COURSE OUTCOMES 2019 Pattern

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COURSE CODE	COURSE NAME	COURSE OUTCOMES
402041	Heating,Ventilation,Air Conditioning and Refrigeration	1. ANALYSE different air-craft refrigeration systems and EXPLAIN the properties, applications and environmental issues of different refrigerants.
		2. ANALYSE multi pressure refrigeration system used for refrigeration applications
		3. DISCUSS types of compressors, condensers, evaporators and expansion valves along with regulatory and safety controls and DESCRIBES Transcritical and ejector refrigeration systems
		4. ESTIMATE cooling load for air conditioning systems used with concern of design conditions and indoor quality of air.
		5. DESIGN air distribution system along with consideration of ventilation and infiltration
		6 EXPLAIN the working of types of desiccants, evaporative, thermal storage, radiant cooling, clean room and heat pump systems.
402042	Dynamics of Machinery	1. APPLY balancing technique for static and dynamic balancing of multi cylinder inline and radial engines.
		2. ANALYZE the gyroscopic couple or effect for stabilization of Ship, Airplane and Four wheeler vehicles.
		3. ESTIMATE natural frequency for single DOF un-damped & damped free vibratory systems
		4 DETERMINE response to forced vibrations due to harmonic excitation, base excitation and excitation due to unbalance forces.
		5. .ESTIMATE natural frequencies, mode shapes for 2 DOF un-damped free longitudinal and torsional vibratory systems.
		6. .DESCRIBE noise and vibration measuring instruments for industrial / real life applications

		along with suitable method for noise and vibration control.
402043	Turbomachinery	1. VALIDATE impulse moment principle using flat, inclined and curved surfaces and INVESTIGATE performance characteristics of hydraulic turbines.
		2. DETERMINE performance parameters of impulse and reaction steam turbine along with discussion of nozzles, governing mechanism & losses.
		3. MEASURE performance parameters of single & multistage centrifugal pumps along with discussion of cavitation and selection.
		4. EXPLAIN performance parameters of centrifugal compressor along with discussion of theoretical aspects of axial compressor.
402046	Data Analytics Laboratory	1. UNDERSTAND the basics of data analytics using concepts of statistics and probability.
		2. APPLY various inferential statistical analysis techniques to describe data sets and withdraw useful conclusions from acquired data set.
		3. EXPLORE the data analytics techniques using various tools
		4. :APPLY data science concept and methods to solve problems in real world context
		5. :SELECT advanced techniques to conduct thorough and insightful analysis and interpret the results
402047	Project (Stage-I)	1. Implement systems approach.
		2. To conceptualize a novel idea / technique into a product.
		3. To think in terms of a multi-disciplinary environment.
		4. To take on the challenges of teamwork, and document all aspects of design work.
		5. To understand the management techniques of implementing a project.
402048	Computer Integrated Manufacturing	1. EXPLAIN CIM and factory automation.
		2. UNDERSTAND the integration of hardware and software elements for CIM
		3. APPLY CNC program for appropriate manufacturing techniques.
		4. ANALYZE processes planning, quality and MRP integrated with computers.
		5. INTERPRET flexible, cellular manufacturing and group technology.
		6. ANALYZE the effect of IOT, Industry-4.0 and cloud base manufacturing.
402049	Energy Engineering	1. EXPLAIN the power generation scenario, the layout components of thermal power plant and ANALYZE the improved Rankine cycle.
		2. ANALYZE the performance of steam condensers, cooling tower system; RECOGNIZE an environmental impact of energy systems and methods to control the same.
		3. EXPLAIN the layout, component details of diesel engine plant, hydel and nuclear energy systems.
		4. ANALYZE gas and improved power cycles.
		5. EXPLAIN the fundamentals of renewable energy systems.
		6. EXPLAIN basic principles of energy management, storage and economics of power generation.

