Mechanical Engineering Department all Subjects Course Outcomes (COs) 2019Course

FE 2019 Pat Mechanical

102003 : Systems in Mechanical Engineering

Course Outcomes On completion of the course, learner will be able to

CO1: Describe and compare the conversion of energy from renewable and non-renewable energy sources

CO2: Explain basic laws of thermodynamics, heat transfer and their applications

CO3: List down the types of road vehicles and their specifications

CO4: Illustrate various basic parts and transmission system of a road vehicle

CO5: Discuss several manufacturing processes and identify the suitable process

CO6: Explain various types of mechanism and its application

111006 : Workshop Practice

Course Outcomes:

CO1: Familiar with safety norms to prevent any mishap in workshop.

CO2: Able to handle appropriate hand tool, cutting tool and machine tools to manufacture a job.

CO3: Able to understand the construction, working and functions of machine tools and their parts.

CO4: Able to know simple operations (Turning and Facing) on a centre lathe.

102012 : Engineering Graphics

Course Outcomes On completion of the course, learner will be able to

CO1: Draw the fundamental engineering objects using basic rules and able to construct the simple geometries.

CO2: Construct the various engineering curves using the drawing instruments.

CO3: Apply the concept of orthographic projection of an object to draw several 2D views and its sectional views for visualizing the physical state of the object.

CO4: Apply the visualization skill to draw a simple isometric projection from given orthographic views precisely using drawing equipment.

CO5: Draw the development of lateral surfaces for cut section of geometrical solids.

 CO6: Draw fully-dimensioned 2D, 3D drawings using computer aided drafting tools

SE 2019 Pat Mechanical

202041 : Solid Mechanics

Course Outcomes On completion of the course, learner will be able to

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

Course Outcomes On completion of the course, learner will be able to

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

Course Outcomes On completion of the course, learner will be able to

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

Course Outcomes On completion of the course, learner will be able to

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 nondestructive 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

Course Outcomes On completion of the course, learner will be able to

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

Course Outcomes On completion of the course, learner will be able to

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 – III

Course Outcomes On completion of the course, learner will be able to

 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.

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

Course Outcomes On completion of the course, learner will be able to

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

Course Outcomes On completion of the course, learner will be able to

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

Course Outcomes On completion of the course, learner will be able to

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

Course Outcomes On completion of the course, learner will be able to

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

Course Outcomes On completion of the course, learner will be able to

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

Course Outcomes On completion of the course, learner will be able to

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.

TE 2019 Patt Mechanical

302041: Numerical and Statistical Methods

Course Outcomes: On completion of the course the learner will be able to;

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:DEMONSTRATE the data, using the concepts of probability and linear algebra.

302042: Heat and Mass Transfer

Course Outcomes: On completion of the course, learner will be able to

CO1. ANALYZE & APPLY the modes of heat transfer equations for one dimensional thermal system.

CO2. DESIGN a thermal system considering fins, thermal insulation and & Transient heat conduction.

CO3. EVALUATE the heat transfer rate in natural and forced convection & validate with experimentation results.

CO4. INTERPRET heat transfer by radiation between objects with simple geometries, for black and grey surfaces.

CO5. ABILITY to analyze the rate of mass transfer using Fick's Law of Diffusion and understands mass diffusion in different coordinate systems.

CO6. DESIGN & ANALYSIS of heat transfer equipments and investigation of its performance.

302043: Design of Machine Elements

Course Outcomes: On completion of the course, learner will be able to

CO1. DESIGN AND ANALYZE the cotter and knuckle Joints, levers and components subjected to eccentric loading.

CO2. DESIGN shafts, keys and couplings under static loading conditions.

CO3. ANALYZE different stresses in power screws and APPLY those in the procedure to design screw jack.

CO4. EVALUATE dimensions of machine components under fluctuating loads.

CO5.EVALUATE & INTERPRET the stress developed on the different type of welded and threaded joints.

CO6. APPLY the design and development procedure for different types of springs.

302044: Mechatronics

Course Outcomes: On completion of the course, learner will be able to

CO1. DEFINE key elements of mechatronics, principle of sensor and its characteristics.

CO2. UTILIZE concept of signal processing and MAKE use of interfacing systems such as ADC, DAC, Digital I/O.

CO3. DETERMINE the transfer function by using block diagram reduction technique.

