



SAPTHAGIRI COLLEGE OF ENGINEERING

Affiliated to VTU, Belagavi & Approved by AICTE, New Delhi
An ISO 9001:2015 and 14001:2015 Certified Institution

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE OUTCOMES

2015 SCHEME

II Year Mechanical Engineering

Course Code	Course Name	Course Outcomes-On completion of this course the students will be able to
15MAT31	Engineering Mathematics-III	<p>CO1: Find the Fourier series, half range Fourier series and Fourier coefficients of periodic functions.</p> <p>CO2: Find the Fourier and inverse Fourier transforms of periodic functions.</p> <p>CO3: Find Z-transforms and inverse Z-transform, and to solve the finite difference equations using Z-transforms.</p> <p>CO4: Apply the concept of statics for curve fitting, correlation and regression.</p> <p>CO5: Solve the algebraic/transcendental equation, interpolating polynomials, intermediate values and Evaluation of integrals using appropriate numerical techniques.</p> <p>CO6: Evaluate the integrals using Green's, Stokes and Gauss divergence theorem and able to apply Euler's equation to find the maxima or minima of the functional.</p>
15ME32	Materials Science	<p>CO1: Explain the basic structure of mechanical properties and failure of materials.</p> <p>CO2: Explain the phase transformation of Solidification.</p> <p>CO3: Describe the heat treatment process of metals.</p> <p>CO4: Explain the process, and application of ceramics, plastics and smart materials properties.</p> <p>CO5: Explain the process and application of composite Materials.</p>
15ME33	Basic Thermodynamics	<p>CO1: Determine heat and work interactions in different thermodynamic systems.</p> <p>CO2: Apply first and second law of thermodynamics for work and heat interactions.</p> <p>CO3: Analyze reversible and irreversible processes based on change in entropy.</p> <p>CO4: Compute available energy in thermodynamic processes using thermodynamic relations.</p> <p>CO5: Determine thermodynamic properties of pure substance.</p>

		CO6: Determine the behavior of the ideal and real gases using gas laws.
15ME34	Mechanics of Materials	CO1: Determine the stress, strain and elastic constants in bars. CO2: Analyze stress and strain under combined loading using analytical and Mohr circle method. CO3: Draw shear force and bending moment diagrams and determine bending stresses for beams. CO4: Determine the structural behavior of shafts and columns. CO5: Determine the strain energy of structural member and apply theories of failure.
15ME35A/45A	Metal Casting and Welding	CO1: Explain the basics & preparation of sand mould. CO2: Explain different melting furnaces & methods of casting. CO3: Explain the solidification process & casting of aluminium. CO4: Describe different types of welding processes. CO5: Describe metallurgical aspects in welding process & inspection methods.
15ME35B/45B	Machine Tools and Operations	CO1: Demonstrate various conventional machines and operations. CO2: Explain various cutting tool materials geometry and surface finish. CO3: Explain and determine parameters of machining process. CO4: Estimation tool life and cost of machining process.
15ME36A/46A	Computer Aided Machine Drawing	CO1: Demonstrate the usage of CAD software for 3D modeling. CO2: Draw section of solids and conversion of pictorial to orthographic views. CO3: Draw different forms of threads and fasteners. CO4: Draw types of riveted joints, knuckle joint, cotter joints and couplings. CO5: Draw machine parts assembly and drafting
15ME36B/46B	Mechanical Measurements and Metrology	CO1: Describe metrology, methods, standards, of measurement and measuring instruments. CO2: Explain system of limits, fits tolerances, gauges and comparators. CO3: Explain metrological measurements of screw threads, gear tooth parameters and describe advanced Metrology instruments. CO4: Explain the basics and methods of indirect measurements. CO5: Explain measurement of parameters force, pressure, temperature and strain.

