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

	CO1	Understand the basic mechanics of fluid statics.
Mechanics of Fluids and Hydraulic Machines/ A14315	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.

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IV YEAR II SEM

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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.

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B.Tech Mechanical Engineering
R18 Course Outcomes

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

I YEAR I SEM		
English A21001	**CO1**	Infer the importance of scientific discoveries in promoting social responsibilities.
	CO2	Comprehend the given texts and respond appropriately for technical and professional purposes.
	CO3	Communicate confidently and transfer information into various forms of writing.
	CO4	Understand the importance of health and nutrition for a better society.
	CO5	Present various forms of business writing skills for successful careers.
Mathematics-I A21002	**CO1**	Write the matrix representation of system of linear equations and identify the consistency of the system of equations.
	CO2	Find the Eigen values and Eigen vectors of the matrix and discuss the nature of the quadratic form.
	CO3	Analyze the convergence of sequence and series.
	CO4	Discuss the applications of mean value theorems to the mathematical problems, Evaluation of improper integrals using Beta and Gamma functions.
	CO5	Examine the extreme of functions of two variables with/ without constraints.
Chemistry A21004	**CO1**	Acquire knowledge of atomic, molecular and electronic changes related to conductivity.
	CO2	Apply the various processes of treatment of water for both domestic and industrial purpose.
	CO3	Apply the knowledge of electrode potentials for the protection of metals from corrosion.
	CO4	Analyze the major chemical reactions that are used in the synthesis of compounds.
	CO5	Apply the knowledge of polymers in every day's life.

Programming for Problem Solving-I A21501	**CO1**	Design Algorithms and Flowcharts for real world applications using 'C'.
	CO2	Know the usage of various operators in Program development.
	CO3	Design programs involving decision and iteration structures.
	CO4	Apply the concepts code reusability using Functions.
	CO5	Analyze various searching and sorting techniques using Arrays
English Language Skills Lab (ELSL) A21081	**CO1**	Reproduce speech sounds and improve fluency in language.
	CO2	Understand syllables and consonant clusters for appropriate pronunciation.
	CO3	Exhibit effective professional skills with rhetoric eloquence.
	CO4	Deliver enthusiastic and well-practiced presentation.
	CO5	Learn Task-Based Language Learning (TBLL) through various language learning activities effectively.
Chemistry Lab A21083	**CO1**	Determination of parameters like hardness, alkalinity and chloride content in water.
	CO2	Estimation of rate constant of a reaction from concentration-time relationships.
	CO3	Determination of physical properties like adsorption, surface tension and viscosity.
	CO4	Synthesize a small drug molecule and analyze a salt sample.
	CO5	Calculation of strength of compound using instrumentation techniques.
Engineering Workshop A21381	**CO1**	Understanding the tools and methods of using to fabricate engineering components
	CO2	Applying the measuring techniques to verify the dimensional accuracy.
	CO3	Evaluating various methods and trades of workshop in the component building.
Programming for Problem Solving Lab-I	**CO1**	Apply the specification of syntax rules for numerical constants and variables, data types.
	CO2	Know the Usage of various operators and other C constructs.

A21581	CO3	Design programs on decision and control constructs.
	CO4	Develop programs on code reusability using functions.
	CO5	Implement various searching and sorting techniques using arrays

I YEAR II SEM		
Mathematics-II A22006	CO1	Classify the various types of differential equations of first order and first degree and apply the concepts of differential equations to the real world problems.
	CO2	Solve higher order differential equations and apply the concepts of differential equations to the real world problems.
	CO3	Find the Laplace Transform of various functions and apply to find the solutions of differential equations.
	CO4	Evaluate the multiple integrals and identify the vector differential operators physically in engineering problems.
	CO5	Evaluate the line, surface and volume integrals and converting them from one to another by using vector integral theorems.
Engineering Physics A22007	CO1	Interpret the forced damped harmonic oscillations and Transverse waves.
	CO2	Identify various optical phenomena of light.
	CO3	Explain the working principle of optical fibers and lasers.
	CO4	Describe the crystalline structures of solids.
	CO5	Classify magnetic and dielectric behavior of materials.
Engineering Graphics & Modeling A22302	CO1	Understand the concepts of engineering drawing of planes, solids and the CAD drawing software.
	CO2	Conceptualize and draw the projections of points and straight lines.
	CO3	Visualize and project different views of a planes and solids.
	CO4	Analyze given solids and represent sectional views.
	CO5	Generate isometric and corresponding orthographic views of any given component.
Engineering Mechanics A22303	CO1	Understand and apply the concepts of force, moment and their resolutions.
	CO2	Analyze and apply the concepts of friction.