402052	Mechanical System Analysis Laboratory	1. DEVELOP an understanding of the Systems Engineering Process and the range of factors that influence the product need, problem-specific information collection, Problem Definition, Task Specification, Solution Concept inception, Concept Development, System's Mathematical Modelling, Synthesis, Analysis, final solution Selection, Simulation, Detailed Design, Construction, Prototyping, Testing, system using manual calculation, computational tools to automate product development process, redesign from customer feedback and control of technological systems.
		2. ILLUSTRATE the concepts and USE the developed skill-set of use of computational tools (FEA, CFD, MBD, FSI, CAE) to automate the complete product development process.
		3. EVALUATE the knowledge of new developments and innovations in technological systems to carry forward to next stage of employment after passing your Undergraduate Degree Examination.
		4. APPRAISE how technologies have transformed people's lives and can be used to SOLVE challenges associated with climate change, efficient energy use, security, health, education and transport,which will be coming your ways in the coming future.
		5. PRIORITIZE the concept of quality and standards, including systems reliability, safety and fitness for the intended purpose.
		6. INVENT yourself to face the challenges of future technologies and their associated Problems
402053	Project (Stage-II)	1. Implement systems approach.
		2. To conceptualize a novel idea / technique into a product.
		3. To think in terms of a multi-disciplinary environment.
		4. To take on the challenges of teamwork, and document all aspects of design work.
		5. To understand the management techniques of implementing a project.

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302041	Numerical & Statistical Methods	1. Solve system of equations using direct and iterative numerical methods.
		2. Estimate solutions for differential equations using numerical techniques
		3. Develop solution for engineering applications with numerical integration.
		4. Design and Create a model using a curve fitting and regression analysis.
		5. Apply statistical Technique for quantitative data analysis.
		6. Demonstrate the data, using the concepts of probability and linear algebra.
302042	Heat & Mass Transfer	1. Analyze & Apply the modes of heat transfer equations for one dimensional thermal system.
		2. Design a thermal system considering fins, thermal insulation and & Transient heat conduction.
		3. Evaluate the heat transfer rate in natural and forced convection & validate with experimentation results.
		4. Interpret heat transfer by radiation between objects with simple geometries, for black and grey surfaces.
		5. Ability to analyze the rate of mass transfer using Fick's Law of Diffusion and understands mass diffusion in different coordinate systems.
		6. Design & Analysis of heat transfer equipments and investigation of its performance.
302043	Design of Machine Elements	1. Design and Analyze the cotter and knuckle Joints, levers and components subjected to eccentric loading.
		2. Design shafts, keys and couplings under static loading conditions.
		3. Analyze different stresses in power screws and APPLY those in the procedure to design screw jack.
		4. Evaluate dimensions of machine components under fluctuating loads.
		5. Evaluate & Interpret the stress developed on the different type of welded and threaded joints.
		6. Apply the design and development procedure for different types of springs.
302044	Mechatronics	1. Define key elements of mechatronics, principle of sensor and its characteristics.

		2. Utilize concept of signal processing and MAKE use of interfacing systems such as ADC, DAC, Digital I/O.
		3. Determine the transfer function by using block diagram reduction technique.
		4. Evaluate Poles and Zero, frequency domain parameter for mathematical modeling for mechanical system.
		5. Apply the concept of different controller modes to an industrial application.
		6. Develop the ladder programming for industrial application.
302046	Digital Manufacturing Laboratory	1. Develop a component using conventional machines, CNC machines and Additive Manufacturing Techniques.
		2. Analyze cutting tool parameters for machining given job.
		3. Demonstrate simulation of manufacturing process using Digital Manufacturing Tools.
		4. Select and Design jigs and Fixtures for a given component.
		5. Demonstrate different parameters for CNC retrofitting and reconditioning.
302047	Skill Development	Apply & Demonstrateprocedure of assembly & disassembly of various machines.
		Design & develop a working/model of machine parts or any new product.
		Evaluate fault with diagnosis on the machines, machine tools and home appliances.
		Identify & demonstrate the various activities performed in an industry such as maintenance, design of components, material selection.
302049	Artificial Intelligence &Machine Learning	1. Demonstrate fundamentals of artificial intelligence and machine learning.
		2. Apply feature extraction and selection techniques.
		3. Apply machine learning algorithms for classification and regression problems.
		4. Devise and Develop a machine learning model using various steps.
		5. Explain concepts of reinforced and deep learning.
		6. Simulate machine learning model in mechanical engineering problems.
302050	Computer Aided Engineering	1. Define the use of CAE tools and Describe the significance of shape functions in finite element formulations.
		2. Apply the various meshing techniques for better evaluation of approximate results.
		3. Apply material properties and boundary condition to Solve 1-D and 2-D element stiffness matrices to obtain nodal or elemental solution.
		4. Analyze and Apply various numerical methods for different types of analysis.
		5. Evaluate and Solve non-linear and dynamic analysis problems by analyzing the results obtained from analytical and computational method.
		6. Generate the results in the form of contour plot by the Use of CAE tools.

