

R19 COURSE OUTCOMES

COURSE CODE	COURSE	COURSE OUTCOME DESCRIPTION
111	Mathematics-I	1 Examine the convergence of series and apply mean value theorem to real life problem
		2 Solve the Differential Equations of first and higher order related to various engineering applications.
		3 Apply the partial differentiation technique to solve physical problem
		4 Apply double and triple integrals to find areas and volumes
112	Mathematics – II	1 Solve system of linear algebraic equations and apply Eigen value computation techniques to reduce a given quadratic to
		2 Solve algebraic and Transcendental equations by using Numerical methods
		3 Apply Newton's forward and backward interpolation and Lagrange's formula for equal and unequal intervals.
		4 Computer numerical solutions of differential equations.
113	Engineering Physics	1 Computer numerical solutions of differential equations.
		2 Improve the acoustic quality of concert halls and apply Ultrasonic waves concept in Non Destructive Testing.
		3 Explain the concepts of elasticity & plasticity and distinguish different types of moduli
		4 Distinguish between laser sources and conventional sources and identify different types of sensors
		5 Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
114	Programming for Problem Solving Using C	1 Describe the concept of computer system, analyze a given problem, develop an algorithm, fundamental programming
		2 Understand branching and loop statements.
		3 Describe the concept of homogeneous derives data types, strings and functions.
		4 Understand pointers and heterogeneous data types.
		5 Describe the concept of file system and functions.
115	Engineering Drawing	1 Construct polygons, scales and draw curves used in engineering applications
		2 Apply concept of orthographic projection to project Points, St. lines inclined to one and both reference planes.
		3 Produce orthographic projections of planes inclined to both the reference planes.

		4	Produce orthographic projections of regular solids inclined to both the reference planes.
		5	Construct isometric view from orthographic views and vice versa.
		6	Drawing practice on AUTO-CAD
116	English Lab	1	Recognize the sounds of English with the help of audiovisual aids.
		2	Build confidence and overcome inhibitions while speaking in English
		3	Demonstrate acquired language skills in performing the designated activity.
117	Engineering Physics Lab	1	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring
		2	Verify the laws of thermo dynamics, electro magnetism and stretched string.
		3	Draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various
118	Programming for Problem Solving Using C Lab	1	Describe the basics of computer and understand the problem-solving aspect.
		2	Design and develop C program to evaluate simple expressions and logical operations.
		3	Develop & Implement C programs with suitable modules to solve the given problem.
		4	Demonstrate the concept of pointer and perform I/O operations in files.
121	English	1	Apply the four languages learning skills-listening, speaking, reading, writing (LSRW) for professional success.
		2	Employ knowledge of grammatical structures and vocabulary in speech and writing
		3	Apply effective communication skills to enhance professional possibilities.
		4	Develop acceptable personality traits suitable for chosen profession.
122	Engineering Chemistry	1	Identify the advantages and limitations of Plastic materials, Elastomers and their use in day to day life.
		2	Select the suitable methods of corrosion control and gain the knowledge of applications of batteries.
		3	Identify the advantages and limitations of building materials and their use in day to day life and select the various lubricants for
		4	Identify the fuels which are commonly used and their advantages and limitations.
		5	Select the various methods used for purification of water for domestic and industrial purposes.
123	Engineering Mechanics	1	Analyze the system of forces acting on rigid bodies by FBD's
		2	Apply laws of friction to find friction forces acting on the rigid bodies
		3	Find Moment of Inertia of plane laminas by locating its Centroid and Analyze the frames