CO4. EVALUATE Poles and Zero, frequency domain parameter for mathematical modeling for mechanical system.

CO5. APPLY the concept of different controller modes to an industrial application.

CO6. DEVELOP the ladder programming for industrial application.

302045-A: Advanced Forming & Joining Processes

Course Outcomes: On completion of the course, learner will be able to

CO1. ANALYSE the effect of friction in metal forming deep drawing and IDENTIFICATION of surface defects and their remedies in deep drawing operations

CO2. ASSESS the parameters for special forming operation and SELECT appropriate special forming operation for particular applications

CO3. ANALYSE the effect of HAZ on microstructure and mechanical properties of materials

CO4. CLASSIFY various solid state welding process and SELECT suitable welding processes for particular applications

CO5. CLASSIFY various advanced welding process and SELECT suitable welding processes for particular applications.

CO6. INTERPRET the principles of sustainable manufacturing and its role in manufacturing industry.

302045-B: Machining Science &Technology

Course Outcomes: On completion of the course, learner will be able to

CO1. DEFINE metal cutting principles and mechanics of metal cutting and tool life.

CO2. DESCRIBE features of gear and thread manufacturing processes.

CO3. SELECT appropriate grinding wheel and demonstrate the various surface finishing processes.

CO4. SELECT appropriate jigs/fixtures and to draw the process plan for a given component.

CO5. SELECT & EVALUATE various parameters of process planning.

CO6. GENERATE CNC program for Turning / Milling processes and generate tool path using CAM software.

302046: Digital Manufacturing Laboratory

Course Outcomes: On completion of the course, learner will be able to

CO1. DEVELOP a component using conventional machines, CNC machines and Additive Manufacturing Techniques.

CO2. ANALYZE cutting tool parameters for machining given job.

CO3. DEMONSTRATE simulation of manufacturing process using Digital Manufacturing Tools.

CO4.SELECT and DESIGN jigs and Fixtures for a given component.

CO5. DEMONESTRATE different parameters for CNC retrofitting and reconditioning.

302047: Skill Development

Course Outcomes: On completion of the course, learner will be able to

CO1.APPLY& DEMONSTRATE procedure of assembly & disassembly of various machines.

CO2.DESIGN & DEVELOP a working/model of machine parts or any new product.

CO3.EVALUATE fault with diagnosis on the machines, machine tools and home appliances.

CO4.IDENTIFY & DEMONSTRATE the various activities performed in an industry such as maintenance, design of components, material selection

302049: Artificial Intelligence & Machine Learning

Course Outcomes: On completion of the course, learner will be able to

CO1. DEMONSTRATE fundamentals of artificial intelligence and machine learning.

 CO2. APPLY feature extraction and selection techniques.

 CO3. APPLY machine learning algorithms for classification and regression problems.

CO4. DEVISE AND DEVELOP a machine learning model using various steps.

CO5. EXPLAIN concepts of reinforced and deep learning.

CO6. SIMULATE machine learning model in mechanical engineering problems.

302050: Computer Aided Engineering

Course Outcomes: On completion of the course, learner will be able to

CO1: DEFINE the use of CAE tools and DESCRIBE the significance of shape functions in finite element formulations.

CO2: APPLY the various meshing techniques for better evaluation of approximate results.

CO3: APPLY material properties and boundary condition to SOLVE 1-D and 2-D element stiffness matrices to obtain nodal or elemental solution.

CO4: ANALYZE and APPLY various numerical methods for different types of analysis.

CO5: EVALUATE and SOLVE non-linear and dynamic analysis problems by analyzing the results obtained from analytical and computational method.

CO6: GENERATE the results in the form of contour plot by the USE of CAE tools

302051: Design of Transmission Systems

Course Outcomes: On completion of the course, learner will be able to

 CO1.APPLY the principle of Spur & Helical gear design for industrial application and PREPARE a manufacturing drawing with the concepts of GD&T.

CO2.EXPLAIN and DESIGN Bevel & Worm gear considering design parameters as per design standards.

CO3.SELECT&DESIGN Rolling and Sliding Contact Bearings from manufacturer's catalogue for a typical application considering suitable design parameters.

CO4.DEFINE and DESIGN various types of Clutches, Brakes, used in automobile.