	CO3	Calculate area and mass Moment of Inertia for given cross-sections.
	CO4	Analyze the motion of bodies considering the cause of motion. Appreciate and apply the concept of Work-Energy method.
	CO5	Understand the kinetics of rigid body in translation and rotation
Programming for Problem Solving-II A22502	**CO1**	Identify various string handling functions in 'C'.
	CO2	Develop programs with user defined data types.
	CO3	Use Dynamic memory allocation functions with pointers.
	CO4	Distinguish between Stacks and Queues.
	CO5	Analyze various Dynamic Data Structures.
English Communication Skills Lab (ECSL) A22084	**CO1**	Understand the variants in pronunciation.
	CO2	Identify the diverse purposes of listening and speaking.
	CO3	Discuss ideas in diverse communicative settings.
	CO4	Exhibit increased confidence in public speaking.
	CO5	Display critical thinking, problem solving and decision making skills through GD's.
Engineering Physics Lab A22085	**CO1**	Characterize the mechanical properties of given material.
	CO2	Demonstrate various types of oscillation and rotational motion to determine mechanical parameters.
	CO3	Evaluate the magnetic Induction along the axis of current carrying coil.
	CO4	Apply optical phenomena to characterize optical sources and components.
	CO5	Characterize LCR and RC circuits.
Programming for Problem Solving Lab-II A22582	**CO1**	Build programs on various string handling functions.
	CO2	Develop applications on user defined data types.
	CO3	Apply dynamic memory allocation through pointers.
	CO4	Implement linear data structures through stacks and queues.

	CO5	Create linked list dynamically through stacks and queues.

II YEAR I SEM		
Numerical Methods & Partial Differentiation A23009	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 and also to fit different types of Curves.
	CO3	To know various types of numerical methods in solving engineering problems.
	CO4	Classify the nature of second and Higher order partial differential equations and find the solutions of linear and non linear PDE.
	CO5	To apply Partial differential Equations in different engineering problems.
Materials Technology A23304	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.
Mechanics of Solids A23305	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 principal stresses and strains. Determine the slope and deflection of beams under different types of loadings.
	CO5	Analyze and compute stresses and strains in thin and thick cylinders.
Thermodynamics A23306	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.
Production Technology A23307	**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	Appreciate the process of high velocity forming and understand different types of plastics.
Professional Communication A23010	**CO1**	Acquire enhanced personality
	CO2	Exhibit appropriate professional etiquette
	CO3	Practice team building with strong communication skills
	CO4	Develop problem solving skills and decision-making
	CO5	Demonstrate effective presentation skill
Metallurgy and Mechanics of Solids Lab A23383	**CO1**	Understand and identify microstructure of metals and measure their mechanical properties.
	CO2	Analyze the microstructure and mechanical properties of metals by applying metallurgical principles.
	CO3	Compare the hardness and mechanical properties of treated and untreated steels tested
Production Technology Lab A23384	**CO1**	Understand the operating methods of welding mechanical press and moulding machines.
	CO2	Measuring the properties of moulding sand.
	CO3	Evaluate the quality of welded joints and products made by mechanical press.
Environmental Sciences A23MC1	**CO1**	Define and explain the structure and functions of ecosystem, value of biodiversity, threats and conservation of biodiversity.
	CO2	Explain the limitations of the resources and impacts of over utilization of all natural resources.
	CO3	Explain the sources and effects of environmental pollutions and

		list the available techniques to control the pollution.
	CO4	Explain the global environmental issues like climate change, ozone hole and can explain the scope of EIA, Environmental Management Plan, and environmental audit and list the EIA methods.
	CO5	Mention the salient features of environmental acts and rules, define the sustainable goals along with measures required for the sustainability.

