screw threads, keys, couplings and bearings.
	CO4	Draw the machine elements including cotters, knuckle, riveted, and bolted joints.
	CO5	Construct an assembly drawing using part drawings of machine components.
Probability and Statistics/ A14015	**CO1**	Demonstrate an understanding of the basics concepts of probability, random variables, binomial and normal distributions.
	CO2	Understand the concept of the sampling distribution ofa statistics, and in particular describe the behavior of the sample mean.
	CO3	Use the normal distributions to test statistical hypotheses and to Compute confidence intervals.
	CO4	Application of regression analysis to analyze a problem.
	CO5	Application of control charts for quality control and measurement of trends.
Production Technology Lab/ A14384	**CO1**	Understand pattern designs & making, test sand properties and perform moulding, melting & casting
	CO2	Attain knowledge on arc and spot welding processes and able to perform them.
	CO3	Analyze and select suitable welding process based on the type of material used.
	CO4	Study different mechanical press working operations and perform operations like blanking, piercing, deep drawing, extrusion and bending operations
	CO5	Attain knowledge on processing of plastics and perform operations like injection moulding and blow moulding
Mechanics of Fluids and Hydraulic Machines Lab/	**CO1**	Practical exposure of using components like vacuum gauge, pressure gauge, manometers, pipes, motors, pumps, turbines.
	CO2	Measure fluid flow using Ventutimeter and Orificemeter.

A14385	**CO3**	Understand friction factor and minor losses in a pipe line
	CO4	Understand and calculate performance of turbines and pumps at constant speed and head.
	CO5	Know and understand the impact of jet on vanes and Bernoulli's theorem.

III YEAR I SEM		
Design of Machine Members-I/ A15317	**CO1**	Understand the design procedure and selection of material for a specific application. Analyze the simple stresses and strains in components.
	CO2	Appreciate variable stresses in mechanical components, fatigue analysis and fatigue theories of failure.
	CO3	Design fastened joints like riveted and welded joints.
	CO4	Design various joints like bolted joints, keys, cotter joints and knuckle joint.
	CO5	Design shafts for strength and rigidity. Design rigid and flexible shaft couplings.
Thermal Engineering-II/ A15318	**CO1**	Understand the basic concepts of rankine cycle and analyze improvements in rankine cycle, types of fuels and combustion, analysis of fuels and combustion, stoichiometry.
	CO2	Know the working principles of different types of boilers, mountings and accessories. Perform Thermodynamic analysis of nozzles.
	CO3	Analyze impulse and reaction steam turbines and subsequently apply to real time scenarios.
	CO4	Understand working of different types of gas turbines, efficiency improvements. Know the concepts and types of steam condensers.
	CO5	Appreciate different types of propulsive engines, thrust augmentation methods, rockets, propellant types.
Dynamics of Machinery/ A15319	**CO1**	Understand gyroscopic effects of rotating bodies for aero planes, naval ships, automobiles, and two wheelers. Perform static and dynamic force analysis of planar mechanisms.
	CO2	Compute friction in clutches, breaks and dynamometers.
	CO3	Diagrammatically represent turning moment and design flywheels. Understand the applications of Governors in mechanical systems
	CO4	Understand how to balance rotating and reciprocating masses in different planes.
	CO5	Perform calculations pertinent to several parameters of free and forced vibrations.
Machine tools and Metrology/ A15320	**CO1**	Understand the mechanics of metal cutting and working principles of lathe machines.
	CO2	Understand the working, classification, specifications and kinematic schemes of shaping, planing, drilling and boring machines.

