

Brahma Valley college of engineering and Research Institute, Nashik  
Department of Mechanical Engineering  
Course outcomes

Year	Course Name	Course Outcome No.	Course Outcome
SE	202041 - Solid Mechanics	CO1	DEFINE various types of stresses and strain developed on determinate and indeterminate members.
		CO2	DRAW Shear force and bending moment diagram for various types of transverse loading and support
		CO3	COMPUTE the slope & deflection, bending stresses and shear stresses on a beam.
		CO4	CALCULATE torsional shear stress in shaft and buckling on the column.
		CO5	APPLY the concept of principal stresses and theories of failure to determine stresses on a 2-D element
		CO6	UTILIZE the concepts of SFD & BMD, torsion and principal stresses to solve combined loading application based problems.
	202042 - Solid Modeling and Drafting	CO1	UNDERSTAND basic concepts of CAD system, need and scope in Product Lifecycle Management
		CO2	UTILIZE knowledge of curves and surfacing features and methods to create complex solid geometry
		CO3	CONSTRUCT solid models, assemblies using various modeling techniques & PERFORM mass property analysis, including creating and using a coordinate system
		CO4	APPLY geometric transformations to simple 2D geometries
		CO5	USE CAD model data for various CAD based engineering applications viz. production drawings, 3D printing, FEA, CFD, MBD, CAE, CAM, etc.
		CO6	USE PMI & MBD approach for communication
	202043 - Engineering Thermodynamics	CO1	DESCRIBE the basics of thermodynamics with heat and work interactions
		CO2	APPLY laws of thermodynamics to steady flow and non-flow processes
		CO3	APPLY entropy, available and non-available energy for an Open and Closed System
		CO4	DETERMINE the properties of steam and their effect on performance of vapour power cycle
		CO5	ANALYSE the fuel combustion process and products of combustion.
		CO6	SELECT various instrumentations required for safe and efficient operation of steam generator
	202044 - Engineering Materials and Metallurgy	CO1	COMPARE crystal structures and ASSESS different lattice parameters.
		CO2	CORRELATE crystal structures and imperfections in crystals with mechanical behaviour of materials
		CO3	DIFFERENTIATE and DETERMINE mechanical properties using destructive and non-destructive testing of materials.
		CO4	IDENTIFY & ESTIMATE different parameters of the system viz., phases, variables, component, grains, grain boundary, and degree of freedom. etc.
		CO5	ANALYSE effect of alloying element & heat treatment on properties of ferrous & nonferrous alloy.
		CO6	SELECT appropriate materials for various applications.
203156 - Electrical and Electronics Engineering	CO1	APPLY programming concepts to UNDERSTAND role of Microprocessor and Microcontroller in embedded systems	
	CO2	DEVELOP interfacing of different types of sensors and other hardware devices with Atmega328 based Arduino Board	
	CO3	UNDERSTAND the operation of DC motor, its speed control methods and braking.	
	CO4	DISTINGUISH between types of three phase induction motor and its characteristic features	
	CO5	EXPLAIN about emerging technology of Electric Vehicle (EV) and its modular subsystems	
	CO6	CHOOSE energy storage devices and electrical drives for EVs	
202045 - Geometric Dimensioning and Tolerancing Lab	CO1	SELECT appropriate IS and ASME standards for drawing	
	CO2	READ & ANALYSE variety of industrial drawings	
	CO3	APPLY geometric and dimensional tolerance, surface finish symbols in drawing	
	CO4	EVALUATE dimensional tolerance based on type of fit, etc.	
	CO5	SELECT an appropriate manufacturing process using DFM, DFA, etc	
207002 - Engineering Mathematics	CO1	SOLVE higher order linear differential equations and its applications to model and analyze mass spring systems	
	CO2	APPLY Integral transform techniques such as Laplace transform and Fourier transform to solve differential equations involved in vibration theory, heat transfer and related mechanical engineering applications	
	CO3	APPLY Statistical methods like correlation, regression in analyzing and interpreting experimental data applicable to reliability engineering and probability theory in testing and quality control	

ics - III	CO4	PERFORM Vector differentiation & integration, analyze the vector fields and APPLY to fluid flow problems
	CO5	SOLVE Partial differential equations such as wave equation, one and two dimensional heat flow equations
202047 - Kinematics of Machinery	CO1	APPLY kinematic analysis to simple mechanisms
	CO2	ANALYZE velocity and acceleration in mechanisms by vector and graphical method
	CO3	SYNTHESIZE a four bar mechanism with analytical and graphical methods
	CO4	APPLY fundamentals of gear theory as a prerequisite for gear design
	CO5	CONSTRUCT cam profile for given follower motion
202048 - Applied Thermodynamics	CO1	DETERMINE COP of refrigeration system and ANALYZE psychrometric processes.
	CO2	DISCUSS basics of engine terminology, air standard, fuel air and actual cycles.
	CO3	IDENTIFY factors affecting the combustion performance of SI and CI engines.