II YEAR II SEM		
Probability and Statistics A24013	CO1	To differentiate among random variables involved in the probability models which are useful for all branches of engineering.
	CO2	Derive relationship among variety of performance measures using probability distributions.
	CO3	Acquire elementary knowledge of parametric and non-parametric –tests and understand the use of observing state analysis for predicting future conditions.
	CO4	Identify and examine situations that generate using problems and able to solve the tests of ANOVA for classified data.
	CO5	Apply proper measurements, Indicators and techniques of Correlation and regression analysis.
Basic Electrical Engineering A24211	CO1	Understand the fundamentals of basic circuit components and their characteristics.
	CO2	Analyze basic electrical circuits with A.C excitation.
	CO3	Understand the concepts of magnetic circuits and transformers.
	CO4	Acquire the basic concepts of electrical motors.
	CO5	Understand the concept of A.C generator and low voltage electrical installations.
Machine Drawing & Drafting A24308	CO1	Prepare the engineering drawings by employing conventional representation.
	CO2	Develop the assembly drawings using part drawings of machine components.
	CO3	Applying the drawing practice using solid works software.
Kinematics of Machinery A24309	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 A24310	**CO1**	Understand the concepts of actual cycles and their analysis.
	CO2	Analyze the combustion phenomenon in SI engines.
	CO3	Analyze the combustion phenomenon in CI engines.
	CO4	Understand the testing and performance of IC engines.
	CO5	Know about the alternative fuels and appreciate the recent trends in IC engines.
Mechanics of Fluids and Hydraulic Machines A24311	**CO1**	Understand fluid properties and 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.
Mechanics of Fluids and Hydraulic Machines Lab A24385	**CO1**	Test performance of different turbines.
	CO2	Test performance of different pumps.
	CO3	Evaluate the quality of welded joints and products made by mechanical press.
Basic Electrical Engineering Lab A24286	**CO1**	Get an exposure to basic electrical laws.
	CO2	Understand the response of different types of electrical circuits to different excitations.
	CO3	Understand the measurement, calculation and relation between basic electrical parameters.
	CO4	Understand the performance characteristics of D.C electrical machines.
	CO5	Understand the performance characteristics of A.C electrical machines
Gender Sensitization A24MC1	**CO1**	To develop awareness about gender discrimination and take measurable steps to counter it.
	CO2	To identify the basic dimensions of biological, sociological, psychological and legal aspects of gender.
	CO3	To acquire knowledge about gendered division of labour in

		relation to politics and economics.
	CO4	To prepare the students against gender violence.
	CO5	To prepare the students to work and live together as equals.

III YEAR I SEM		
Managerial Economics and Financial Analysis A25016	**CO1**	Understand the importance of certain basic issues governing the business operations namely demand and supply, production function, cost analysis.
	CO2	Apply managerial tools and techniques in obtaining optimal solutions for business problems.
	CO3	Differentiate the various forms of business organizations.
	CO4	Evaluate and interpret the financial statements of companies using ratios.
	CO5	Apply the methods of capital budgeting in effective investment decision making.
Dynamics of Machinery A25312	**CO1**	Understand gyroscopic effects of rotating bodies for aero planes, naval ships, automobiles, and two wheelers. Appreciate the working of brakes and dynamometers.
	CO2	Compute frictional torque in clutches and understand the applications of Governors in mechanical systems.
	CO3	Perform static and dynamic force analysis of planar mechanisms. Diagrammatically represent turning moment and design flywheels.
	CO4	Understand how to balance rotating and reciprocating masses in different planes.
	CO5	Perform calculations pertinent to several parameters of free and forced vibrations.
Design of Machine Members-I A25313	**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.
Applied Thermodynamics	**CO1**	Understand the working of steam power plants and boilers.