		and trusses to find internal forces in
		4 Analyze motion parameters of bodies both in translation and rotation(D Alemberts Principle)
		5 Apply work- Energy and Impulse-momentum methods to find motion parameters of a moving bodies
124	Basic Electrical and Electronics Engineering	1 To Learn the basic principles of electrical circuit laws and analysis of networks
		2 To Understand Principle of operation and construction details of AC & DC machines
		3 To Learn Operation of rectifiers ,IC'S and transistors
125	Computer Aided Engineering Drawing Practice	1 Produce orthographic projections of regular solids using auxiliary projection
		2 Produce sectional drawings, developments and interpenetration of solids as per
		3 Produce Isometric view of regular solids and machine components etc from their
		4 Produce geometric models (orthographic, isometric etc.) of simple solids and
126	English - Communication Skills Lab	1 Recognize the sounds of English with the help of audio visualaids.
		2 Build confidence and overcomeinhibitions while speaking inEnglish.
		3 Demonstrate acquired language skills in performing the designated activity.
127	Engineering Chemistry Laboratory	1 Obtain the knowledge of acid-base titrations to determine the strength of acid and base solutions.
		2 Gain the knowledge of Redox titrations to determine the concentration of samples such as ores, KMnO4 and Copper using
		3 Obtain the knowledge of complexometry titrations to determine the hardness of given water sample by EDTA method.
		4 Gain the knowledge of commonly used instruments such as pH meter, Conductivity meter and Potentiometer to determine the
128	Basic Electrical & Electronics Engineering Lab	1 Examining the characteristics of different DC machines & AC Machines
		2 Compare the speed control method of different types of DC motors
		3 Analyse the operation of devices like diodes, transistors and FETs practically
		4 Design rectifier circuits with and without filters
129	Workshop Practice Lab	1 Make simple wood joints by applying wood working knowledge
		2 Make sheet metal objects by applying development of surfaces concept
		3 Prepare simple fitting joints with the use of proper fitting tools
		4 Analyze the basic house wiring circuits.
129.1	Engineering Exploration	1 Build mindsets & foundations essential for designers.

	Project	2	Learn about the Human- Centread Design methodology and understand their real- world applications.
		3	Use Design Thinking for problem solving methodology for investigating illdefined problems.
		4	Undergo Several design challenges and work towards the final design challenge
211	Vector Calculus & Fourier Transforms	1	Solve system of linear algebraic equations and apply Eigen value computation techniques to reduce a given quadratic to canonical form
		2	Apply double and triple integrals to find areas and volumes.
		3	Apply special functions to evaluate improper integrals
		4	Apply the concepts of vector calculus to the problems of work done by a force, circulation and flux
212	Mechanics of Solids	1	Solve problems on simple stresses and strains including thermal concept and relate elastic constants.
		2	Analyze shear force and bending moment diagram for beams with different loading conditions.
		3	Calculate bending and shear stresses in beams of different cross sections.
		4	Calculate slope and deflections in beams using Macaulay's and moment area methods and Analyze members subjected to torsion
		5	Design thin, thick cylindrical vessels and spherical vessels andsolve columns and struts.
213	Metallurgy & Materials Science	1	Explain different strctures of metals and constitution of alloys.
		2	Explain the types of phase diagrams for various alloy systems.
		3	Classify ferrous and non ferrous metals and alloys for different applications.
		4	Explain the principles of heat treatment processes for various alloys.
		5	Explain the types of ceramics and composite materials.
214	Production Technology	1	Design of gating system for casting process
		2	Explain principles of welding process for various metals and alloys
		3	Design various types of weld joints for specific applications
		4	Explain the principles of different metal forming process for various metals and alloys
		5	Explain the methods of processing of plastics
215	Thermodynamics	1	Explain the basic concepts of thermodynamic systems in the energy perspective; distinguish the point function and the path function with respect to energy, work and heat.
		2	Apply the knowledge of thermodynamic systems while learning the first law of