	CO4	DETERMINE performance parameters of IC Engines and emission control
	CO5	EXPLAIN working of various IC Engine systems and use of alternative fuels.
	CO6	CALCULATE performance of single and multi-stage reciprocating compressors and DISCUSS rotary positive displacement compressors
202049 - Fluid Mechanics	CO1	DETERMINE various properties of fluid
	CO2	APPLY the laws of fluid statics and concepts of buoyancy
	CO3	IDENTIFY types of fluid flow and terms associated in fluid kinematics
	CO4	APPLY principles of fluid dynamics to laminar flow
	CO5	ESTIMATE friction and minor losses in internal flows and DETERMINE boundary layer formation over an external surface
	CO6	CONSTRUCT mathematical correlation considering dimensionless parameters, also ABLE to predict the performance of prototype using model laws
202050 - Manufacturing Processes	CO1	SELECT appropriate moulding, core making and melting practice and estimate pouring time, solidification rate and DESIGN riser size and location for sand casting process
	CO2	UNDERSTAND mechanism of metal forming techniques and CALCULATE load required for flat rolling
	CO3	DEMONSTRATE press working operations and APPLY the basic principles to DESIGN dies and tools for forming and shearing operations
	CO4	CLASSIFY and EXPLAIN different welding processes and EVALUATE welding characteristics
	CO5	DIFFERENTIATE thermoplastics and thermosetting and EXPLAIN polymer processing techniques
	CO6	UNDERSTAND the principle of manufacturing of fibre-reinforce composites and metal matrix composites
202051 - Machine Shop	CO1	PERFORM welding using TIG/ MIG/ Resistance/Gas welding technique
	CO2	MAKE Fibre-reinforced Composites by hand lay-up process or spray lay-up techniques
	CO3	PERFORM cylindrical/surface grinding operation and CALCULATE its machining time
	CO4	DETERMINE number of indexing movements required and acquire skills to PRODUCE a spur gear on a horizontal milling machine
	CO5	PREPARE industry visit report
	CO6	UNDERSTAND procedure of plastic processing
202052 - Project Based Learning - II	CO1	IDENTIFY the real-world problem (possibly of interdisciplinary nature) through a rigorous literature survey and formulate / set relevant aims and objectives
	CO2	ANALYZE the results and arrive at valid conclusions.
	CO3	PROPOSE a suitable solution based on the fundamentals of mechanical engineering by possibly integration of previously acquired knowledge
	CO4	CONTRIBUTE to society through proposed solutions by strictly following professional ethics and safety measures.
	CO5	USE of technology in proposed work and demonstrate learning in oral and written form.
	CO6	DEVELOP ability to work as an individual and as a team member.
302041: Numerical and Statistical Methods	CO1	SOLVE system of equations using direct and iterative numerical methods.
	CO2	ESTIMATE solutions for differential equations using numerical techniques
	CO3	DEVELOP solution for engineering applications with numerical integration.
	CO4	DESIGN and CREATE a model using a curve fitting and regression analysis.
	CO5	APPLY statistical Technique for quantitative data analysis.

	CO6	<b>DEMONSTRATE</b> the data, using the concepts of probability and linear algebra.
<b>302042: Heat and Mass Transfer</b>	CO1	<b>ANALYZE &amp; APPLY</b> the modes of heat transfer equations for one dimensional thermal system.
	CO2	<b>DESIGN</b> a thermal system considering fins, thermal insulation and & Transient heat conduction
	CO3	<b>EVALUATE</b> the heat transfer rate in natural and forced convection & validate with experimentation results.
	CO4	<b>INTERPRET</b> heat transfer by radiation between objects with simple geometries, for black and grey surfaces
	CO5	<b>ABILITY</b> to analyze the rate of mass transfer using Fick's Law of Diffusion and understands mass diffusion in different coordinate systems.
	CO6	<b>DESIGN &amp; ANALYSIS</b> of heat transfer equipment's and investigation of its performance.
<b>302043: Design of Machine Elements</b>	CO1	<b>DESIGN AND ANALYZE</b> the cotter and knuckle Joints, levers and components subjected to eccentric loading
	CO2	<b>DESIGN</b> shafts, keys and couplings under static loading conditions.
	CO3	<b>ANALYZE</b> different stresses in power screws and <b>APPLY</b> those in the procedure to design screw jack.
	CO4	<b>EVALUATE</b> dimensions of machine components under fluctuating loads.
	CO5	<b>EVALUATE &amp; INTERPRET</b> the stress developed on the different type of welded and threaded joints
	CO6	<b>APPLY</b> the design and development procedure for different types of springs.
<b>302044: Mechatronics</b>	CO1	<b>DEFINE</b> key elements of mechatronics, principle of sensor and its characteristics.
	CO2	<b>UTILIZE</b> concept of signal processing and <b>MAKE</b> use of interfacing systems such as ADC, DAC, Digital I/O.
	CO3	<b>DETERMINE</b> the transfer function by using block diagram reduction technique.