A25314	CO2	Perform Thermodynamic analysis of nozzles and condensers.
	CO3	Analyze impulse and reaction steam turbines and subsequently apply to real time scenarios.
	CO4	Understand working of different types of compressors and gas turbines.
	CO5	Appreciate different types of propulsive engines and rockets.
Automobile Engineering A25315	CO1	Understand the components of automobile engines and appreciate the working of lubrication and cooling systems. Know about the fuel systems in SI engine and CI engines.
	CO2	Appreciate the functions and importance of ignition and electrical systems.
	CO3	Elucidate the working principles, types and importance of transmission and suspension systems.
	CO4	Appreciate the working principles, types and importance of braking and steering systems.
	CO5	Understand the environmental implications of automobile emissions and application of various alternative fuels.
Composite Materials A25316	CO1	Understand the importance to Composite Materials.
	CO2	Appreciate Manufacturing Methods of Composite Materials.
	CO3	Analyze Elastic Theory of Composites.
	CO4	Perform Micromechanical Analysis of a Lamina.
	CO5	Carry out Macro Mechanical Analysis of Laminates and Failure Analysis and Design of Laminates
Additive Manufacturing A25317	CO1	Understand the additive manufacturing technologies.
	CO2	Appreciate Liquid-Based and Solid-Based additive manufacturing systems.
	CO3	Know the rudiments of Powder Based additive manufacturing Systems, Rapid Tooling and Tooling Classification.
	CO4	Understand data formats and software packages of additive manufacturing.
	CO5	Know the applications of additive manufacturing in the industry
Elements of Mechanical	CO1	Understand the basic concepts of mechanical engineering.
	CO2	Apply principles of engineering mechanics in mechanism and

Engineering A25318		machines
	CO3	Develop manufacturing methods to produce engineering components.
	CO4	Evaluate alternative designs for the engineering components
	CO5	Compare various standards relevant to automobiles.
Product Engineering A25319	**CO1**	Understand project management and collaborative working.
	CO2	Appreciate Product Lifecycle Management.
	CO3	Design products using engineering design concepts.
	CO4	Understand the benefits of design documentation and drawings in engineering.
	CO5	Appreciate the concepts of rapid prototyping.
Thermal Engineering Lab A25386	**CO1**	Understand the assembly/disassembly and their working of IC engines for performance measurement.
	CO2	Analyze the output responses of the IC engines by applying thermodynamic principles.
	CO3	Evaluate performance parameters for consequent applications.
Advanced Communication Skills Lab A25087	**CO1**	Develop sound communication skills in various situations with the help of enriched vocabulary.
	CO2	Practice reading techniques for a faster and better comprehension.
	CO3	Exhibit strong writing skills to express ideas effectively.
	CO4	Demonstrate effective presentation skills.
	CO5	Use appropriate verbal and non-verbal skills for a successful career.
Quantitative Methods & Logical Reasoning A25TP1	**CO1**	Perform well in various competitive exams and placement drives.
	CO2	Solve basic and complex mathematical problems in short time.
	CO3	Attain solving skills and analytical abilities.
	CO4	Perform job roles effectively using logical skills.

III YEAR II SEM		
Design of Machine Members-II A26320	**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 A26321	**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.	
	CO5	Analyze the performance of heat exchangers by LMTD and NTU methods. Appreciate radiation heat transfer scenarios.	
Metrology & Machine Tools A26322	**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 and the working of Coordinate Measuring Machine.	
Finite Element Methods A26323	**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	Solve 2-D problems using CST element and integration using Numerical Integration method.	
	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.	
Refrigeration And Air Conditioning A26324	**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	Understand the working principles of vapor absorption and steam jet refrigeration systems.	
	CO4	Estimate the air conditioning load for comfort and industrial applications by applying the principles of psychrometry and design	

