MECHANICAL ENGINEERING

R-15 Course Outcomes

subject code	subject	course outcomes
1521101	Mathematics-1	CO 1 Apply the essential tool of matrices in a comprehensive manner. CO 2 Describe the convergence of series. CO 3 Classify the functions of several variables which is useful in optimization techniques. CO 4 Define Beta and gamma functions and solve definite integrals. CO 5 Determine the Fourier series of the functions. (L3)
1522102	Engineering Physics	CO1. Expose students to theoretical and mathematical aspects of Interference, Diffraction techniques and Lasers for testing of materials. CO2. To understand the concepts of Simple harmonic Oscillator & non dispersive Transverse & Longitudinal waves . CO3. Develop knowledge and understanding the fundamental concepts of solids and semiconductors. CO4. Adaptability to new developments in science and technology.
1523103	Engineering Chemistry	CO 1 Remember the major chemical reactions that are used in the synthesis and stereochemistry of Molecules. CO 2 Understand the periodic properties such as ionization potential, electro negativity and oxidation states. CO 3 Determine the ranges of the electromagnetic spectrum used for exciting different molecular Energy levels in various spectroscopic techniques. CO 4 Analyze microscopic chemistry in terms of atomic and molecular orbital and intermolecular forces. . CO 5 Outline the properties of metals, water and thermodynamic considerations
1524104	English	CO 1 Describe the classification of words, sentences and their usages in sentences. CO 2 Understand the difference between spoken and written English. CO 3 Analyze the rules in language for changing the form of sentences. CO 4 Illustrate the factors that influence grammar and vocabulary in speaking and writing CO 5 Classify the parts of speech, tenses and sentence structures

1503105	Engineering Drawing-1	CO1 Understand the conventions and the methods adopted and how to draw different curves in engineering drawing CO2 Know the importance of projections of planes and solids CO3 Apply the concepts of section planes and sectional objectives CO4 Improve their visualization skills so that they can apply these skills in developing new products
1525106	Human Values and Professional Ethics	Co1: Understand verity of moral issues. Co2 : Know the Balanced outlook on Law Co3: Assessment of safety and risk Co4: Use responsibilities and rights.
1599107	Physics and Chemistry Lab	CO1. To explore the application of interference and diffraction by doing concerned experiments. CO2. Elucidate the concepts of Physics through involvement in the experiment by applying theoretical knowledge. CO 3 Compare rate constants of reactions from concentration of reactants/products as a function of time. CO 4 Evaluate molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
1524108	English Language and Communication Skills Lab	CO 1 Describe objects, places and persons. CO 2 Understand the listening process and answer the questions related to it. CO 3 Analyze phonetics with examples CO 4 Illustrate different modes of communication skills CO 5 Classify LSRW skills
1521201	Mathematics-2	CO 1 Gain a higher level of personal involvement and interest in understanding and solving environmental problems. CO 2 Understand the interconnection of human dependence on this ecosystem. CO 3 Influence their society in proper utilization of Natural resources. CO 4 Increases critical thinking and helps in analyzing the impact of developmental activities on environment CO 5 Learn the management of environmental hazards and disasters and have a clear understanding on environmental concerns and follow sustainable developmental activities.