15MEL37A/47A	Materials Testing Lab	<p>CO1: Acquire experimentation skills in the field of material testing.</p> <p>CO2: Develop theoretical understanding of the mechanical properties of materials by performing Experiments.</p> <p>CO3: Apply the knowledge to analyze a material failure and determine the failure inducing agents.</p> <p>CO4: Apply the knowledge of testing methods in related areas.</p> <p>CO5: Know how to improve structure/behavior of materials for various industrial applications.</p>
15ME37B/47B	Mechanical Measurements and Metrology Lab	<p>CO1: Calibrate measuring instruments.</p> <p>CO2: Measure thread and gear tooth parameters using measuring instruments.</p> <p>CO3: Measure linear and angular dimensions using measuring instruments.</p> <p>CO4: Measure force, pressure, temperature and strain using indirect measuring methods</p>
15ME38A/48A	Foundry and Forging Lab	<p>CO1: Determine properties of sand</p> <p>CO2: Prepare sand mould</p> <p>CO3: Prepare models using basic forging operations</p>
15ME38B/48B	Machine Shop	<p>CO1: Carrying out different operations on lathe & make a cylindrical model as per dimensioned sketch.</p> <p>CO2: Carrying out different operations on shaper & make different grooved models as per dimensioned sketches</p> <p>CO3: Carrying out different operations on milling machine & make a spur Gear tooth as per dimensioned sketches</p>
15MAT41	Engineering Mathematics – III	<p>CO1: Apply the numerical methods to solve the linear ordinary differential equations of first and second Order.</p> <p>CO2: Derive Bessel's function, Legendre's polynomials and its properties. Also able to apply Rodrigues's Formula to find the polynomials.</p> <p>CO3: Solve problems on analytic functions using Cauchy – Riemann equations and to solve the complex line integrals, conformal and bilinear transformations.</p> <p>CO4: Analyze and solve the probability distribution problems.</p> <p>CO5: Define hypothesis, analyze and interpret the hypothesis for the given sampling distribution and to</p>

		Solve stochastic process problems.
15ME42	Kinematics of Machinery	<p>CO1: Describe the working of various types of mechanisms.</p> <p>CO2: Analyze graphically the velocity and acceleration of simple mechanisms.</p> <p>CO3: Analyze analytically the velocity and acceleration of simple mechanisms.</p> <p>CO4: Determine various parameters of spur gear and analyse gear trains.</p> <p>CO5: Draw and analyze the cam profiles for different types of follower motions.</p>
15ME43	Applied Thermodynamics	<p>CO1: Explain Propulsion systems and determine performance parameters of Gas Power Cycles.</p> <p>CO2: Analyse the performance parameters of Vapour Power Cycles.</p> <p>CO3: Analyse Combustion constituents of exhaust gases.</p> <p>CO4: Determine the performance parameters of I C Engines.</p> <p>CO5: Determine performance parameters of Refrigeration system and properties of conditioned air</p> <p>CO6: Determine performance parameters of Reciprocating Compressors.</p>
15ME44	Fluid mechanics	<p>CO1: Calculate the Fluid properties, Stability of floating bodies and hydrostatic forces on surfaces.</p> <p>CO2: Apply the principles of fluid kinematics and dynamics for fluid flow problems.</p> <p>CO3: Analyze the fluid flows.</p> <p>CO4: Formulate the relations of fluid properties by using dimensional analysis.</p> <p>CO5: Describe the boundary layer concept.</p> <p>CO6: Explain the thermodynamics of compressible flow and basics of CFD.</p>

III Year Mechanical Engineering

Course Code	Course Name	Course Outcomes-On completion of this course the students will be able to
15ME51	Management & Economics	CO 1: Explain the Overview of Management. CO2: Explain the functions of Management CO3: Explain the basics of Economics. CO4: Determine the interest by various Methods. CO5: Evaluate and Select Economic Models from Various Alternatives. CO6: Determine the Cost and Depreciation of Product.
15ME52	Dynamics of Machinery	CO1: Analyze simple mechanisms subjected to static and dynamic force. CO2: Analyze the balancing of rotating and reciprocating masses. CO3: Analyze various characteristics of the governor and gyroscope. CO4: Explain the basics of vibration and apply principle of super position to addition of motion CO5: Analyze free vibration of single degree of freedom systems. CO6: Analyze forced vibration of single degree of freedom system.
15ME53	Turbo Machines	CO1: Explain basic concepts of turbo machines and to determine the fluid flow parameters by using model studies. CO2: Determine efficiency of turbo machines by using thermodynamic principles. CO3: Analyze energy transfer in turbo machines. CO4: Determine performance parameters of steam turbine. CO5: Design and determine performance parameters of hydraulic turbines. CO6: Find performance parameters of centrifugal pump, centrifugal and axial compressor.
15ME54	Design of Machine Elements-I	CO1: Describe and apply various codes and standards in design process. CO2: Analyze the behaviour of machine elements subjected to static, impact and fatigue loading. CO3: Design shafts, couplings and joints for power transmission. CO4: Design riveted and welded joints. CO5: Design threaded fasteners and power screws.