	CO3	Know the operations of milling, grinding, lapping, honing and broaching machines.
	CO4	Understand the concepts of limits, fits and interchangeability. Design of GO and NO GO gauges
	CO5	Understand how to measure different parameters of surface roughness. Appreciate measurement of different dimensional parameters in screw threads.
Automobile Engineering/ A15321	**CO1**	Understand the components of four wheeler automobile engines. Appreciate the functions and importance of lubrication and cooling systems.
	CO2	Know about the fuel systems in SI engine and CI engines.
	CO3	Appreciate the functions and importance of ignition and electrical systems.
	CO4	Explain the working principles, types and importance of transmission and suspension systems
	CO5	Appreciate the working principles, types and importance of braking and steering systems. Understand the environmental implications of automobile emissions and application of various alternative fuels.
Elements of Mechanical engineering/ A15324	**CO1**	Understand the basic concepts of mechanical engineering.
	CO2	Applying principles of engineering mechanics in mechanism and machines
	CO3	Develop manufacturing methods to produce engineering components.
	CO4	Evaluating alternative designs for the engineering components
	CO5	Comparing various standards relevant to automobiles.
Thermal Engineering lab/ A15386	**CO1**	Investigate IC engines with varied parameters to evaluate the performance.
	CO2	Evaluate engine friction and heat balance of 4-stroke SI and CI engines.
	CO3	Determine A/F ratio, Volumetric Efficiency, Economical Speed and optimum cooling water temperature for IC engines.
	CO4	Acquire hands on experience on the assembly & disassembly of various IC engine parts
	CO5	Test performance of Reciprocating Air-compressor and understand the working of different types of boilers.
Metrology and machine Tools Lab/ A15387	**CO1**	Identify suitable instrument for measuring dimensions and surface roughness of a given component.
	CO2	Perform alignment and flatness tests on given machine and component.
	CO3	Perform wear resistance test and know the usage of tool makers microscope.
	CO4	Operate lathe, milling machines, drilling machine, grinding machines.
	CO5	Select suitable machining operation to fabricate the required product from the given raw material.

III YEAR II SEM		
Design of Machine Members-II/ A16326	**CO1**	Understand different sliding contact and rolling contact bearings and perform design calculations.
	CO2	Analyze design considerations of IC engine parts like piston, connecting rod and cylinder.
	CO3	Appraise the design of belt and rope drives used in power transmission. Understand the stresses, deflection and energy storage capacity of helical springs.
	CO4	Design spur and helical gear drives by calculating different parameters.
	CO5	Compute design parameters of bevel gear drives. Design power screws applied in various mechanical members.
Heat Transfer/ A16327	**CO1**	Understand the basic modes of heat transfer, steady and unsteady periodic heat transfer.
	CO2	Solve 1-D problems of steady state and transient conduction heat transfer.
	CO3	Appreciate concepts of convective heat transfer process and evaluate heat transfer coefficient for free and forced convection over exterior and interior surfaces with proper boundary conditions.
	CO4	Applying the boiling and condensation principles in the heat transfer equipment design. Analyze the performance of heat exchangers by LMTD and NTU methods.
	CO5	Analyze radiation heat transfer scenarios in black and gray bodies
Finite Element Methods/ A16328	**CO1**	Understand the basics of FEM, stress-strain relations and gain knowledge of Weighted Residual Methods and Variational Methods.
	CO2	Solve 1-D problems by applying the pertinent boundary conditions.
	CO3	Analyze and formulate finite element equations for 1-D planar truss element and beam element.
	CO4	Appreciate the treatment of CST, iso-parametric and axi-symmetric elements to solve 2-D problems.
	CO5	Analyze and solve 1-D and 2-D heat transfer problems using FEM. Formulate Finite element equations for a stepped bar and a beam using dynamic analysis.
Managerial Economics and Financial Analysis/ A16018	**CO1**	Analyze the scope of managerial economics.
	CO2	Apply managerial tools and techniques to attain optimal decisions
	CO3	Analyze how production function is carried out to achieve maximum output.
	CO4	Analyze changing business environment in post liberalization scenario.