1521202	Mathematics-3	CO1. Get knowledge of Matrices, curve fitting, Partial Differential Equations, Numerical Methods , Fourier Series and Transforms and Interpolation CO2. Understand algebra of Matrices Numerical methods, Interpolation, Curve fitting, Numerical Differentiation and Integration and the solution of Partial Differential Equations. CO3. Analyze the numerical solutions of Differential Equations in Quantum Mechanics, Electrical Networks etc CO4. Apply Trapezoidal rule and Simpson's rules in numerical differentiation and integration CO5. Synthesize problems of one and two dimensional Partial Differential Equations for the wave
1505203	Programming in C	CO 1 Understand the basics of computer system and C programming. CO 2 Analyze a given problem and develop an algorithm to solve the problem. CO 3 Apply proper branching and loop constructs to solve a complex problem CO 4 Understand the concepts of arrays and strings to solve real time applications CO 5 Apply modular approaches for solving complex problems CO 6 Illustrate memory optimization for solving real world problems using structures and Unions
1524204	English-2	1. Application of Advance grammar concepts 2. Acquisition of English language skills and soft skills based on rubrics like IELTS/TOEFL 3. Enriching LSRW through various genres viz. Autobiography, Essays 4. Practice Technical writing and Documentation 5. Understand engineering related concepts like environment and social media
1503205	Engineering Drawing-	CO1. Understand the theory of orthographic projection. CO2. Understand the conventions and the methods adopted in engineering drawing. CO3. Know the importance of sectioning and Developments of solids in actual applications. CO4. Improve their visualization skills so that they can apply these skills in developing new products.

1501206	Environmental Studies	CO 1 Gain a higher level of personal involvement and interest in understanding and solving environmental problems. CO 2 Understand the interconnection of human dependence on this ecosystem. CO 3 Influence their society in proper utilization of Natural resources. CO 4 Increases critical thinking and helps in analyzing the impact of developmental activities on environment CO 5 Learn the management of environmental hazards and disasters and have a clear understanding on environmental concerns and follow sustainable developmental activities
1599207	Engineering Workshop	CO 1 Identify different manufacturing processes which are commonly employed in the industry CO 2 Analyze the practical knowledge about fabricate components using different materials with their ownhands CO 3 Understand the knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes CO 4 Understand the knowledge of the dimensional accuracies and tolerances applicable for
1505208	Programming in C Lab	CO 1 Analyze given problem and develop an algorithm CO 2 Implement Code and debug programs in C language using various constructs CO 3 Choose proper C language constructs to solve complex problems. CO 4 Organize and implement heterogeneous data in efficient memory utilization
1503301	**Engineering Mechanics**	CO 1 Determine the resultant of system of Forces CO 2 Identify equilibrium conditions for static problems CO 3 Determine the centroid of composite figures ,centre of gravity of bodies ,area, moment of inertia and mass moment of inertia CO 4 Analyze trusses for forces in members
1511302	**Mechanics of Solids**	CO 1 Determine the stresses , strains in bars subjected to loads and temperatures CO 2 Draw the Shear Force and Bending Moment diagrams for beams CO 3 Evaluate the bending & shear stress in beams ,longitudinal & hoop stresses in thin and thick cylinders CO 4 Analyze Torsions in shafts and deflections in various beams

1599303	**Basic Electrical &Electronics Engineering**	CO1: Understand the functionalities of the diodes. CO2: Analyze the performance of rectifiers. CO3: Use the transistors in various applications CO4: Understand the working of voltmeters and CROs.
1503304	**Material Science and Metallurgy**	CO 1 Describe the relation between structure , properties of metals and non metallic materials CO 2 Explain the mechanism of crystallization of metals CO 3 Determine the grain size by using various methods for different Alloys CO 4 Analyze the binary phase diagram of iron iron carbon equilibrium diagram. and (TTT) diagram for heat treatment process
1503305	**Thermodynamics**	CO 1 Understand the concept of system, Control volume, thermodynamic properties ,Thermodynamic Equilibrium, work and heat CO 2 Apply the Laws of Thermodynamics to thermodynamic system CO 3 Use Steam tables to define properties of steam CO 4 Estimate the performance of Gas Power cycles applied to prime movers
1503306	**Machine Drawing**	1. Student can identify different conventions used in industrial drawings 2. Student can develop drawing for different fasteners used in engineering 3. Student can able to identify indentify various parts according to their dimensions during their assembly 4. Student can learn the skills of developing process sheet for the given machine element
1503307	**Material Science Lab & Mechanics of Solids Lab**	CO 1 Use the metal specimen and trace the microstructure at different magnifications CO 2 Determine the hardness of the given Steel specimen before and after annealing and normalizing operations CO 3 Develop the behavior of material under tensile load and draw stress strain diagram CO 4 Analyze hardness test on mild steel , brass and copper
1503308	**Manufacturing Technology Lab**	CO 1 Examine a pattern with allowances CO 2 Test the properties of the moulding sand and prepare a casting CO 3 Develop a model using arc welding ,spot welding and soldering