	CO4	<b>EVALUATE</b> Poles and Zero, frequency domain parameter for mathematical modeling for mechanical system
	CO5	<b>APPLY</b> the concept of different controller modes to an industrial application.
	CO6	<b>DEVELOP</b> the ladder programming for industrial application
<b>302045- Advanced Forming &amp; Joining Processes</b>	CO1	<b>ANALYSE</b> the effect of friction in metal forming deep drawing and <b>IDENTIFICATION</b> of surface defects and their remedies in deep drawing operations
	CO2	<b>ASSESS</b> the parameters for special forming operation and <b>SELECT</b> appropriate special forming operation for particular applications
	CO3	<b>ANALYSE</b> the effect of HAZ on microstructure and mechanical properties of materials
	CO4	<b>CLASSIFY</b> various solid state welding process and <b>SELECT</b> suitable welding processes for particular applications
	CO5	<b>CLASSIFY</b> various advanced welding process and <b>SELECT</b> suitable welding processes for particular applications
	CO6	<b>INTERPRET</b> the principles of sustainable manufacturing and its role in manufacturing industry
<b>302045- Machining Science &amp; Technology</b>	CO1	<b>DEFINE</b> metal cutting principles and mechanics of metal cutting and tool life.
	CO2	<b>DESCRIBE</b> features of gear and thread manufacturing processes.
	CO3	<b>SELECT</b> appropriate grinding wheel and demonstrate the various surface finishing processes
	CO4	<b>SELECT</b> appropriate jigs/fixtures and to draw the process plan for a given component
	CO5	<b>SELECT &amp; EVALUATE</b> various parameters of process planning
	CO6	<b>GENERATE</b> CNC program for Turning / Milling processes and generate tool path using CAM software
<b>302046: Digital Manufacturing Laboratory</b>	CO1	<b>DEVELOP</b> a component using conventional machines, CNC machines and Additive Manufacturing Techniques
	CO2	<b>ANALYZE</b> cutting tool parameters for machining given job
	CO3	<b>DEMONSTRATE</b> simulation of manufacturing process using Digital Manufacturing Tools
	CO4	<b>SELECT</b> and <b>DESIGN</b> jigs and Fixtures for a given component
	CO5	<b>DEMONESTRATE</b> different parameters for CNC retrofitting and reconditioning
<b>302047: Skill Development</b>	CO1	<b>APPLY&amp; DEMONSTRATE</b> procedure of assembly & disassembly of various machines.
	CO2	<b>DESIGN &amp; DEVELOP</b> a working/model of machine parts or any new product.
	CO3	<b>EVALUATE</b> fault with diagnosis on the machines, machine tools and home appliances.
	CO4	<b>IDENTIFY &amp; DEMONSTRATE</b> the various activities performed in an industry such as maintenance, design of components, material selection.
<b>302049: Artificial Intelligenc</b>	CO1	<b>DEMONSTRATE</b> fundamentals of artificial intelligence and machine learning
	CO2	<b>APPLY</b> feature extraction and selection techniques.
	CO3	<b>APPLY</b> machine learning algorithms for classification and regression problems.

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e & Machine Learning	CO4	<b>DEVISE AND DEVELOP</b> a machine learning model using various steps.
	CO5	<b>EXPLAIN</b> concepts of reinforced and deep learning
	CO6	<b>SIMULATE</b> machine learning model in mechanical engineering problems.
302050: Computer Aided Engineering	CO1	<b>DEFINE</b> the use of CAE tools and <b>DESCRIBE</b> the significance of shape functions in finite element formulations
	CO2	<b>APPLY</b> the various meshing techniques for better evaluation of approximate results.
	CO3	<b>APPLY</b> material properties and boundary condition to <b>SOLVE</b> 1-D and 2-D element stiffness matrices to obtain nodal or elemental solution.
	CO4	<b>ANALYZE</b> and <b>APPLY</b> various numerical methods for different types of analysis.
	CO5	<b>EVALUATE</b> and <b>SOLVE</b> non-linear and dynamic analysis problems by analyzing the results obtained from analytical and computational method
	CO6	<b>GENERATE</b> the results in the form of contour plot by the USE of CAE tools.
302051: Design of Transmission Systems	CO1	<b>APPLY</b> the principle of Spur & Helical gear design for industrial application and <b>PREPARE</b> a manufacturing drawing with the concepts of GD&T.
	CO2	<b>EXPLAIN</b> and <b>DESIGN</b> Bevel & Worm gear considering design parameters as per design standards
	CO3	<b>SELECT&amp;DESIGN</b> Rolling and Sliding Contact Bearings from manufacturer's catalogue for a typical application considering suitable design parameters.
	CO4	<b>DEFINE</b> and <b>DESIGN</b> various types of Clutches, Brakes, used in automobile.