		thermodynamics and apply the steady flow steady state energy equation on several mechanical devices also understand the concept of equality of temperature, temperature measuring devices.
		3 Apply second law statements of thermodynamics on heat engines and heat pumps and analyze the concept of Carnot cycle, entropy, availability and irreversibility and understand the use of Maxwell's relations and thermodynamic functions.
		4 Demonstrate the process of steam formation and related properties and related steam utilizing mechanical devices with the help of appropriate property relations, steam tables and charts. Students will be able to use Psychometric chart and properties to describe the behavior of mixture of ideal gases and real gases.
216	Machine Drawing	1 Sketch conventional representation of mechanical components.
		2 Draw orthographic projections, sectional views of the mechanical components
		3 Draw various types of screw fasteners, Riveted and welding joints.
		4 Draw various types of shaft couplings , bearings and pipe joints.
		5 Draw assemblies of engine parts, machine parts.
217	Metallurgy & Mechanics of Solids Lab	1 Find mechanical properties of different materials using universal testing machine
		2 Find shear modulus of given material using torsion test rig
		3 Calculate Impact resistance of a given material using impact testing machine
		4 Determine the hardness of different materials using vickers, rockwell and brinell hardness testing machines
218	Production Technology Lab	1 Prepare sand moulds in foundry using appropriate foundry shop hand tools.
		2 Produce different welding joints at variable voltage sources.
		3 Find moulding sand properties
		4 Prepare patterns, produce mould cavities for manufacturing castings.
221	Complex Variables & Statistical Methods	1 Solve algebraic and transcendental equations by using Numerical methods.
		2 Apply the concepts of interpolation to numerical integration and solve the differential equations by using numerical methods.
		3 Compute Fourier series of the periodic function and apply Fourier transform to a range of non-periodic function.
		4 Solve the wave, heat and Laplace equations
222	Kinematics of Machinery	1 Understand the fundamentals of Mechanisms, Inversions and ability to calculate mobility
		2 Analyze the velocity, accelerations of given mechanism by graphical and analytical methods

		3	Construct the cam profiles at different follower motions
		4	Analyze the velocity ratio of gears, belts and chain drives
223	Applied Thermodynamics	1	Compare the Air Standard Cycles, Fuel Air Cycles and Actual Cycles
		2	Explain working of internal combustion engines, IC engine systems, design of combustion chambers and combustion phenomenon
		3	Calculate various performance parameters of IC engines
		4	Explain working of reciprocating and rotary compressors
		5	Students calculate various performance parameters on reciprocating and rotary compressors
224	Fluid Mechanics & Hydraulic Machines	1	Apply the basic concepts of continuum, properties of fluid, pressure measurement, hydrostatic forces on the surfaces, buoyancy & floatation in fluid flow problems (Unit 1 BTL 3)
		2	Solve problems on kinematics & dynamics of fluid flow in engineering applications with the help of Euler and Bernoulli's equations.
		3	Analyze the boundary layer theory, apply flow through pipes and flow on free surface concepts in solving real life flow problems
		4	Solve the problems of hydraulic machines like turbines, pumps and other fluid machines.
225	Metal Cutting & Machine Tools	1	Analyze cutting mechanics to metal machining based on cutting force and power consumption and can prevent tool failure.
		2	Explain working principle, mechanism and operations performed on various machine tools.
		3	Explain the finishing processes like grinding, lapping, honing and broaching.
		4	Explain the working principle of Jigs and Fixtures, CNC machines.
226	Design of Machine Members -I	1	Apply the design procedure to select suitable materials by considering technical and manufacturing constraints.
		2	Design of machine elements for failure of materials under fluctuating stress, fatigue.
		3	Design of Riveted joints, Welded joints and Bolted joints.
		4	Design different machine elements such as fasteners, shafts, keys etc.
		5	Design different machine elements such as couplings.
		6	Design different machine elements such as axially loaded joints, Springs etc.
227	Fluid Mechanics & Hydraulic Machines Lab	1	Apply the basic concepts of continuum, properties of fluid, pressure measurement, hydrostatic forces on the surfaces, buoyancy & floatation in fluid flow problems
		2	Solve problems on kinematics & dynamics of fluid flow in engineering applications with the help of Euler and Bernoulli's equations.