1503309	**Aptitude**	CO1. Knowledge on menstruation CO2. Ability to solve arithmetical problem with easy CO3. Knowledge on reasoning & logic CO4. Knowledge on notations and numbering. CO5. Build-up the confidence to face competitive examination
1521401	**Probability and Statistics**	CO 1 Determine the roots of polynomial and transcendental equations by different methods. CO 2 Apply discrete and continuous probability distributions. CO 3 Demonstrate the components of a classical hypothesis test. CO 4 Infer the statistical inferential methods based on small and large sampling tests.
1503402	**Composite and Nano materials**	CO1 understand the need of composite materials and know the properties, types and applications of various types of composites. CO2 Analyze the Types of polymers Thermosetting and thermoplastic resins etc, types of fibers and manufacturing methods of polymers. CO3. Determine the various types of metal composites and difference between alloy and metal composites,and manufacturing methods of metal composites. CO4 understand the properties advantages, limitations of ceramics, types of ceramics and
1511403	**Mechanics of Fluids**	CO1: Employ the basic knowledge of fluid properties. CO2: Analyze Hydraulic machines by developing mathematical models to study characteristics of various flows. CO3 :understand the mathematical techniques of practical flow problems. CO4: Understand the boundary layer theory and forces on submerged bodies
1503404	**Kinematics of Machinery**	CO1: Design a suitable mechanism depending on application CO 2: understand the working principles of common mechanisms CO3: Analyze mechanism for finding its displacement, velocity, acceleration, CO4: understand different types of motions and various configurations of followers, by drawing displacement diagrams and cam profile diagram for followers

1503405	**Thermal Engineering – I**	CO1. Understand the concept and working of I.C Engines, Steam Turbines and Steam condensers etc CO2. Describe the operation of air compressors, Steam Generators, Steam Turbines and Steam condensers. CO3. Apply thermodynamics laws in engineering applications like IC Engines, Air Compressors, Steam Nozzles etc CO4. Evaluate the performance of IC Engines, Air Compressors, Steam Nozzles and Steam turbines etc.
1503406	**Manufacturing Technology**	CO1. Knowledge and understanding the, Extending the student's knowledge of production machines and design and analyze of such systems. CO2. Developing theoretical/practical capabilities of students so that they can characterize, transform, use and apply in engineering from the knowledge gained in solving related engineering problems. CO3. Understand Arc, Gas, Solid state and resistance process CO4. Identify the effect of process variables to manufacture defect free products
1511407	**Fluid Mechanics and Hydraulic Machines Lab**	1. Extending the student's knowledge of hydraulic machines and learning the design of such systems. Cognitive skills (thinking and analysis) 2. The students should link the scientific concepts they are learning with real applications by giving live examples 3. Where the subject concepts are applied, Communication skills (personal and academic 4. Students gain a lot of information by searching through the internet and references and from local
1599408	**Basic Electrical & Electronics Engineering lab**	1. Understand the principles of dc machines and transformers. 2. Analyze the working operations of measuring instruments, electrical machines. 3. Determine the efficiency of machines, half wave and full wave rectifiers. 4. Able to observe the different tests and calculations of all machines.