	CO5	<b>APPLY</b> various concept to <b>DESIGN</b> Machine Tool Gear box, for different applications
	CO6	<b>ELABORATE</b> various modes of operation, degree of hybridization and allied terms associated with hybrid electric vehicles
302052-A: Composite Materials	CO1	<b>DEFINE &amp; COMPARE</b> composites with traditional materials
	CO2	<b>IDENTIFY &amp; ESTIMATE</b> different parameters of the Polymer Matrix Composite
	CO3	<b>CATEGORISE</b> and <b>APPLY</b> Metal Matrix Process from possessions landscape.
	CO4	<b>DETERMINE</b> volume/weight fraction and strength of Composites.
	CO5	<b>SELECT</b> appropriate testing and inspection method for composite materials
	CO6	<b>SELECT</b> composites materials for various applications
302052-B: Surface Engineering	CO1	<b>DEFINE</b> the basic's principle & mechanism of surface degradation.
	CO2	<b>ANALYSE &amp; SELECT</b> correct corrosion prevention techniques for a different service condition.
	CO3	<b>DEMONSTRATE</b> the role of surface engineering of materials to modify/improve the surface properties
	CO4	<b>SELECT</b> the suitable surface heat treatments to improve the surface properties.
	CO5	<b>APPLY</b> the surface modification technique to modify surface properties.
	CO6	<b>ANALYSE &amp; EVALUTE</b> various surface coating defects using various testing/characterization method.
302053: Measurement Laboratory	CO1	<b>EVALUATE</b> 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.
	CO2	<b>ANALYZE</b> strain measurement parameters by taking modulus of elasticity in consideration to acknowledge its usage in failure detection and force variations
	CO3	<b>EXAMINE</b> surface Textures, surface finish using equipment's like Talysurf and analyze surface finish requirements of metrological 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.
	CO4	<b>MEASURE</b> 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
	CO5	<b>PERFORM</b> Testing of Flow rate, speed and temperature measurements and their effect on performance in machines and mechanisms like hydraulic or pneumatic trainers, lathe machine etc. to increase repeatability and reproducibility.
	CO6	<b>COMPILE</b> 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	CO1	<b>DEFINE</b> working principle of components used in hydraulic and pneumatic systems.
	CO2	<b>IDENTIFY &amp; EXPLAIN</b> various applications of hydraulic and pneumatic systems.
	CO3	<b>SELECT</b> an appropriate component required for hydraulic and pneumatic systems using manufactures' catalogues
	CO4	<b>SIMULATE &amp; ANALYSE</b> various hydraulic and pneumatic systems for industrial/mobile applications
	CO5	<b>DESIGN</b> a hydraulic and pneumatic system for the industrial applications
	CO6	<b>DESIGN &amp; DEMONESTRATE</b> various IoT, PLC based controlling system using hydraulics and pneumatics
	CO1	<b>DEMONSTRATE</b> professional competence through industry internship.

	<b>302055: Internship /Mini project</b>	CO2	<b>APPLY</b> knowledge gained through internships to complete academic activities in a professional manner
		CO3	<b>CHOOSE</b> appropriate technology and tools to solve given problem.
		CO4	<b>DEMONSTRATE</b> abilities of a responsible professional and use ethical practices in day to day life.
		CO5	<b>DEVELOP</b> network and social circle, and <b>DEVELOPING</b> relationships with industry people.
		CO6	<b>ANALYZE</b> various career opportunities and <b>DECIDE</b> career goals.
	<b>Mini project</b>	CO1	<b>EXPLAIN</b> plan and execute a Mini Project with team.
		CO2	<b>IMPLEMENT</b> hardware/software/analytical/numerical techniques, etc.
		CO3	<b>DEVELOP</b> a technical report based on the Mini project
CO4		<b>DELIVER</b> technical seminar based on the Mini Project work carried out	
<b>402041: Heating, Ventilation, Air Conditioning and Refrigeration</b>	CO1	<b>ANALYZE</b> different air-craft refrigeration systems and <b>EXPLAIN</b> the properties, applications and environmental issues of different refrigerants.	
	CO2	<b>ANALYZE</b> multi pressure refrigeration system used for refrigeration applications.	
	CO3	<b>DISCUSS</b> types of compressors, condensers, evaporators and expansion valves along with regulatory and safety controls and <b>DESCRIBE</b> Transcritical and ejector refrigeration systems.	
	CO4	<b>ESTIMATE</b> cooling load for air conditioning systems used with concern of design conditions and indoor quality of air.	
	CO5	<b>DESIGN</b> air distribution system along with consideration of ventilation and infiltration.	
	CO6	<b>EXPLAIN</b> the working of types of desiccants, evaporative, thermal storage, radiant cooling, clean room and heat pump systems.	