CO5.APPLY various concept to DESIGN Machine Tool Gear box, for different applications

CO6.ELABORATE various modes of operation, degree of hybridization and allied terms associated with hybrid electric vehicles

302052-A: Composite Materials

Course Outcomes: On completion of the course, learner will be able to

CO1. DEFINE & COMPARE composites with traditional materials.

CO2.IDENTIFY & ESTIMATE different parameters of the Polymer Matrix Composite

CO3. CATEGORISE and APPLY Metal Matrix Process from possessions landscape.

CO4. DETERMINE volume/weight fraction and strength of Composites.

CO5. SELECT appropriate testing and inspection method for composite materials.

CO6. SELECT composites materials for various applications.

302052-B: Surface Engineering

Course Outcomes: On completion of the course, learner will be able to

CO1. DEFINE the basic's principle & mechanism of surface degradation.

CO2. ANALYSE & SELECT correct corrosion prevention techniques for a different service condition.

CO3. DEMONSTRATE the role of surface engineering of materials to modify/improve the surface properties.

CO4. SELECT the suitable surface heat treatments to improve the surface properties.

CO5. APPLY the surface modification technique to modify surface properties.

CO6. ANALYSE & EVALUTE various surface coating defects using various testing/characterization method.

302053: Measurement Laboratory

Course Outcomes: On completion of the course, learner will be able to

CO1. 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.

CO2. ANALYZE strain measurement parameters by taking modulus of elasticity in consideration to acknowledge its usage in failure detection and force variations.

CO3. EXAMINE 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. 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.

CO5. PERFORM 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. 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

Course Outcomes: On completion of the course, learner will be able to

CO1. DEFINE working principle of components used in hydraulic and pneumatic systems.

CO2.IDENTIFY & EXPLAIN various applications of hydraulic and pneumatic systems.

CO3.SELECT an appropriate component required for hydraulic and pneumatic systems using manufactures' catalogues.

CO4.SIMULATE & ANALYSE various hydraulic and pneumatic systems for industrial/mobile applications.

CO5. DESIGN a hydraulic and pneumatic system for the industrial applications.

CO6.DESIGN & DEMONESTRATE various IoT, PLC based controlling system using hydraulics and pneumatics.

302055: Internship/Mini project

Course Outcomes: On completion of the course, learners should be able to

CO1. DEMONSTRATE professional competence through industry internship.

CO2. APPLY knowledge gained through internships to complete academic activities in a professional manner.

CO3. CHOOSE appropriate technology and tools to solve given problem.

CO4. DEMONSTRATE abilities of a responsible professional and use ethical practices in day to day life.

CO5. DEVELOP network and social circle, and DEVELOPING relationships with industry people.

CO6. ANALYZE various career opportunities and DECIDE career goals.

Mini project

Course Outcomes: On completion of the course, learner will be able to

CO1. EXPLAIN plan and execute a Mini Project with team.

CO2. IMPLEMENT hardware/software/analytical/numerical techniques, etc.

CO3. DEVELOP a technical report based on the Mini project.

CO4. DELIVER technical seminar based on the Mini Project work carried out.

BE Mechanical 2019 Pattern COs

1. **402041: Heating, Ventilation, Air Conditioning and Refrigeration**

CO1. ANALYSE different air-craft refrigeration systems and EXPLAIN the properties, Applications and environmental issues of different refrigerants

CO2. ANALYSE multi pressure refrigeration system used for refrigeration applications.

CO3. DISCUSS types of compressors, condensers, evaporators and expansion valves along with regulatory and safety controls and DESCRIBES Transcritical and ejector refrigeration systems.

CO4. ESTIMATE cooling load for air conditioning systems used with concern of design conditions and indoor quality of air.

CO5. ESIGN air distribution system along with consideration of ventilation and infiltration

CO6. EXPLAIN the working of types of desiccants, evaporative, thermal storage, radiant cooling, clean room and heat pump systems.

2. 402042: Dynamics of Machinery

CO1. APPLY balancing technique for static and dynamic balancing of multi cylinder inline and radial engines.

CO2. ANALYZE the gyroscopic couple or effect for stabilization of Ship, Airplane and Four wheeler vehicles.

CO3. ESTIMATE natural frequency for single DOF un-damped & damped free vibratory systems.

CO4. DETERMINE response to forced vibrations due to harmonic excitation, base excitation and excitation due to unbalance forces.