1503501	Heat Transfer	CO 1 Understand the basic mechanism of heat transfer CO 2 Determine the heat transfer rates for the three modes of heat transfer. CO 3 Solve various heat transfer problems encountered in Engineering practice. CO 4 Develop relations for efficiency and analyze heat exchangers using effective -NTU method.
1503502	Design of Machine Elements-I	CO 1 Understand the concepts of design and perform stress analysis on members. CO 2 Design members Under the action of Fluctuating forces based on failures of theories. CO 3 Analyze members having welded and bolted joints. CO 4 Apply Design Procedure for cotter joints ,shaft ,Keys and couplings.
1503503	Machine tools	CO 1 Apply Theory of metal cutting to Machining components and to under stand machining components, operations performed on lathe. CO 2 Understand the use of shaping, slotting and planning machine time calculations. CO 3 Describe various types of drilling machines and boring machines CO 4 Apply the indexing methods that are used in milling machines, also understand grinding machines and broaching Machines.
1503504	Dynamics of Machinery- I	CO 1 Estimate the velocity ratio for different gear trains CO 2 Calculate the length of the belt in an open belt drive CO 3 Analyze different types of brakes and dynamometers CO 4 Design the flywheels for different applications and also Classify governors.
1503505	Thermal Engineering II	CO 1 understand Vapor power cycles. CO 2 Design chimney using draught principles. CO 3 Analyze steam Nozzles used in steam turbines. CO 4 Compare impulse and reaction turbines for their performance and also classify steam condensers.
Elective I 1503506	Hydraulic Machinery	CO 1 Understand different components of a hydroelectric power station. CO 2 Calculate hydro dynamic forces of Jet . CO 3 Classify different types of of Hydraulic Turbines and Estimate their performance CO 4 Analyze Losses , efficiency of centrifugal pump and reciprocating pump

1503507	Industrial Management	CO 1 Define Method study, List the objectives of method study CO 2 Explain various types of plant layouts CO 3 Calculate the floats in the critical path method CO 4 Classify Inspection Methods, Infer the Inspection and quality control
1503508	Entrepreneurship	CO 1 Apply ethics and understand the social responsibilities of entrepreneur CO 2 Create the sources of new ideas and design new plans for development. CO 3 Evaluate business plans, marketing plans, & financial plans. CO 4 Use Inventory control, Material handling, Quality control capable to start their own Entrepreneurship
1503509	Thermal Engineering Lab	CO 1 Understand the working of four stroke and two stroke engine by plotting the valve timing and port timing diagrams. CO 2 Determine the friction power of an IC engine by conducting retardation test CO 3 Evaluate the performance of diesel engines CO 4 Analyze energy distribution by conducting heat balance test on diesel engine.
1524510	Advanced English Communication Skills lab	CO 1 Describe objects, places and persons. CO 2 Understand the listening process and answer the questions related to it. CO 3 Analyze phonetics with examples CO 4 Illustrate different modes of communication skills CO 5 Classify LSRW skills
1525601	Managerial Economics and Financial Analysis	1. To have a practical insight of the concepts of managerial economics 2. Apply the techniques of demand forecasting in the present economic scenario. 3. Relate the concepts to the performance of different businesses, in the changing environment. 4. Apply and interpret the different situations with the help of corporate finance techniques. 5. Analyze the financial position of the company.

1503602	Design of Machine Elements-II	1. To assess the student's progress towards achieving the learning outcomes 2. Work within realistic constraints in realizing systems 3. Participate in the development and selection of ideas and interact with industry 4. Students may be asked to use solid modeling for engineering applications
1503603	Operations Research	CO 1 Solve L.P.P. using simplex method and Big "M" Method. CO 2 Understand transportation and assignment algorithms to apply real word problems. CO 3 Analyze various Replacement ,sequencing and queuing problems. CO 4 Determine simulation models for inventory and Queuing problems.
1503604	Dynamics of MachineryII	CO1. Apply gyroscopic principles on aero planes, ships, four wheel and two wheel vehicles. CO2. Understand the various forces& torques acting in engine mechanism CO3. learn balancing methods for rotating and reciprocating unbalanced forces and couples, and can Solve the numerical problems on balancing of rotating masses and reciprocating masses. CO4. Analyze the response of single degree freedom systems with free and forced vibration, and can evaluate the critical speed of the shaft.
1503605	Refrigeration and AirConditioning	Co1:Know the functioning of basic components of vapour compression refrigeration systems and the refrigerants used in refrigeration industry. Co2:Understand the working of the aqua –ammonia and lithium bromide-water vapour absorption and refrigeration systems. Co3:Determine the heat and moisture removed or added during various psychrometric processes. Co4:Design an air conditioning system for winter or summer air conditioning or industrial air conditioning system.