<b>402042: Dynamics of Machinery</b>	CO1	<b>APPLY</b> balancing technique for static and dynamic balancing of multi cylinder inline and radial engines	
	CO2	<b>ANALYZE</b> the gyroscopic couple or effect for stabilization of Ship, Airplane and Four wheeler vehicles	
	CO3	<b>ESTIMATE</b> natural frequency for single DOF un-damped & damped free vibratory systems	
	CO4	<b>DETERMINE</b> response to forced vibrations due to harmonic excitation, base excitation and excitation due to unbalance forces	
	CO5	<b>ESTIMATE</b> natural frequencies, mode shapes for 2 DOF un-damped free longitudinal and torsional vibratory systems	
	CO6	<b>DESCRIBE</b> noise and vibration measuring instruments for industrial / real life applications along with suitable method for noise and vibration control.	
<b>402043: Turbomachinery</b>	CO1	<b>VALIDATE</b> impulse moment principle using flat, inclined and curved surfaces and <b>INVESTIGATE</b> performance characteristics of hydraulic turbines.	
	CO2	<b>DETERMINE</b> performance parameters of impulse and reaction steam turbine along with discussion of nozzles, governing mechanism & losses.	
	CO3	<b>MEASURE</b> performance parameters of single & multistage centrifugal pumps along with discussion of cavitation and selection	
	CO4	<b>EXPLAIN</b> performance parameters of centrifugal compressor along with discussion of theoretical aspects of axial compressor.	
<b>402044A: Automobile Design</b>	CO1	<b>COMPREHEND</b> the steps involved in the design process of Principal Engine Components	
	CO2	<b>GAIN</b> the knowledge and design of Engine Sub-Systems	
	CO3	<b>COMPUTE</b> the critical dimensions of chassis components involved in the Steering System and Differential and final drive of a vehicle.	
	CO4	<b>SELECT</b> the tyres and wheels required for automobile vehicle and design the various types automotive brakes.	
	CO5	<b>UNDERSTAND</b> the design concepts of Automotive Suspension system	
	CO6	<b>POSSES</b> the knowledge of Vehicle Packaging and System Integration, NVH	
<b>402044B: Design of Heat Transfer Equipments</b>	CO1	<b>EXPLAIN</b> the design aspect of heat exchanger considering fouling factor for Heat Transfer Applications	
	CO2	<b>SELECT</b> and <b>DESIGN</b> the double tube heat exchangers for process industry	
	CO3	<b>DESIGN</b> the Shell & Tube Heat Exchangers for specified conditions	
	CO4	<b>DESIGN</b> the condensers and evaporators for refrigeration applications	
	CO5	<b>DESIGN</b> the compact heat exchangers	
	CO6	<b>ANALYZE</b> the performance of counter and cross flow cooling tower.	
<b>402044C - Modern Machining Processes</b>	CO1	<b>UNDERSTAND</b> and <b>ANALYZE</b> the mechanism, process parameters of mechanical assisted modern machining processes.	
	CO2	<b>UNDERSTAND</b> the mechanism, construction and working of laser, plasma and electron beam assisted machining	
	CO3	<b>CLASSIFY</b> and <b>ANALYZE</b> the mechanism, process parameters of the chemical and electrochemical machining.	
	CO4	<b>RELATE</b> and <b>ANALYZE</b> the mechanism and select process parameters Electrical Discharge Machining for an application.	
	CO5	<b>ILLUSTRATE</b> the application of micromachining processes	
	CO6	<b>SUGGEST</b> appropriate nanomachining process for the specific application	
	CO1	<b>EVALUATE</b> the productivity and <b>IMPLEMENT</b> various productivity improvement techniques	

<b>402044D: Industrial Engineering</b>	CO2	<b>APPLY</b> work study techniques and <b>UNDERSTANDS</b> its importance for better productivity.
	CO3	<b>DEMONSTRATE</b> the ability to <b>SELECT</b> plant location, appropriate layout and material handling equipment
	CO4	<b>USE</b> of Production planning and control tools for effective planning, scheduling and managing the shop floor control.
	CO5	<b>PLAN</b> inventory requirements and <b>EXERCISE</b> effective control on manufacturing requirements.
	CO6	<b>APPLY</b> Ergonomics and legislations for human comfort at work place and <b>UNDERSTANDS</b> the role of value engineering in improving productivity.
<b>402044E: Internet of Things</b>	CO1	<b>EXPLAIN</b> the Applications/Devices, Protocols and Communication Models of IoT
	CO2	<b>DEMONSTRATE</b> small Mechanical Engineering IoT oriented applications using Sensors, Actuators, Microcontrollers and Cloud
	CO3	<b>SELECT</b> commonly used IoT Simulation Hardware platforms
	CO4	<b>APPLICATION</b> of Interfacing and Communication Technologies for IoT
	CO5	<b>ILLUSTRATE</b> IoT Application Development and Security of IoT Ecosystem
	CO6	<b>EVALUATE</b> Present and Future Domain specific Applications of IoT Ecosystem
<b>402044F: Computational Fluid Dynamics</b>	CO1	<b>DISTINGUISH</b> and <b>ANALYZE</b> the governing equations of fluid mechanics and heat transfer in various formulations
	CO2	<b>ANALYZE</b> and <b>MODEL</b> the conduction and advection problems
	CO3	<b>ANALYZE</b> and <b>MODEL</b> the Convection-Diffusion problems
	CO4	<b>IDENTIFY</b> and <b>EVALUATE</b> the External/Internal flow and its simulation
	CO5	<b>DISTINGUISH</b> and <b>COMPARE</b> concepts of stability and turbulence.