15ME554	Non Traditional Machining	<p>CO1: Understand the different types of Non-Traditional machining processes and their selection parameters.</p> <p>CO2: Understand the concepts of USM, AJM and WJM with their advantages, limitations & applications</p> <p>CO3: Understand the understand the concepts with process characteristics of ECM & CHM with their advantages, limitations & applications</p> <p>CO4: Demonstrate the concepts with process characteristics of EDM and PAM and their advantages, limitations & applications.</p> <p>CO5: Understand the concepts with process characteristics of LBM and EBM and their advantages, limitations & applications.</p>
15ME562	Energy & Environment	<p>CO1: Summarize the basic concepts of energy, its distribution and general Scenario</p> <p>CO2: Explain different energy storage systems, energy management, audit and economic analysis</p> <p>CO3: Summarize the environment Eco system and its need for awareness</p> <p>CO4: Identify the various types of environment pollution and their effects</p> <p>CO5: Discuss the social issues of the environment with associated acts</p>
15ME563	Automation & Robotics	<p>CO1: Explain basics of automation and automated manufacturing systems.</p> <p>CO2: Demonstrate basics of robotics and its performance parameters.</p> <p>CO3: Explain the working principle of controllers, actuators & feedback components of control system.</p> <p>CO4: Explain working principle of robotics sensors & machine vision system.</p> <p>CO5: Explain the advanced technologies of robots & its applications.</p>
15MEL57	Fluid Mechanics & Machinery Lab	<p>CO1: Conduct experiment to perform and calculate the performance of power developing and Power absorbing machines.</p> <p>CO2: Calibrate and to determine the flow properties of flow measuring devices.</p> <p>CO3: Perform and calculate the major and minor losses for flow through pipes.</p> <p>CO4: Perform and calculate the impact of jet on vanes.</p>
15MEL58	Energy Conversion Lab	<p>CO1: Perform experiments to determine the properties of fuels and oils.</p> <p>CO2: Conduct experiments on engines and draw characteristics.</p> <p>CO3: Test basic performance parameters of I.C. Engine and implement the knowledge in industry.</p> <p>CO4: Identify exhaust emission, factors affecting them and report the remedies.</p>

		<p>CO5: Determine the energy flow pattern through the I C Engine</p> <p>CO6: Exhibit his competency towards preventive maintenance of IC engines.</p>
15ME61	Finite Element Analysis	<p>CO1: Describe basics of finite element formulation methods.</p> <p>CO2: Derive interpolation functions for structural elements.</p> <p>CO3: Apply finite element formulation to determine structural behavior of bar, truss, beam and shaft.</p> <p>CO4: Formulate 1D heat transfer and fluid flow problems.</p> <p>CO5: Determine numerical solution for axisymmetric triangular element subjected to point load.</p> <p>CO6: Formulate ID bar and truss element subjected to dynamic loading.</p>
15ME62	Computer Integrated Manufacturing	<p>CO1: Explain the basics of automated manufacturing systems and mathematical model to analyze the different types of automated flow lines.</p> <p>CO2: Explain the different types of manufacturing planning and control system using graphics software.</p> <p>CO3: Explain the Flexible manufacturing system</p> <p>CO4: Analyze the automated flow lines by using line balancing techniques</p> <p>CO5: Write CNC part program and programs for Robots.</p> <p>CO6: Explain the basic principles of additive manufacturing systems and the applications of IOT.</p>
15ME63	Heat Transfer	<p>CO1: Determine the conduction heat transfer of steady and unsteady state.</p> <p>CO2: Analyze one-dimensional and two-dimensional steady and unsteady state heat conduction using numerical methods.</p> <p>CO3: Analyze the radiation heat transfer by applying fundamental laws</p> <p>CO4: Determine convective heat transfer using non-dimensional numbers.</p> <p>CO5: Determine performance parameters using LMTD and NTU methods.</p> <p>CO6: Determine heat transfer co-efficient of boiling and condensation.</p>
15ME64	Design of Machine Elements-II	<p>CO1: Compute the stresses in curved beams and cylinders.</p> <p>CO2: Design belts for power transmission.</p> <p>CO3: Describe wire ropes and chain drives.</p> <p>CO4: Design different types of gears.</p> <p>CO5: Design springs, clutches and brakes.</p> <p>CO6: Design and analyze bearings for engineering applications</p>