	Automobile Engineering	Co1:understand the fuel systems in automobiles Co2:Apply the knowledge of mechanics in automobile transmission systems. Co3:Demonstrate the braking systems in automobiles. Co4:Know the cooling and ignition in engines.
Elective II 1503607	IC Engines	CO1:Acquire the knowledge of engine components and fuel air cycles. CO2:Understand the working of engine auxiliary systems. CO3:Study the combustion accepts of SI and CI engines. CO4:Know the various alternative fuels ,engine emissions ,measuring and control techniques.
Elective II 1503608	Power plant Engineering	Co1 list the sub systems of a plant, indicating the function of each subsystem Co2 Outlinethe typical subsystems of a power plant (example: sketch the coal and ash handling system Co3 Describe basic working principles of gas turbine and diesel engine power plants. Define the performance characteristics and components of such power plants Co4 Classify different types of nuclear and hydroelectric power plants and list the advantages of combined cycles power plant Co5 Solve power plant economics problems
1503609	Metrology& Machine Tools Lab	CO1. Use knowledge of metrology and machine tools for practical applications CO2. Understand and build their abilities for running of metrology and machine tools lab

1503610	Heat Transfer and Dynamics Lab	CO1.Evaluate thermal conductivity of insulating powder, lagged pipe and metal rod and determine the Stefan-Boltzmann constant value for radiation heat transfer. CO2. Estimate the effectiveness and efficiency of a pin fin and equivalent resistance of a composite wall. CO3. Estimateheat transfer coeffient in forced and natural convection process and Measure effectiveness of parallel and counter flow heat exchangers CO4. Experiment with vibrations and balancing and demonstrate the working principles of gyroscope and cam. CO5. Understand the concept of refrigeration and air-conditioning systems.
1503701	Cad/Cam	CO 1 Analyze the basic steps in the design process, components of CAD/CAM and design workstation. CO 2 Apply various transformations to manipulate geometric model, understand curve and surface representation. CO 3 Identify the need of Group Technology and FMS. CO 4 Understand the concept of MRP,CAPP and Shop floor data.
1503702	Metrology	CO 1 Distinguish between line standards and end standards CO 2 Design of limit gauge, Go gauge and NO GO gauge CO 3 Apply the principles of Interferometer and optics in measurements of flatness and straightness CO 4 Describe the significance of surface roughness and calculate surface roughness parameters
1503703	Finite element method	CO 1 Derive Displacement stress, strain relations and apply Variational ,weighted residual methods to solve differential Equations CO 2 Analyze to formulate FEM model for simple problems CO 3 Determine element matrices for applying the principles to find stresses in beams , trusses , temperature distribution in composite walls and fins. CO 4 Use FEM to solve bars, trusses, beams , heat transfer problems and also to apply Boundary conditions in realistic problems

1503704	Instrumentation and control system	CO 1 Understand various measurement systems. CO 2 Describe the fundamentals of various types of transducers CO 3 Analyze various measurement techniques CO 4 Explain the method to analyze the stability of systems
Elective III 1503705	Production operation management	CO 1 Design different types of production systems. CO 2 Apply fore casting techniques to predict future demand. CO 3 Develop the facility layout using computerized lay out techniques. CO 4 Use philosophy of lean management to develop lean enterprise and understand basic concepts of JIT, Six sigma control etc.,
Elective III 1503706	computational fluid dynamics	CO 1 Define the error using computational methods CO 2 Apply numerical methods in heat transfer CO 3 Discuss different techniques to solve the numerical equations CO 4 Analyze the finite volume methods for applying in governing equations
Elective III 1503707	mechatronics	CO 1 understand the concepts of signal conditioning CO 2 Describe electro mechanical drives and micro controllers CO 3 Design various Programmable Logic Controllers CO 4 Determine differential equations for control systems
Elective IV 1503708	Modern manufacturing methods	CO 1 Identify the role of non-traditional machining methods CO 2 Discuss the influence of various parameters affecting a UCM process CO 3 Demonstrate the appropriate EDM process for given application CO 4 classify the applications of Non-traditional machining processes
Elective IV1503709	Tool design	CO 1 Understand properties of different metals and non metals CO 2 Able to design multipoint cutting tools CO 3 Design of Die , Die construction CO 4 Design various types of jigs and fixtures