		conditions.
	CO5	Appraise Air Conditioning Systems and calculate the Cooling Load.
Industrial Management A26325	**CO1**	Understanding the principles of management.
	CO2	Compare management functions in different specializations of management.
	CO3	Apply the concepts of materials management in reducing the total cost.
	CO4	Evaluate the project cost time trade off values during application.
	CO5	Applying the modern management concepts in manufacturing and service organizations
Automation In Manufacturing A26326	**CO1**	Summarize the facets of automation in a manufacturing activity.
	CO2	Applying various elements like sensors, pneumatics, and hydraulics to append in manufacturing automation.
	CO3	Design the assembly lines by considering the on line process analysis.
	CO4	Evaluate the automation elements for low cost automation investment.
	CO5	Applying the automation concepts in automobile and manufacturing sectors
Optimization Techniques A26327	**CO1**	Model the real life situations with mathematical models. Understand the concept of linear programming.
	CO2	Solve transportation and assignment problems.
	CO3	Apply theory of games and queuing concepts for optimization.
	CO4	Formulate the sequencing of jobs on machines. Understand the various replacement concepts. Identify and apply various inventory models.
	CO5	Appraise dynamic programming models and simulation principles.
Maintenance and Safety Engineering A26328	**CO1**	Understand the need for maintenance in an industry and know about Maintenance Management and Control.
	CO2	Appreciate and implement various types of maintenance.
	CO3	Know the concept of inventory control in maintenance.
	CO4	Evaluate the quality and cost of safety and maintenance.
	CO5	Appraise the concepts of reliability and maintainability with reference to the maintenance of equipment.
Heat Transfer Lab A26387	**CO1**	Understand the structural features of heat transfer equipment and their mode of working.
	CO2	Analyze the output responses by comparing with the heat transfer governing equations.

	CO3	Evaluate the process parameters for designing the heat transfer devices.
Metrology & Machine Tools Lab A26388	**CO1**	Understand the kinematic structure of machine tools and their mode of working.
	CO2	Perform the machining operations and the measurement of samples using instruments.
	CO3	Evaluate the responses for their accuracy and precision.
Personality Development & Behavioural Skills A26TP1	**CO1**	Practice optimistic attitude for an efficient, socially viable and multi-faceted personality.
	CO2	Demonstrate functions of non-verbal *communication in formal context.*
	CO3	Build effective individual & team dynamics for professional accomplishments.
	CO4	Analyze appropriate strategic Interpersonal Skills for productive workplace relationships.
	CO5	Correspond in multiple contexts, for varied audiences, across genres and modalities.

IV YEAR I SEM		
Instrumentation and Control Systems A27329	**CO1**	Define basic terms related to measurements, understand displacement measurement techniques.
	CO2	Understand working principles of pressure and temperature measuring instruments.
	CO3	Appraise the working of various flow, level, and speed measurement instruments.
	CO4	Model and analyze acceleration, vibration, stress, strain, force, torque and power measuring methods.
	CO5	Understand control systems and their applications.
CAD/CAM A27330	**CO1**	Appreciate CAD/CAM principles and know the various input and output peripherals of computers. Understand concepts of computer graphics.
	CO2	Develop mathematical models to represent curves, surfaces and solids.
	CO3	Understand numerical control systems and develop CNC part programs. Appraise the rudiments of Group Technology.
	CO4	Understand Computer Aided Quality Control and Computer Integrated Manufacturing Systems.
	CO5	Acquire knowledge on Reverse Engineering Technology.

Robotics A27331	**CO1**	Understand the basic concepts of robotics and know the components of industrial robots.
	CO2	Model forward and inverse kinematics of position for robots.
	CO3	Model forward and inverse kinematics of orientation and differential kinematics of robot manipulators.
	CO4	Formulate dynamic analysis equations for robotic manipulators and plan the trajectory for robots.
	CO5	Appraise principles of different actuators and feedback components. Appreciate the industrial applications of robots.
Gas Dynamics A27332	**CO1**	Understanding the features of different flows.
	CO2	Comparing the flow in different cross sectional arcos.
	CO3	Apply gas dynamics principles to Jet propulsion system.
	CO4	Evaluate the effects with and without shocks during flow.
	CO5	Designing the aviation components using gas dynamics principles
Production And Operations Management A27333	**CO1**	Understand the importance of production and operations management for getting the competitive edge.
	CO2	Analyze the factors effecting plant location and the volume of production to be made.
	CO3	Apply the value engineering and work study method to standardize the manufacturing activity.
	CO4	Evaluate the project management techniques to improve overall productivity.
	CO5	Designing the production systems with the effective PPC principles
Operations Research A27334	**CO1**	Model the real life situations with mathematical models. Understand the concept of linear programming.
	CO2	Solve transportation and assignment and sequencing problems.
	CO3	Understand the various waiting lines and replacement concepts.
	CO4	Identify and apply game theory and inventory models.
	CO5	Apply dynamic programming and network scheduling models.
Energy	**CO1**	Understand the energy data to carry out audit.