15ME655	Automotive Engineering	<p>CO1: Illustrate the working of principle parts of an IC Engine.</p> <p>CO2: Explain cooling, lubrication and ignition system of an IC engine</p> <p>CO3: Explain the working of various components of transmission and braking system and determine the torque output and gear ratios</p> <p>CO4: Explain the working various components of steering and suspension systems and steering geometry</p> <p>CO5: Explain the supercharger, turbocharger, and types of fuels and fuel injecting systems</p> <p>CO6: Explain the automobile emission control system and emission standards.</p>
15ME664	Total Quality Management	<p>CO1: Explain the Principle and Application of Total Quality Management in Organizations.</p> <p>CO2: Explain the Quality, Roles of Leaders and Principles of Leadership.</p> <p>CO3: Explain customer satisfactions and involvement in Service and Products.</p> <p>CO4: Explain the use of Statistical Tools for Continuous Improvement of Processes.</p> <p>CO5: Apply Tools and Techniques of Total Quality Management.</p>
15MEL67	Heat Transfer Lab	<p>CO1: Perform experiments to determine the thermal conductivity of a metal rod</p> <p>CO2: Conduct experiments to determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.</p> <p>CO3: Estimate the effective thermal resistance in composite slabs and efficiency in pin-fin.</p> <p>CO4: Determine surface emissivity of a test plate</p> <p>CO5: Calculate temperature distribution of steady and transient heat conduction through plane wall, cylinder and fin using numerical approach.</p> <p>CO6: Estimate performance of a refrigerator and effectiveness of fin.</p>
15MEL68	Modelling & Analysis Lab	<p>CO1: Use the finite element analysis software.</p> <p>CO2: Analyze 1-D and 2-D Structural Problems.</p> <p>CO3: Analyze 1-D and 2-D Heat Transfer Problems.</p> <p>CO4: Analyze the dynamic behaviour for Bars and Beams Problems.</p>

IV Year Mechanical Engineering

Course Code	Course Name	Course Outcomes - On completion of this course the students will be to
15ME71	Energy Engineering	<p>CO1: Explain plane wall, principles of power generation by fuels, details of equipments used in Thermo Electric power plants & analyze draught in chimney.</p> <p>CO2: Describe the applications of diesel engines in power generation, system and layout of Diesel power plants.</p> <p>CO3: Explain Basics of Hydrology and systems of Hydroelectric power plants and analyze power generatable.</p> <p>CO4: Explain the Principles of energy from solar radiation and details of harnessing by helio thermal and helio electric methods</p> <p>CO5: Explain wind energy and it's harnessing by different types of wind mills and explain concepts of Tidal power and power generation from tidal waves.</p> <p>CO6: Describe about Biomass as energy source and energy conversions and explain Green energy and latest trends of green energy methods such as MHD, Fuel cell, Geothermal and zero energy concepts.</p>
15ME72	Fluid Power Systems	<p>CO1: Describe structural components and working of hydraulic system</p> <p>CO2: Describe different types of pumps and actuators.</p> <p>CO3: Apply the design of hydraulic circuit using control components for given applications.</p> <p>CO4: Describe pneumatic power system and its components.</p> <p>CO5: Apply the design of pneumatic control circuit.</p>
15ME73	Control Engineering	<p>CO1: Describe the Basic Principles of control system and controllers</p> <p>CO2: Determine the system governing equations for physical models (of mechanical, hydraulic, Pneumatic and electrical systems</p> <p>CO3: Determine the transfer function of a control system using Block diagram reduction technique and Signal flow graphs</p> <p>CO4: Illustrate the response of 1st and 2nd order systems</p> <p>CO5: Find the stability of the control system using Nyquist, Polar, Bode and root locus methods</p> <p>CO6: Apply the State Equations to find controllability and Observability using Kalman and Gilbert's test.</p>

15ME742	Tribology	<p>CO1: Understand the fundamentals of tribology and associated parameters.</p> <p>CO2: Understand the concepts of friction and friction theories, consequences of wear, wear mechanisms, wear theories and analysis of wear problems..</p> <p>CO3: Analyze the requirements and design hydrodynamic journal and plane slider bearings for a given application and understand the concept of hydrostatic bearing..</p> <p>CO4: Analyze the requirements of plane slider bearings for a given application and understand the concept of hydrostatic bearing.</p> <p>CO5: Able to analyze free vibration of single degree of freedom systems.</p> <p>CO5: Select proper bearing materials and lubricants for a given tribological application and apply the principles of surface engineering for different applications of tribology.</p>
15ME744	Design for Manufacturing	<p>CO1: Explain the different phases of Design for Manufacturing.</p> <p>CO2: Describe the Assembly Design Process and True Positional for Manufacture.</p> <p>CO3: Describe the Datum feature and component design for various Manufacture Process.</p> <p>CO4: Explain the Design consideration for Casting and Welding.</p> <p>CO5: Explain the Design consideration for forging, powder metallurgy and injection moulding.</p>
15ME753	Mechatronics	<p>CO1: Explain the Components of Mechatronics Systems.</p> <p>CO2: Explain the basic, architecture of Microprocessor and Microcontroller.</p> <p>CO3: Explain the Programmable Logic Controller.</p> <p>CO4: Explain the principles of Actuation System and its classification, application.</p>
15MEL76	Design Lab	<p>CO1: Analyse the vibration characteristics in a single degree of freedom vibrating systems.</p> <p>CO2: Analyse the rotating elements for balancing, critical speed of shaft.</p> <p>CO3: Compute the fringe constant of photo elastic material for different loading conditions.</p> <p>CO4: Analyse the characteristics of governors.</p> <p>CO5: Analyse the stresses for combined loading in straight and curved beam using strain gauges.</p> <p>CO6: Analyse pressure distribution in journal bearing.</p>