302051	Design of Transmission Systems	1. Apply the principle of Spur & Helical gear design for industrial application and Prepare a manufacturing drawing with the concepts of GD&T.
		2. Explain and Design Bevel & Worm gear considering design parameters as per design standards.
		3. Select &Design Rolling and Sliding Contact Bearings from manufacturer's catalogue for a typical application considering suitable design parameters.
		4. Define and Design various types of Clutches, Brakes, used in automobile.
		5. Apply various concept to Design Machine Tool Gear box, for different applications
		6. Elaborate various modes of operation, degree of hybridization and allied terms associated with hybrid electric vehicles.
302053	Measurement Laboratory	1. Evaluate causes of errors in Vernier calipers, micrometers by performing experiments in standard metrological conditions, noting deviations at actual and by plotting cause and effect diagram, to reduce uncertainty in measurement.
		2. Analyze strain measurement parameters by taking modulus of elasticity in consideration to acknowledge its usage in failure detection and force variations.
		3. Examine surface Textures, surface finish using equipment's like Talysurf and analyze surface finish requirements of me equipment's like gauges, jaws of vernier calipers, micrometers, magnifying glasses of height gauge and more, to optimize surface finish accuracy requirements and cost of measurement.
		4. Measure the dimensional accuracy using Comparator and limit gauges and appraise their usage in actual measurement or comparison with standards set to reduce measurement lead time.
		5. Perform Testing of Flow rate, speed and temperature measurements and their effect on performance in machines and me like hydraulic or pneumatic trainers, lathe machine etc. to increase repeatability and reproducibility.
		6. Compile the information of opportunities of entrepreneurships/business in various sectors of metrology like calibrations, testing, coordinate and laser metrology etc in an industry visit report.
302054	Fluid Power &Control Laboratory	1. Define working principle of components used in hydraulic and pneumatic systems.
		2. Identify & Explain various applications of hydraulic and pneumatic systems.
		3. Select an appropriate component required for hydraulic and pneumatic systems using manufactures' catalogues
		4. Simulate & Analyse various hydraulic and pneumatic systems for industrial/mobile applications.
		5. Design a hydraulic and pneumatic system for the industrial applications.
		6. Design & Demonstrate various IoT, PLC based controlling system using hydraulics and pneumatics.
302055	Internship/Mini project	1.Demonstrate professional competence through industry internship.
		2. Apply knowledge gained through internships to complete academic activities in a professional manner.
		3. Choose appropriate technology and tools to solve given problem.
		4. Demonstrate abilities of a responsible professional and use ethical practices in day to day life

		5. Develop network and social circle, and Developing relationships with industry people.
		6. Analyze various career opportunities and Decide career goals.

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202041	**Solid Mechanics**	DEFINE various types of stresses and strain developed on determinate and indeterminate members.
		DRAW Shear force and bending moment diagram for various types of transverse loading and support.
		COMPUTE the slope & deflection, bending stresses and shear stresses on a beam.
		CALCULATE torsional shear stress in shaft and buckling on the column.
		APPLY the concept of principal stresses and theories of failure to determine stresses on a 2-D element.
		UTILIZE the concepts of SFD & BMD, torsion and principal stresses to solve combined loading application based problems.
202042	**Solid Modelling and Drafting**	UNDERSTAND basic concepts of CAD system, need and scope in Product Lifecycle Management
		UTILIZE knowledge of curves and surfacing features and methods to create complex solid geometry
		CONSTRUCT solid models, assemblies using various modeling techniques & PERFORM mass property analysis, including creating and using a coordinate system
		APPLY geometric transformations to simple 2D geometries
		USE CAD model data for various CAD based engineering applications viz. production drawings, 3D printing, FEA, CFD, MBD, CAE, CAM, etc.
		USE PMI & MBD approach for communication
202043	**Engineering Thermodynamics**	DESCRIBE the basics of thermodynamics with heat and work interactions.
		APPLY laws of thermodynamics to steady flow and non-flow processes.
		APPLY entropy, available and non available energy for an open and closed System.
		DETERMINE the properties of steam and their effect on performance of vapour power cycle.
		ANALYSE the fuel combustion process and products of combustion.
		SELECT various instrumentations required for safe and efficient operation of steam generator.