Elective IV 1503710	Rapid prototyping	CO 1 Describe various types of Rapid prototyping Techniques CO 2 Understand various operations, principles and applications of Rp systems CO 3 Determine various part building errors in Rapid prototyping processes CO 4 Analyze 3D printer concepts and Rapid Tooling
1503711	Instrumentation and control system lab	CO 1 Ability to recall the information like displacement, temperature, speed, etc CO 2 Calculate the low pressure gauges CO 3 Analyze measurement of vibration amplitude of an engine test bed at various loads CO 4 Discuss Rota meter, LVDT and strain gauges
1503712	cad/Cam lab	CO 1 Analyze structural, thermal and vibration problems using analysis software like ANSYS CO 2 Design components using modeling software like AUTO CAD, PROE CO 3 Explain the codes of CNC Lathe and CNC milling CO 4 Discuss Robot applications
1503801	Automation & robotics	CO1 Define automation and Describe the levels of automation CO2 Explain the part transfer methods and mechanisms CO3 Illustrate the D-H notation for forward kinematics CO4 Classify the robot actuators and sensors
1503802	Renewable energy sources	CO 1 Define the principles of solar Radiation CO 2 Understand Solar Energy collectors, Solar Energy Storage and applications CO 3 Use wind Energy,Bio mass Energy,Geothermal Energy and Ocean Energy for generation of power CO 4 Analyze direct energy conversion system and their application

1503803	Gas turbines & jet propulsion	CO1 Familiarize with basic components of gas turbine CO2 analyze the power cycles and performance predictions CO3 understand Aircraft propulsion CO4understand different types of Rocket propulsion systems and performance predictions
1503804	Geometric modelling	CO1.understand to produce engineering drawings. CO2 apply geometric modeling techniques CO3. modeling complex curves and surfaces CO4: analyze algorithms and systems for interactive 3D shape modeling, including, Boolean operations, parametric modeling; lighting setup and control.
1503805	Reliability in engineering system	1. Understanding different types of renewable energy sources and their utilization. 2. Ensures the effective employment of energy sources for their corresponding applications 3. Brief knowledge about Bio-Mass and their related applications
1503806	Industrial safety & management	CO1.Awareness of the basic functional areas of organizations,Management Principles, concepts and various Schools of Thought on Management, and also the various types of Organizational Structure need to be followed based on size, type of organization. CO2. Evaluate the qualitative and quantitative parameters for locating a plant and decide on plant layouts and optimization. CO3.knowledge on work study,worksimplification,standardization and improving the method of doing work and also setting time standards for doing work and procedures to arrive at the standard time. CO4. understand the functions of HRM, methods of PerformanceEvaluation, Wage and Incentive Calculation. They will also know the Difference between Inspection &Quality Control, Statistical Quality Control Techniques, TQM , BIS &ISO and also functions of HRM.
1503807	Seminar	CO-1. Student is expected to do an in depth study in a specialized area CO-2. To learn investigation methodologies in specialized areas CO-3. Evaluate and synthesize evidence in order to draw conclusions consistent with the text CO-4. Have and develop presentation skills

1503808	Project work	CO-1. Problem solving skills CO-2.Students must have acquired System integration skills CO-3. Documentation skills CO-4. Project management skills