	CO5	Evaluate and interpret the financial statements to make informed decisions.
Refrigeration and Air Conditioning/ A16329	**CO1**	Understand the basic concepts of refrigeration and thermodynamically analyze air refrigeration systems.
	CO2	Appreciate the working principle and thermodynamically analyze vapor compression refrigeration system.
	CO3	Classify basic components of vapor compression refrigeration system according to different criteria and understand their working. Identify the different refrigerants used in the field of refrigeration and air conditioning, and understand their desirable properties and nomenclature.
	CO4	Understand the working principles and thermodynamically analyze vapor absorption refrigeration system, steam jet refrigeration system and different non conventional methods of producing cooling effect.
	CO5	Estimate the air conditioning load for comfort and industrial applications by applying the principles of psychrometry. Appreciate the working of different air conditioning systems, their components, heat pump and different heat pump circuits.
Basic Automobile engineering/A16332	**CO1**	Understanding the basic structure of an automobile
	CO2	Evaluating different cooling and lubrication systems of an automobile
	CO3	Analyzing the electrical systems in tandem with ignition systems
	CO4	Comparing the various transmission systems for their effectiveness
	CO5	Understanding and there by implement the subsystems in the automobile for its low emission
Heat Transfer Lab/ A16388	**CO1**	Evaluate the amount of heat exchange for plane, cylindrical and spherical geometries
	CO2	Compare the performance of extended surfaces and heat exchangers.
	CO3	Measure heat transfer coefficient in free and forced convection and correlate with theoretical values.
	CO4	Perform tests on Emissivity, Stefan-Boltzmann and Critical Heat Flux apparatus.
	CO5	Demonstrate the working principle of heat pipe and compare convective heat transfer phenomena with phase change heat transfer processes.
Advanced English communication Skills Lab/ A16090	**CO1**	Listen to the speakers attentively, accurately and precisely to understand and respond appropriately in different contexts.
	CO2	Analyze and communicate intelligently while speaking with professionalism and enact different roles; engage themselves in preparing, organizing and delivering speeches, presentations etc
	CO3	Demonstrate command over English vocabulary and develop the ability to read intelligently and imaginatively for comprehending different contexts
	CO4	Master the mechanics of writing and practice it as a process and

		communicate the ideas relevantly and coherently
	CO5	Gain employability skills; develop leadership qualities and problem solving skills to apply them for careers at advanced levels in a wide range of English and enrich themselves to meet industrial needs

IV YEAR I SEM		
Operation Research/A17334	**CO1**	Model the real life situations with mathematical models. Understand the concept of linear programming.
	CO2	Solve transportation and assignment problems.
	CO3	Formulate the sequencing of jobs on machines. Understand the various replacement concepts.
	CO4	Identify and apply various inventory models.
	CO5	Apply queuing and dynamic programming models.
CAD/CAM/ A17335	**CO1**	Appreciate CAD/CAM principles and know the various input and output peripherals of computers. Understand geometric modeling principles.
	CO2	Develop mathematical models to represent surfaces and solids.
	CO3	Understand numerical control systems and develop CNC part programs.
	CO4	Understand the elements of group technology and computer aided process planning
	CO5	Acquire knowledge of Flexible Manufacturing Systems, Computer Aided Quality Control and Computer Integrated Manufacturing Systems.
Mechanical measurements and Instrumentation /A17336	**CO1**	Define basic terms related to measurements, understand measurement techniques.
	CO2	Understand working principles of various displacements, pressure and temperature measuring instruments.
	CO3	Describe the working, advantages, disadvantages and applications of various flow, level, speed, acceleration and vibration measuring instruments.
	CO4	Model and analyze various stress, strain, humidity, force, torque and power measuring instruments.
	CO5	Understand control systems and their applications.
Maintenance and safety engineering / A17344	**CO1**	Understanding the need for maintenance of a machine in an industry
	CO2	Identifying various maintenance policies