15MEL77	CIM Lab	<p>CO1:Generate CNC Lathe part program for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning, Circular interpolation etc.</p> <p>CO2: Generate CNC Mill Part programming for Point to point motions, Line motions, Circular interpolation, Contour motion, Pocket milling- circular, rectangular, Mirror commands etc.</p> <p>CO3: Use Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning Thread cutting etc.</p> <p>CO4: Simulate Tool Path for different Machining operations of small components using CNC Lathe & CNC Milling Machine.</p> <p>CO5: Use high end CAM packages for machining complex parts; use state of art cutting tools and related cutting parameters; optimize cycle time.</p> <p>CO6: Understand & write programs for Robot control, understand the operating principles of hydraulics, pneumatics and electro pneumatic systems. Apply this knowledge to automate & improve efficiency of manufacturing.</p>
15MEP78	Project Phase- I	<p>CO1: Identify, formulate and analyze engineering problems for the need of society.</p> <p>CO2: Design solutions for engineering problems using modern tool/technology to investigate with interpretation of data.</p> <p>CO3: Understand the impact of the engineering solutions in societal and environmental contexts for sustainable development with commit to professional ethics.</p> <p>CO4: Work individually and in team, Communicate effectively through reports and presentations.</p> <p>CO5: Apply engineering, management and ethical principles for Project management and finance.</p>
15ME81	Operation Research	<p>CO1: Explain the basics of operations research and solve linear programming problems.</p> <p>CO2: Formulate and optimize transportation and assignment problems.</p> <p>CO3: Evaluate project completion time using PERT and CPM techniques and formulate strategies of game.</p> <p>CO4: Analyze job sequencing and queuing theory models.</p>
15ME82	Additive Manufacturing	<p>CO1: Explain the different process of additive manufacturing.</p> <p>CO2: Describe the working of different types of actuators.</p> <p>CO3: Explain the different process of polymerization and powder metallurgy techniques.</p> <p>CO4: Analyse the different characterization techniques.</p> <p>CO5: Describe the various NC, CNC machine programming and Automation techniques.</p>

15ME835	Product Life Cycle Management	<p>CO1: Explain the various strategies of PLM and Product Data Management.</p> <p>CO2: Explain the decomposition of product design and model simulation.</p> <p>CO3: Explain the concept of New Product Development and its structuring.</p> <p>CO4: Explain the technological forecasting and the tools in the innovation.</p> <p>CO5: Apply the virtual product development and model analysis.</p>
15ME84	Internship/Professional Bodies	<p>CO1: Apply gained knowledge and skills in engineering practice.</p> <p>CO2: Analyze and design solutions for engineering problems.</p> <p>CO3: Work individually, in team and communicate effectively through reports and presentations.</p> <p>CO4: Demonstrate apt workplace attitude and ethics.</p>
15ME85	Project Phase- II	<p>CO1: Identify, formulate and analyze engineering problems for the need of society.</p> <p>CO2: Design solutions for engineering problems using modern tool/technology to investigate with interpretation of data.</p> <p>CO3: Understand the impact of the engineering solutions in societal and environmental contexts for sustainable development with commit to professional ethics.</p> <p>CO4: Work individually and in team, Communicate effectively through reports and presentations.</p> <p>CO5: Apply engineering, management and ethical principles for Project management and finance.</p>
15MES86	Seminar	<p>CO1: Identify and explore recent trends in mechanical engineering.</p> <p>CO2: Prepare effective report on the selected topic.</p> <p>CO3: Prepare power point presentation (PPT), communicate and answer the queries on the topic.</p>