	CO6	<b>USE</b> and <b>APPLY</b> a CFD tool for effectively solving practical Fluid-Structure Interaction problems
<b>402045A: Product Design and Development</b>	CO1	<b>UNDERSTAND</b> Product design and Product development processes
	CO2	<b>UNDERSTAND</b> Processes, tools and techniques for Market Survey & Product Specification Finalization
	CO3	<b>UNDERSTAND</b> Processes, tools and techniques for Concept Inception, Verification and selection
	CO4	<b>UNDERSTAND</b> Processes, tools and techniques for Concept Exploration & Development
	CO5	<b>UNDERSTAND</b> Processes, tools and techniques for Design Verification and Validation
	CO6	<b>UNDERSTAND</b> Processes, tools and techniques for Robust Design and Development
<b>402045B: Experimental Methods in Thermal Engineering</b>	CO1	<b>IDENTIFY</b> the suitable instrument for measuring parameters as per performance characteristics
	CO2	<b>ANALYZE</b> experimental data by using different statistical techniques and estimate error
	CO3	<b>DISTINGUISH</b> different methods of temperature measurements and thermal radiation
	CO4	<b>CLASSIFY</b> various pressure measurement instruments and their comparison
	CO5	<b>EXPLAIN</b> different flow measurement methods and flow visualization techniques
	CO6	<b>APPLY</b> knowledge of modern engineering experimentation, including calibration, data acquisition, analysis and interpretation using different AI and ML techniques
<b>402045C: Additive Manufacturing</b>	CO1	<b>USE</b> and <b>CLASSIFY</b> the fundamentals of Additive Manufacturing Technologies for engineering applications.
	CO2	<b>IDENTIFY</b> and <b>CATEGORIZE</b> the methodology to manufacture the products using light-based photo-curing, LASER based technologies and <b>STUDY</b> their applications, benefits.
	CO3	<b>IDENTIFY</b> and <b>CATEGORIZE</b> the methodology to manufacture the products using extrusion-based deposition, inkjet-based technologies and <b>STUDY</b> their applications, benefits.
	CO4	<b>SYNTHESIZE, RECOMMEND</b> and <b>DESIGN</b> the suitable material and process for fabrication and build behavior of varieties of product.
	CO5	<b>DESIGN</b> and <b>CONSTRUCT</b> the AM equipment's for appropriate applications and the input CAD model
	CO6	<b>DEVELOP</b> the knowledge of additive manufacturing for various real-life applications
<b>402045D: Operations Research</b>	CO1	<b>EVALUATE</b> various situations of Games theory and Decision techniques and <b>APPLY</b> them to solve them in real life for decision making.
	CO2	<b>SELECT</b> appropriate model for queuing situations and sequencing situations and <b>FIND</b> the optimal solutions using models for different situations.
	CO3	<b>FORMULATE</b> various management problems and <b>SOLVE</b> them using Linear programming using graphical method and simplex method.
	CO4	<b>FORMULATE</b> variety of problems such as transportation, assignment, travelling salesman and <b>SOLVE</b> these problems using linear programming approach.
	CO5	<b>PLAN</b> optimum project schedule for network models arising from a wide range of applications and for replacement situations find the optimal solutions using appropriate models for the situation
	CO6	<b>APPLY</b> concepts of simulation and Dynamic programming
<b>402045E: Augmented Reality</b>	CO1	<b>UNDERSTAND</b> fundamental Computer Vision, Computer Graphics and Human-Computer Interaction Techniques related to VR/AR
	CO2	<b>UNDERSTAND</b> Geometric Modeling Technique
	CO3	<b>UNDERSTAND</b> the Virtual Environment

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and Virtual Reality	CO4	<b>ANALYZE</b> and <b>EVALUATE</b> VR/AR Technologies
	CO5	<b>APPLY</b> various types of Hardware and Software in Virtual Reality systems
	CO6	<b>DESIGN</b> and <b>FORMULATE</b> Virtual/Augmented Reality Applications
402046: Data Analytics Laborator y	CO1	<b>UNDERSTAND</b> the basics of data analytics using concepts of statistics and probability.
	CO2	<b>APPLY</b> various inferential statistical analysis techniques to describe data sets and withdraw useful conclusions from acquired data set.
	CO3	<b>EXPLORE</b> the data analytics techniques using various tools
	CO4	<b>APPLY</b> data science concept and methods to solve problems in real world context
	CO5	<b>SELECT</b> advanced techniques to conduct thorough and insightful analysis and interpret the results
402047: Project (Stage I)	CO1	<b>IMPLEMENT</b> systems approach.
	CO2	<b>CONCEPTUALIZE</b> a novel idea / technique into a product.