		3 Analyze the boundary layer theory, apply flow through pipes and flow on free surface concepts in solving real life flow problems
		4 Solve the problems of hydraulic machines like turbines, pumps and other fluid machines.
228	Machine Tools Lab	1 Apply operating principles to perform different operations of lathe
		2 Apply operating principles required to get different shapes of products on machine tools
		3 Operate different machine tools with understanding of work holders.
		4 Apply the mechanics of metal cutting to produce tool angles for a single point cutting tool
311	Dynamics of Machinery	1 Analyze stabilization of sea vehicles, aircrafts and automobile vehicles
		2 Compute frictional losses, torque transmission of mechanical systems.
		3 Analyze dynamic force analysis of slider crank mechanism and design of flywheel.
		4 Determine the variation of speed in various types of governors
		5 Understand balancing of reciprocating and rotary masses
		6 Determine the natural frequencies of continuous systems starting from the general equation of displacement
312	Design of Machine Members–II	1 Select suitable bearings and its constituents from manufacturers catalogues under given loading conditions
		2 Design ic engine parts based on maximum bending and twisting moment conditions
		3 Estimate stresses induced in curved beams and hooks. Of various cross sections [BT L4, Synthesis BT L6, Evaluation
		4 Design belt , rope, chain drives and power screws for transmission efficiencies
		5 Apply the design concepts to estimate the strength of the gear and load carrying capacity of brackets and levers
		6
313	Mechanical Measurements & Metrology	1 Describe the construction and working principle of measuring instruments for measurement of displacement and speed.
		2 Describe the construction and working principle of measuring instruments for strain, force, torque,power, acceleration and vibration.
		3 Explain shaft basis system and hole basis system for fits and represent tolerances for a given fit.
		4 Explain the methods of linear, angular and flatness measurements and its relevant instrument.
		5 Discuss the measurement of threads, gear toothprofiles, surface roughness and flatness using

		appropriate instruments.
314	Managerial Economics and Financial Accountancy	1 Explain managerial economics, demand analysis, elasticity of demand and its types, methods for measuring elasticity of demand, demand forecasting, methods
		2 Discuss theory of production, types of production functions, cost analysis, types of cost and BEP analysis, to solve simple problem
		3 Describe the concepts of Market structures and pricing policies and models of pricing, theories of firm
		4 Explain business organizations, different forms of business organizations and phases of business cycles.
		5 Discuss different accounting systems, preparation of financial statements and uses of different tools for performance evaluation
		6 Explain the concept of capital, capitalization, capital budgeting and to know the techniques used to evaluate capital budgeting proposals by using different methods.
315	IC Engines & Gas turbines	1 Explain the concept of combustion of fuels, working of Boilers, boiler mountings and accessories.
		2 Explain the functionality and working of Steam nozzles, Steam turbines and Steam condensers.
		3 Calculate performance parameters of Rankine cycle, Boilers, Steam nozzles, Steam Turbines and Steam Condensers.
		4 Explain working of gas turbines, jet propulsion engines and rockets.
		5 Solve problems on gas turbines and jet propulsion engines.
316	Thermal Engineering Lab	1 Analyze the performance characteristics of an internal combustion engines
		2 Draw the Heat balance sheet for diesel engine
		3 Analyze the characteristics of air compressor.
		4 Determine the properties of a given sample of fuel.
		5 Explain different boilers models, mountings and their accessories
317	Theory of Machines Lab	1 Apply fundamentals of four bar mechanism, governors, cam and follower motions, gears, screwjack
		2 Analyze the single slider crank chain, gyroscope apparatus, static and dynamic balancing, various cam and follower systems
		3 Determine the gyroscopic couple, coefficient of friction between belt and pulley, moment of inertia of flywheel, frequency of damped and undamped spring mass system
318	Mechanical Measurements	1 Demonstrate the use of instruments for measuring linear (internal and external), angular