CO5. ESTIMATE natural frequencies, mode shapes for 2 DOF un-damped free longitudinal and torsional vibratory systems.

CO6. DESCRIBE noise and vibration measuring instruments for industrial / real life applications along with suitable method for noise and vibration control.

3. 402043: Turbomachinery

CO1: VALIDATE impulse moment principle using flat, inclined and curved surfaces and INVESTIGATE performance characteristics of hydraulic turbines.

CO2: DETERMINE performance parameters of impulse and reaction steam turbine along with discussion of nozzles, governing mechanism & losses.

CO3: MEASURE performance parameters of single & multistage centrifugal pumps along with discussion of cavitation and selection.

CO4: EXPLAIN performance parameters of centrifugal compressor along with discussion of theoretical aspects of axial compressor.

4. **402044A: Automobile Design**

CO1: DESIGN of Principal Engine Components

CO2: DESIGN of Drive train

CO3: DESIGN of brakes and Suspension

5. **402044B: Design of Heat Transfer Equipments**

CO1: EXPLAIN the design aspect of heat exchanger considering fouling factor for Heat Transfer Applications

CO2: SELECT and DESIGN the double tube heat exchangers for process industry

CO3: DESIGN the Shell & Tube Heat Exchangers for specified conditions

CO4: DESIGN the condensers and evaporators for refrigeration applications

CO5: DESIGN the compact heat exchangers CO6: ANALYSE the performance of counter and cross flow cooling tower.

6. **402044C - Modern Machining Processes**

CO1.UNDERSTAND and ANALYZE the mechanism, process parameters of mechanical assisted modern machining processes.

CO2.UNDERSTAND the mechanism, construction and working of laser, plasma and electron beam assisted machining.

CO3.CLASSIFY and ANALYZE the mechanism, process parameters of the chemical and electrochemical machining.

CO4.RELATE and ANALYZE the mechanism and select process parameters Electrical Discharge Machining for an application.

CO5.ILLUSTRATE the application of micromachining processes.

CO6.SUGGEST appropriate nanomachining process for the specific application

7. 402044D: Industrial Engineering

CO1. EVALUATE the productivity and IMPLEMENT various productivity improvement techniques.

CO2. APPLY work study techniques and UNDERSTANDS its importance for better productivity.

CO3. DEMONSTRATE the ability to SELECT plant location, appropriate layout and material handling equipment.

CO4. USE of Production planning and control tools for effective planning, scheduling and managing the shop floor control.

CO5. PLAN inventory requirements and EXERCISE effective control on manufacturing requirements.

CO6. APPLY Ergonomics and legislations for human comfort at work place and UNDERSTANDS the role of value engineering in improving productivity

8. 402044E: Internet of Things

CO1. EXPLAIN the Applications/Devices, Protocols and Communication Models of IoT

CO2. DEMONSTARTE small Mechanical Engineering IoT oriented applications using Sensors, Actuators, Microcontrollers and Cloud

CO3. SELECT commonly used IoT Simulation Hardware platforms

CO4. APPLICATION of Interfacing and Communication Technologies for IoT

CO5. ILLUSTRATE IoT Application Development and Security of IoT Ecosystem

CO6. EVALUATE Present and Future Domain specific Applications of IoT Ecosystem

9. 402044F: Computational Fluid Dynamics

CO1. DISTINGUISH and ANALYSE the governing equations of fluid mechanics and heat transfer in various formulations

CO2. ANALYZE and MODEL the conduction and advection problems

CO3. ANALYZE and MODEL the Convection-Diffusion problems

CO4. IDENTIFY and EVALUATE the External/Internal flow and its simulation

CO5. DISTINGUISH and COMPARE concepts of stability and turbulence.