	CO3	<b>THINK</b> in terms of a multi-disciplinary environment.
	CO4	<b>TAKE ON</b> the challenges of teamwork, and <b>DOCUMENT</b> all aspects of design work.
	CO5	<b>UNDERSTAND</b> the management techniques of implementing a project.
	CO6	<b>DEMONSTRATE</b> the final product for Functionality, Design ability, and Manufacturability
402048: Computer Integrated Manufact uring	CO1	<b>EXPLAIN</b> CIM and factory automation
	CO2	<b>UNDERSTAND</b> the integration of hardware and software elements for CIM
	CO3	<b>APPLY</b> CNC program for appropriate manufacturing techniques.
	CO4	<b>ANALYZE</b> processes planning, quality and MRP integrated with computers
	CO5	<b>INTERPRET</b> flexible, cellular manufacturing and group technology
	CO6	<b>ANALYZE</b> the effect of IOT, Industry-4.0 and cloud base manufacturing
402049: Energy Engineeri ng	CO1	<b>EXPLAIN</b> the power generation scenario, the layout components of thermal power plant and <b>ANALYZE</b> the improved Rankine cycle
	CO2	<b>ANALYZE</b> the performance of steam condensers, cooling tower system; <b>RECOGNIZE</b> an environmental impact of energv systems and methods to control the same.
	CO3	<b>EXPLAIN</b> the layout, component details of diesel engine plant, hydel and nuclear energy systems
	CO4	<b>ANALYZE</b> gas and improved power cycles.
	CO5	<b>EXPLAIN</b> the fundamentals of renewable energy systems
	CO6	<b>EXPLAIN</b> basic principles of energy management, storage and economics of power generation.
402050A: Quality & Reliability Engineeri ng	CO1	<b>UNDERSTAND</b> basic concepts of quality and <b>RELATE</b> various quality tools
	CO2	<b>DEVELOP</b> analytical competencies to <b>SOLVE</b> problems on control charts and process capability
	CO3	<b>UNDERSTAND</b> fundamental concepts of reliability
	CO4	<b>EVALUATE</b> system reliability
	CO5	<b>IDENTIFY</b> various failure modes and <b>CREATE</b> fault tree diagram
	CO6	<b>UNDERSTAND</b> the concept of reliability centered maintenance and <b>APPLY</b> reliability tests methods.
402050B: Energy Audit and Managem ent	CO1	<b>EXPLAIN</b> the energy need and role of energy management
	CO2	<b>CARRY OUT</b> an energy audit of the Institute/Industry/Organization
	CO3	<b>ASSESS</b> the ENCON opportunities using energy economics
	CO4	<b>ANALYSE</b> the energy conservation performance of Thermal Utilities
	CO5	<b>ANALYSE</b> the energy conservation performance of Electrical Utilities
	CO6	<b>EXPLAIN</b> the energy performance improvement by Cogeneration and WHR method
402050C: Manufact uring System and Simulation	CO1	<b>UNDERSTAND</b> the concepts of manufacturing system, characteristics, type, etc.
	CO2	<b>UNDERSTAND</b> the concepts of Facilities, manufacturing planning & control and Support System
	CO3	<b>UNDERSTAND</b> the concepts of manufacturing towards solving productivity related problems
	CO4	<b>DEVELOP</b> a virtual model to solve industrial engineering related issues such as capacity. utilization, line balancing.
	CO5	<b>BUILDING</b> tools to view and control simulations and their results
	CO6	<b>PLAN</b> the data representation & Evaluate the results of the simulation

<b>402050D: Engineering Economics and Financial Management</b>	CO1	<b>UNDERSTAND</b> the business environment, concepts of economics and demand-supply scenario.
	CO2	<b>APPLY</b> the concepts of costing and pricing to evaluate the pricing of mechanical components
	CO3	<b>UNDERSTAND</b> accounting systems and analyze financial statements using ratio analysis
	CO4	<b>SELECT</b> and <b>PREPARE</b> the appropriate type of budget and understand the controlling aspects of budget
	CO5	<b>UNDERSTAND</b> the international business and trade system functioning
	CO6	<b>DEMONSTRATE</b> understanding of financing decisions of new ventures and performance
<b>402050E: Organizational Informatics</b>	CO1	Demonstrate an understanding of the scope, purpose and value of information systems in an organization
	CO2	Understand the constituents of the information system.
	CO3	Demonstrate the Understanding of the management of product data and features of various PLM aspects
	CO4	Relate the basic concepts of manufacturing system and the ERP functionalities in context of information usage
	CO5	Understand the manufacturing execution system and its applications in functional areas.
	CO6	Outline the role of the information system in various types of business and allied emerging technologies.