	& Metrology Lab	dimensions and surface roughness.
		2 Perform alignment tests on various machine tools.
		3 Demonstrate the use of instruments for measuring pressure, flow, speed, displacement and temperature
		4 Calibrate the Bourdon tube pressure gauge
321	Operations Research	1 Apply linear programming model and assignment model to domain specific situations.
		2 Describe the various methods under transportation and queuing theory mode and apply them for testing the closeness of their results to optimal results.
		3 Analyze the concepts of replacement and game theory and apply them for arriving at optimal decisions.
		4 Apply the concepts of PERT and CPM for decision making and optimally managing projects.
322	Heat Transfer	1 Apply the concepts of modes of heat transfer
		2 Solve the problems on Conduction, Convection and Radiation Heat transfer
		3 Analyze the performance of heat exchangers after determining the design parameters using LMTD and NTU methods.
		4 Apply the concepts of Boiling and Condensation heat transfer
323	CAD/CAM	1 Discuss basic fundamentals of computer aided design and manufacturing and the technique of transformation of geometric entities.
		2 Describe the mathematical basis in the technique of representation of geometric entities and parametric curves, surfaces and solids.
		3 Develop CNC part programs for CNC machine tools.
		4 Discuss the benefits of Group technology, Computer aided process planning and Flexible manufacturing systems in industry.
		5 Identify the various elements and their activities in the computer integrated manufacturing systems and learn the concept of Computer aided quality control.
324	Unconventional Machining Processes	1 Explain the classification of unconventional machining processes
		2 Explain the principle, mechanism of metal removal of various unconventional machining processes
		3 Identify the process parameters and their effect on the component machined on various unconventional machining processes.
		4 Explain the applications of different processes.
325	Automobile Engineering	1 Describe the layout of an automobile

		2 Explain Transmission System in automobile
		3 Explain steering system in automobile
		4 Describe suspension, Braking and Electrical systems in automobile
		5 Discuss engine specification and safety systems in automobile
		6 Explain engine emission control, Engine service for automobile
326	Simulation of Mechanical Systems Lab	1 Measure load, displacement and temperature using analogue and digital sensors.
		2 Develop PLC programs for control of traffic lights, water level, lifts and conveyor belts.
		3 Simulate and analyse PID controllers for a physical system using MATLAB.
		4 Develop pneumatic and hydraulic circuits using Automaton studio.
327	Heat Transfer Lab	1 Perform steady state conduction experiments to estimate the thermal conductivity of a solid and overall heat transfer coefficient of a composite wall
		2 Perform the heat transfer experiment on a Pin fin and obtain variation of temperature along the length of the Pin fin
		3 Estimate the heat transfer coefficients in free and forced convection environments
		4 Perform Radiation experiments to determine Stephen Boltzman constant and emissivity of a test plate
		5 Estimate condensation heat transfer coefficients and to determine critical heat flux values in boiling
328	CAD/CAM Lab	1 Explain the graphic devices, geometric modeling and drafting devices.
		2 Analyze the design procedure & CAD packages
		3 Determine the Finite Element problems
		4 Explain basics of ANSYS, NASTRAN, NISA-II, Artificial Intelligence
411	Industrial Management	1 Explain the distinguish industrial engineering and production management, with a basis of thorough knowledge on the applications and quantitative measurement tools and also understand the concepts and importance as given by F.W.Taylor, Mc.Gregor and Fayol's principles. [BTL - 2] [Comprehension]
		2 Discuss the summarize the various types of plant layouts based on the techniques of design and their maintenance.
		3 Explain the identify the applications of work study and various recording techniques and their comparisons.
		4 Describe the outline the applications of various statistical quality control tools, methods and charts, which should help him/her understand the concepts of total quality management like quality circles, zero defect, ISO Quality systems and six-sigma. [BTL - 4] [Analysis]