CO6. USE and APPLY a CFD tool for effectively solving practical Fluid-Structure Interaction problems

10. 402045A: Product Design and Development

CO1. UNDERSTAND Product design and Product development processes

CO2. UNDERSTAND Processes, tools and techniques for Market Survey & Product Specification Finalization

CO3. UNDERSTAND Processes, tools and techniques for Concept Inception, Verification and selection

CO4. UNDERSTAND Processes, tools and techniques for Concept Exploration & Development

CO5. UNDERSTAND Processes, tools and techniques for Design Verification and Validation

CO6. UNDERSTAND Processes, tools and techniques for Robust Design and Development

11. 402045B: Experimental Methods in Thermal Engineering

CO1. IDENTIFY the suitable instrument for measuring parameters as per performance characteristics

CO2. ANALYZE experimental data by using different statistical techniques and estimate error

CO3. DISTINGUISH different methods of temperature measurements and thermal radiation

CO4. CLASSIFY various pressure measurement instruments and their comparison

CO5. EXPLAIN different flow measurement methods and flow visualization techniques

CO6. APPLY knowledge of modern engineering experimentation, including calibration, data acquisition, analysis and interpretation using different AI and ML techniques

12. 402045C: Additive Manufacturing

CO1. USE and CLASSIFY the fundamentals of Additive Manufacturing Technologies for engineering applications.

CO2. IDENTIFY and CATEGORIZE the methodology to manufacture the products using light-based photo-curing, LASER based technologies and STUDY their applications, benefits.

CO3. IDENTIFY and CATEGORIZE the methodology to manufacture the products using extrusion-based deposition, inkjet-based technologies and STUDY their applications, benefits.

CO4. SYNTHESIZE, RECOMMEND and DESIGN the suitable material and process for fabrication and build behavior of verities of product.

CO5. DESIGN and CONSTRUCT the AM equipment's for appropriate applications and the input CAD model.

CO6. DEVELOP the knowledge of additive manufacturing for various real-life applications.

13. 402045D: Operations Research

CO1. EVALUATE various situations of Games theory and Decision techniques and APPLY them to solve them in real life for decision making.

CO2. SELECT appropriate model for queuing situations and sequencing situations and FIND the optimal solutions using models for different situations.

CO3. FORMULATE various management problems and SOLVE them using Linear programming using graphical method and simplex method.

CO4. FORMULATE variety of problems such as transportation, assignment, travelling salesman and SOLVE these problems using linear programming approach.

CO5. PLAN 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. APPLY concepts of simulation and Dynamic programming

402045E: Augmented Reality and Virtual Reality

CO1. UNDERSTAND fundamental Computer Vision, Computer Graphics and HumanComputer Interaction Techniques related to VR/AR

CO2. UNDERSTAND Geometric Modeling Techniques

CO3. UNDERSTAND the Virtual Environment

CO4. ANALYZE and EVALUATE VR/AR Technologies

CO5. APPLY various types of Hardware and Software in Virtual Reality systems

CO6. DESIGN and FORMULATE Virtual/Augmented Reality Applications

14. 402046: Data Analytics Laboratory

CO1: UNDERSTAND the basics of data analytics using concepts of statistics and probability.

CO2: APPLY various inferential statistical analysis techniques to describe data sets and withdraw useful conclusions from acquired data set.

CO3: EXPLORE the data analytics techniques using various tools

CO4: APPLY data science concept and methods to solve problems in real world context

CO5: SELECT advanced techniques to conduct thorough and insightful analysis and interpret the results

15. 402047: Project (Stage I)

CO1. Implement systems approach.

CO2. To conceptualize a novel idea / technique into a product

CO3. To think in terms of a multi-disciplinary environment

CO4. To take on the challenges of teamwork, and document all aspects of design work.

CO5. To understand the management techniques of implementing a project

16. 402048: Computer Integrated Manufacturing

CO1. EXPLAIN CIM and factory automation

CO2. UNDERSTAND the integration of hardware and software elements for CIM

CO3. APPLY CNC program for appropriate manufacturing techniques.

CO4. ANALYZE processes planning, quality and MRP integrated with computers.

CO5. INTERPRET flexible, cellular manufacturing and group technology.

CO6. ANALYZE the effect of IOT, Industry-4.0 and cloud base manufacturing.

17. 402049: Energy Engineering

CO1: EXPLAIN the power generation scenario, the layout components of thermal power plant and ANALYZE the improved Rankine cycle.

CO2: ANALYZE the performance of steam condensers, cooling tower system; RECOGNIZE an environmental impact of energy systems and methods to control the same.

CO3: EXPLAIN the layout, component details of diesel engine plant, hydel and nuclear energy systems.

CO4: ANALYZE gas and improved power cycles.

CO5: EXPLAIN the fundamentals of renewable energy systems.

CO6: EXPLAIN basic principles of energy management, storage and economics of power generation.