<b>402050F: Computational Multi Body Dynamics</b>	CO1	<b>APPLY</b> the basic terminology and concepts used in Multibody Dynamics to solve varieties of motion related applications
	CO2	<b>IDENTIFY</b> and <b>EVALUATE</b> the types of joints, its kinematics and relevant transformations
	CO3	<b>DISTINGUISH</b> and <b>COMPARE</b> the formulation methods
	CO4	<b>DERIVE</b> equations of motion and <b>EVALUATE</b> the kinematics and dynamics of rigid Planar inter-connected bodies
	CO5	<b>DERIVE</b> equations of motion and <b>EVALUATE</b> the kinematics of rigid Spatial inter-connected bodies
	CO6	<b>APPLY</b> MBD tool effectively and <b>SIMULATE</b> it to solve and validate practical Multibody Dynamics problems and its solutions
<b>402051A: Process Equipment Design</b>	CO1	<b>INTERPRET</b> the different parameters involved in design of process Equipments.
	CO2	<b>ANALYZE</b> thin and thick walled cylinder
	CO3	<b>DESIGN</b> cylindrical vessel, spherical vessel, tall vessels and thick walled high pressure vessels
	CO4	<b>DESIGN</b> different process Equipments and select pump, compressor etc. and auxiliary services
	CO5	<b>EVALUATE</b> Process parameters and their correlation
	CO6	<b>APPLY</b> the concepts of process equipment design for specific applications
<b>402051B: Renewable Energy Technologies</b>	CO1	<b>DESCRIBE</b> fundamentals, needs and scopes of renewable energy systems.
	CO2	<b>EXPLAIN</b> performance aspects of flat and concentric solar collectors along with applications
	CO3	<b>DESIGN</b> solar photovoltaic system for residential applications
	CO4	<b>DESIGN AND ANALYSIS</b> of wind energy conversion system
	CO5	<b>APPLY</b> Installation practices of Wind and Solar Photovoltaic Systems for grid connection.
	CO6	<b>DETERMINE</b> performance parameters of bio-energy conversion systems.
<b>402051C: Automation and Robotics</b>	CO1	<b>UNDERSTAND</b> the basic concepts of Automation
	CO2	<b>UNDERSTAND</b> the basic concepts of Robotics
	CO3	<b>IDENTIFY</b> and <b>EVALUATE</b> appropriate Drive for Robotic Applications
	CO4	<b>COMPARE</b> and <b>SELECT</b> End-effectors and Sensors as per Application
	CO5	<b>DEVELOPE</b> the Mathematical Modeling Approaches of Robot
	CO6	<b>EVALUATE</b> the fundamentals of robot programming and <b>CLASSIFY</b> the Applications
<b>402051D: Industrial Psychology and Organizational Behavior</b>	CO1	<b>DEMONSTRATE</b> fundamental knowledge about need and scope of industrial - organizational psychology and behavior.
	CO2	<b>ANALYZE</b> the job requirement, have understanding of fatigue, boredom and improve the job satisfaction
	CO3	<b>UNDERSTAND</b> the approaches to enhance the performance.
	CO4	<b>KNOWLEDGE</b> of theories of organizational behavior, learning and social-system
	CO5	<b>UNDERSTAND</b> the mechanism of group behavior, various aspects of team, leadership and conflict management
	CO6	<b>EVALUATE</b> the organizational culture, manage the change and understands organizational development approaches.
	CO1	<b>UNDERSTAND</b> the basics related to e-vehicle

<b>402051E: Electric and Hybrid Vehicle</b>	CO2	<b>CLASSIFY</b> the different hybrid vehicles
	CO3	<b>IDENTIFY</b> and <b>EVALUATE</b> the Prime Movers, Energy Storage and Controllers
	CO4	<b>DISCOVER</b> and <b>CATAGORIZE</b> the Electric Vehicle Configuration with respect to Propulsion, Power distribution and Drive-Train Topologies
	CO5	<b>DEVELOP</b> body frame with appropriate suspension system and <b>TESTING</b> of for e-Vehicles.
	CO6	<b>CLASSIFY</b> and <b>EVALUATE</b> Battery Charging techniques and management.
<b>402052: Mechanical Systems Analysis Laboratory</b>	CO1	<b>DEVELOP</b> 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, fault-finding, Diagnosis, Performance Analysis, and Evaluation, Maintenance, Modification, Validation, Planning, Production, Evaluation and use of a system using manual calculation, computational tools
	CO2	<b>ILLUSTRATE</b> the concepts and <b>USE</b> the developed skill-set of use of computational tools (FEA, CFD, MBD, FSI, CAE) to automate the complete product development process.
	CO3	<b>EVALUATE</b> the knowledge of new developments and innovations in technological systems to carry forward to next stage of employment after passing your Undergraduate Degree Examination.
	CO4	<b>APPRAISE</b> how technologies have transformed people's lives and can be used to <b>SOLVE</b> challenges associated with climate change, efficient energy use, security, health, education and transport, which will be coming your ways in the coming future.
	CO5	<b>PRIORITIZE</b> the concept of quality and standards, including systems reliability, safety and fitness for the intended purpose
	CO6	<b>INVENT</b> yourself to face the challenges of future technologies and their associated Problems