		5	Discuss and analyze the importance of personnel management and industrial relations, based on the concepts of human resource management like job evaluation, merit rating, etc.
		6	Explain the relate and characterize various aspects of value analysis and project management like, value engineering, ERP, SCM, PERT and CPM.
412	Finite Element Methods	1	Apply finite element method to solve problems in solid mechanics.
		2	Formulate and solve problems in one dimensional structures including trusses, beams and frames.
		3	Formulate FE characteristic equations for two dimensional elements and analyze plane stress, plane strain, axi-symmetric problems and higher order elements such as quadratic bar element, 6-node triangle, 4,8,9-node quadrilateral elements
		4	Apply numerical Integration for finding stiffness matrix of different elements and apply the FE procedure to field problems like heat transfer.
413	Production Planning and Control	1	Report the functions of production control, various production system, different aspects of product development and break even analysis
		2	Investigate the concept of method study, motion study and work measurement techniques
		3	Evaluate the economic order quantity and economic lot size in inventory control.
		4	Discuss about production scheduling, production control systems, progress reporting and expediting and it's techniques for aligning completion times and due dates.
		5	Analyze the problems in lack of product planning, quantity determination in batch production capabilities in a multi product system
414	Power Plant Engineering	1	Explain the Layout and working of Steam, Diesel, Gas turbine and Hydro Power Plants
		2	Explain the working of Nuclear Power plants, identification of Nuclear Hazards and disposal of radioactive waste
		3	Explain the combined operations of different power plants and there Instrumentation and Control
		4	Estimate the loads on power plants by considering various factors and the impact of pollutants on environment and methods of pollution control
415	Operations Management	1	Describe the scope of operations management and forecast the demand for products as well as services for a given organization.
		2	Analyze managerial problems related to plant location and layout for a given organization.
		3	Apply appropriate material control techniques and material requirement plans to manage the materials effectively.
		4	Develop aggregate planning and Master production schedules in operation environment.

		5	Apply Deterministic models and Contemporary management techniques to the service sector as well as manufacturing firms.
416	Finite Element Simulation Lab	1	Use the Graphical User Interface (GUI) of relevant software in solving problems related to solid mechanics, heat transfer and free vibrations.
		2	Use relevant software for analysis of beams and frames.
		3	Use relevant software to solve plane stress and plane strain analysis problems. Use relevant software for analysis of axisymmetric solids.
		4	Use relevant software for analysis of three-dimensional solids in problems related with heat transfer and modal analysis.
	Project-I	1	Report the functions of production control, various production system, different aspects of product development and break even analysis
		2	Investigate the concept of method study, motion study and work measurement techniques
		3	Analyze the problems in lack of product planning, quantity determination in batch production capabilities in a multi product system
		4	Discuss about production scheduling, production control systems, progress reporting and expediting and it's techniques for aligning completion times and due dates.
		5	Evaluate the economic order quantity and economic lot size in inventory control.
421	Additive Manufacturing	1	Demonstrate the knowledge of Rapid Prototyping technologies and its techniques.
		2	Analyze and select suitable process and materials used in rapid prototyping.
		3	Select appropriate tooling for rapid prototyping process and rapid prototyping techniques for reverse engineering.
		4	Select and use correct CAD formats in the manufacture of a 3D printed part.
		5	Apply knowledge of additive manufacturing for various real-life applications.
422	Non Destructive Evaluation	1	Apply the basic principles and fundamentals of Radiographic test.
		2	Apply the basic principles and fundamentals of Ultrasonic Testing
		3	Apply the basic principles and fundamentals of Liquid Penetrant Test, Eddy Current and magnetic particle test
		4	Apply the basic principles and fundamentals of Thermography
		5	Analyze the different NDT methods to select the appropriate techniques for inspections
423	Robotics	1	Understand the basic components of robotics.
		2	Differentiate types of robots and robot sensors.
		3	Explain the mathematical model of forward and inverse kinematics of robot manipulators.

		4 Analyze forces in links and joints of a robot.
		5 Programme a robot to perform tasks in industrial applications
424	Entrepreneurship	1 Gain the competency of preparing business plans
		2 Get the awareness on industrial policies
		3 Study the impact of launching small business
		4 Understand the recourse planning and market selection for start ups
425	Project-II	1 Identify complex engineering problems relevant to the society and industry.
		2 Apply modern technologies, tools and systems in the field of mechanical Engineering to analyze the identified problem.
		3 Design and implement a viable solution to the problem.
		4 Apply communication, report writing skills & Presentation skills.
		5 Develop team work and leadership skills with professional and ethical values.