Conservation And Management A27335	**CO2**	Identifying the electrical, thermal and other systems with their energy consumption.
	CO3	Perform energy audit of consumption of industries.
	CO4	Evaluate the energy consumption of units by the economic concepts.
	CO5	Designing the mechanical systems employing energy conservation principles
Fluid Power Systems A27336	**CO1**	Understand the properties fluid and fluid power systems.
	CO2	Apply accessories and valves in the systems for effective functioning.
	CO3	Design and analyze typical hydraulic circuits.
	CO4	Evaluate the systems with different control units.
	CO5	Designing the modern fluid power systems with the hydraulic principles
Basic Automobile Engineering A27337	**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	Understand various transmission and suspension systems.
	CO5	Appraise steering and braking systems. Understand emission norms of automobiles.
Material Science Engineering A27338	**CO1**	Understand structure of metals and constitution of alloys.
	CO2	Appraise equilibrium diagrams of various alloys.
	CO3	Classify steels, cast irons and their alloys.
	CO1	Appreciate different heat treatment processes and their influence on properties of metals and alloys. Know different Non-ferrous Metals and Alloys.
	CO2	Apply the knowledge of composite and ceramic materials to replace metals and alloys wherever applicable.
CAD/CAM Lab A27389	**CO1**	Understand the usage of relevant software and the syntax of CNC part program.
	CO2	Develop the 2D, 3D models and conduct the analysis.
	CO3	Evaluate the veracity between manual part program and the automated part program.
Production Drawing Practice and Instrumentation Control Systems Lab A27390	**CO1**	Understanding the symbols and their representation on drawings.
	CO2	Calibrate the measuring devices and analyze the errors in measurement.
	CO3	Evaluate the instruments in terms of accuracy and precision.

	CO1	Apply the engineering principles in the execution of a sub system under mechanical engineering domain.
Industry Oriented Mini Project A273P1	CO2	Predict and solve the related issues of the sub system.
	CO3	Evaluate the effectiveness of the sub systems the light of technical, ethical and other standards.

IV YEAR II SEM		
Production Planning & Control A28339	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.
Unconventional Machining And Processes A28340	CO1	Understand the need, importance and classification of various unconventional machining processes.
	CO2	Appreciate basic principles and process parameters of ultrasonic, water jet and abrasive jet machining processes.
	CO3	Appreciate thermal energy based machining processes with emphasis on surface finish and accuracy.
	CO4	Appraise different chemical material removal processes.
	CO5	Understand electron beam machining and plasma arc machining along with applications.
Technical Seminar A283TS	CO1	Synthesizing information on any one specialized topic from text books, peer revised journals, hand books and other technical resources.
	CO2	Generation a technical seminar report comprising of all relevant information with stipulated standards.
	CO3	Judge the veracity of the topic with various time domains
Comprehensive Viva Voce A283CV	CO1	Revise the mechanical engineering principles postulations and other technical information in order to apply in various conditions.
	CO2	Explain the relevance of a technical note for a given application.
	CO3	Collate and justify the design by the acquired comprehensive technical knowledge and skill.
Major Project A283P2	CO1	Develop a model comprising of real time application in the industry.
	CO2	Design a system under the domain of mechanical engineering.

	CO3	Evaluate for simulation design, analysis and manufacturing facts of the system.