202044	**Engineering Material and Metallurgy**	COMPARE crystal structures and ASSESS different lattice parameters.
		CORRELATE crystal structures and imperfections in crystals with mechanical behaviour of materials.
		DIFFERENTIATE and DETERMINE mechanical properties using destructive and non-destructive testing of materials.
		IDENTIFY & ESTIMATE different parameters of the system viz., phases, variables, component, grains, grain boundary, and degree of freedom. etc.
		ANALYSE effect of alloying element & heat treatment on properties of ferrous & nonferrous alloy.
		SELECT appropriate materials for various applications.
202045	**Geometric Dimensioning and Tolerancing lab**	To understand requirements of industrial drawings
		To read, understand and explain basic Geometric Dimensioning & Tolerance concepts
		To apply various geometric and dimension tolerances based on type of fit
		To include surface roughness symbols based on manufacturing process
		To measure and verify position tolerances with applied material conditions
		To understand requirements for manufacturing and assembly
202047	**Kinematics and machinary**	PERFORM kinematic analysis of simple mechanisms.
		ANALYZE velocity and acceleration of four-bar and single slider mechanisms by analytical methods.
		ANALYZE velocity and acceleration of mechanisms by ICR and relative velocity methods.
		SYNTHESIZE four-bar and single slider mechanisms with analytical and graphical methods
		APPLY fundamentals of gear theory as a prerequisite for gear design.
		CONSTRUCT cam profile for given follower motion.
202046	**Appled Thermodynamics**	DETERMINE COP of refrigeration system and ANALYZE psychrometric processes.
		DISCUSS basics of engine terminology,air standard, fuel air and actual cycles.
		IDENTIFY factors affecting the combustion performance of SI and CI engines
		DETERMINE performance parameters of IC Engines and emission control
		EXPLAIN working of various IC Engine systems and use of alternative fuels.
		CALCULATE performance of single and multi stage reciprocating compressors and DISCUSS rotary positive displacement compressors
202049	**Fluid Mechanics**	DETERMINE various properties of fluid
		APPLY the laws of fluid statics and concepts of buoyancy
		IDENTIFY types of fluid flow and terms associated in fluid kinematics
		APPLY principles of fluid dynamics to laminar flow

		ESTIMATE friction and minor losses in internal flows and DETERMINE boundary layer formation over an external surface
		CONSTRUCT mathematical correlation considering dimensionless parameters, also ABLE to predict the performance of prototype using model laws
202050	**Manufacturing Processes**	SELECT appropriate moulding, core making and melting practice and estimate pouring time, solidification rate and DESIGN riser size and location for sand casting process
		UNDERSTAND mechanism of metal forming techniques and CALCULATE load required for flat rolling
		DEMONSTRATE press working operations and APPLY the basic principles to DESIGN dies and tools for forming and shearing operations
		CLASSIFY and EXPLAIN different welding processes and EVALUATE welding characteristics
		DIFFERENTIATE thermoplastics and thermosetting and EXPLAIN polymer processing techniques
		UNDERSTAND the principle of manufacturing of fibre-reinforce composites and metal matrix composites.
202052	**Project Based Learning II**	IDENTIFY the real-world problem through a rigorous literature survey and formulate / set relevant aims and objectives.
		ANALYZE the results and arrive at valid conclusions.
		PROPOSE a suitable solution based on the fundamentals of mechanical engineering by possibly integration of previously acquired knowledge.
		CONTRIBUTE to society through proposed solutions by strictly following professional ethics and safety measures.
		USE of modern tools and technology in proposed work and demonstrate learning in oral and written form.
		DEVELOP ability to work as an individual and as a team member.
203156	**Electrical and Electronics Engineering**	APPLY programming concepts to UNDERSTAND role of Microprocessor and Microcontroller in embedded systems
		DEVELOP interfacing of different types of sensors and other hardware devices with Atmega328 based Arduino Board
		UNDERSTAND the operation of DC motor, its speed control methods and braking
		DISTINGUISH between types of three phase induction motor and its characteristic features
		EXPLAIN about emerging technology of Electric Vehicle (EV) and its modular subsystems
		CHOOSE energy storage devices and electrical drives for EVs
207002	**Engineering Mathematics III**	SOLVE higher order linear differential equations and its applications to model and analyze mass spring systems.
		APPLY Integral transform techniques such as Laplace transform and Fourier transform to solve differential equations involved theory, heat transfer and related mechanical engineering applications.
		APPLY Statistical methods like correlation, regression in analyzing and interpreting experimental data applicable to reliability engineering and probability theory in testing and quality control.
		Perform Vector differentiation & integration, analyze the vector fields and APPLY to fluid flow problems.
		SOLVE Partial differential equations such as wave equation, one and two dimensional heat flow equations.