	CO3	Analyzing the cost and time concepts while implementing the maintenance
	CO4	Evaluating the quality concepts for safety and maintenance of an equipment
	CO5	Appreciating the terms reliability and maintainability with reference the maintenance of an equipment
Robotics/A17337	**CO1**	Understand the basic concepts of robotics and know the components of industrial robots. Analyze the motion of robots with respect to position and orientation.
	CO2	Model forward and inverse kinematics of robot manipulators.
	CO3	Model differential kinematics of robot manipulators. Formulate dynamic analysis equations for robotic manipulators.
	CO4	Plan the trajectory of robot. Know principles of different actuators and feedback components (sensors).
	CO5	Appreciate the industrial applications of robots.
Power Plant Engineering/A70353	**CO1**	Understand the layout of steam power plant and know different handling systems. Appreciate the working principles of various components responsible for combustion.
	CO2	Understand the layout of diesel power plant with detailed emphasis on its auxiliaries.
	CO3	Know the working of hydroelectric power plants and characteristics of hydrographs.
	CO4	Know the advantages, disadvantages & applications of nuclear power plants.
	CO5	Analyze and estimate different power plant economic factors and environmental considerations.
Computer Aided Design and Manufacturing Lab/A17389	**CO1**	Design 2D drawings using solid edge software
	CO2	Develop 3D cad models as per given dimensions
	CO3	Assemble of sub components in their working positions.
	CO4	Perform Finite Element Analysis and obtain results to any given problem.
	CO5	Prepare CNC programs and simulate the manufacturing process
Production Drawing Practice and Instrumentation Lab/A17390	**CO1**	Represent limits, fits, tolerances, surface roughness, heat and surface treatment symbols.
	CO2	Generate detailed and part drawings from assembly drawings.
	CO3	Calibrate pressure, flow, strain and displacement measuring instruments.

	CO4	Use magnetic and speed pickups for speed measurement.
	CO5	Calibrate different instruments used for temperature measurement
Industrial Oriented Mini Project/A80087	**CO1**	Interact with industry and get familiarized with its practices.
	CO2	Identify a topic in various areas of Mechanical Engineering.
	CO3	Review literature to identify gaps and define objectives & scope of the work.
	CO4	Generate and implement innovative ideas for social benefit.
	CO5	Develop a report that meets specified standards and defend the work.
IV YEAR II SEM		
Production Planning & Control/A18345	**CO1**	Understand the basic concepts of production planning and control.
	CO2	Appreciate principles and importance of forecasting techniques.
	CO3	Analysis of various inventory management and control systems. Plan the stock required based on various methods like MRP, ERP, LOB, JIT and other Japanese concepts.
	CO4	Know the factors of routing and schedule. Apply standard scheduling methods and line balancing.
	CO5	Appreciate dispatching procedure and application of computer in production planning and control.
Plant Layout & Material Handling/A18346	**CO1**	Understand different plant layouts, selection and comparison of process and product layouts.
	CO2	Understand heuristics for plant layouts like ALDEP, CORELAP and CRAFT.
	CO3	Get an overview of material handling systems and relationship between material handling and plant layout.
	CO4	Understand various methods of material handling like path and function oriented systems.
	CO5	Minimize cost of material handling with safety perquisites
Unconventional Machining Processes/A18347	**CO1**	Understand the need, importance and classification of various unconventional machining processes. Gain a thorough understanding of ultrasonic machining.
	CO2	Appreciate basic principles and process parameters of water jet, abrasive jet machining and electro-chemical machining processes.
	CO3	Appreciate thermal energy based machining processes with emphasis on surface finish and accuracy.
	CO4	Understand electron beam machining and laser beam machining

		along with applications.
	CO5	Know the advanced unconventional processes like plasma machining, chemical machining, magnetic abrasive finishing and abrasive flow finishing.
Seminar/ A183TS	**CO1**	Identify and compare technical and practical issues related to the area of course specialization.
	CO2	Outline annotated bibliography of research demonstrating scholarly skills.
	CO3	Prepare a well-organized report employing elements of technical writing and critical thinking.
	CO4	Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting.
	CO5	Communicate and articulate effectively so as to present the required technical content.
Project work/ A183P2	**CO1**	Identify methods and materials to carry out experiments.
	CO2	Reorganize the procedures with a concern for society, environment and ethics.
	CO3	Analyze and discuss the results to draw valid conclusions.
	CO4	Prepare a report as per recommended format and defend the work.
	CO5	Explore the possibility of publishing papers in peer reviewed journals/conference proceedings.
Comprehensive Viva/ A183CV	**CO1**	Comprehend the knowledge gained in the course work
	CO2	Infer principles of the working of various systems of mechanical engineering
	CO3	Demonstrate the ability of problem solving.
	CO4	Communicate effectively and enunciate the skills lucidly.
	CO5	Acquire profound knowledge on cutting edge technologies.