18. 402050A: Quality & Reliability Engineer

CO1. UNDERSTAND basic concepts of quality and RELATE various quality tools

CO2. DEVELOP analytical competencies to SOLVE problems on control charts and process capability.

CO3. UNDERSTAND fundamental concepts of reliability.

CO4. EVALUATE system reliability.

CO5.IDENTIFY various failure modes and CREATE fault tree diagram.

CO6. UNDERSTAND the concept of reliability centered maintenance and APPLY reliability tests methods

19. 402050B: Energy Audit and Management

CO1. EXPLAIN the energy need and role of energy management

CO2. CARRY OUT an energy audit of the Institute/Industry/Organization

CO3. ASSESS the ENCON opportunities using energy economics

CO4. ANALYSE the energy conservation performance of Thermal Utilities

CO5. ANALYSE the energy conservation performance of Electrical Utilities

CO6. EXPLAIN the energy performance improvement by Cogeneration and WHR method

20. 402050C: Manufacturing System and Simulation

CO1. UNDERSTAND the concepts of manufacturing system, characteristics, type, etc.

CO2. UNDERSTAND the concepts of Facilities, manufacturing planning & control and Support System.

CO3. UNDERSTAND the concepts of manufacturing towards solving productivity related problems.

CO4. DEVELOP a virtual model to solve industrial engineering related issues such as capacity. utilization, line balancing.

CO5. BUILDING tools to view and control simulations and their results.

CO6. PLAN the data representation & Evaluate the results of the simulation.

21. 402050D: Engineering Economics and Financial Management

CO1. UNDERSTAND the business environment, concepts of economics and demand-supply scenario.

CO2. APPLY the concepts of costing and pricing to evaluate the pricing of mechanical components.

CO3. UNDERSTAND accounting systems and analyze financial statements using ratio analysis

CO4. SELECT and PREPARE the appropriate type of budget and understand the controlling aspects of budget.

CO5. UNDERSTAND the international business and trade system functioning

CO6. DEMONSTRATE understanding of financing decisions of new ventures and performance

22. 402050E: Organizational Informatics

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 it's applications in functional areas.

CO6. Outline the role of the information system in various types of business and allied emerging technologies.

23. 402050F: Computational Multi Body Dynamics

CO1. APPLY the basic terminology and concepts used in Multibody Dynamics to solve varieties of motion related applications

CO2. IDENTIFY and EVALUATE the types of joints, its kinematics and relevant transformations

CO3. DISTINGUISH and COMPARE the formulation methods

CO4. DERIVE equations of motion and EVALUATE the kinematics and dynamics of rigid Planar inter-connected bodies

CO5. DERIVE equations of motion and EVALUATE the kinematics of rigid Spatial interconnected bodies

CO6. APPLY MBD tool effectively and SIMULATE it to solve and validate practical Multibody Dynamics problems and its solutions

24. 402051A: Process Equipment Design

CO1. INTERPRET the different parameters involved in design of process Equipments.

CO2. ANALYZE thin and thick walled cylinder

CO3. DESIGN cylindrical vessel, spherical vessel, tall vessels and thick walled high pressure vessels

CO4. DESIGN different process Equipments and select pump, compressor etc. and auxiliary services

CO5. EVALUATE Process parameters and their correlation

CO6. APPLY the concepts of process equipment design for specific applications

25. 402051B: Renewable Energy Technologies

CO1. DESCRIBE fundaments, needs and scopes of renewable energy systems.

CO2. EXPLAIN performance aspects of flat and concentric solar collectors along with applications.

CO3. DESIGN solar photovoltaic system for residential applications.

CO4. DESIGN AND ANALYSIS of wind energy conversion system.

CO5. APPLY Installation practices of Wind and Solar Photovoltaic Systems for grid connection.

CO6. DETERMINE performance parameters of bio-energy conversion systems.

26. 402051C: Automation and Robotics

CO1. UNDERSTAND the basic concepts of Automation

CO2. UNDERSTAND the basic concepts of Robotics

CO3. IDENTIFY and EVALUATE appropriate Drive for Robotic Applications

CO4. COMPARE and SELECT End-effectors and Sensors as per Application

CO5. DEVELOPE the Mathematical Modeling Approaches of Robot

CO6. EVALUATE the fundamentals of robot programming and CLASSIFY the Applications

27. 402051D: Industrial Psychology and Organizational Behavior

CO1. DEMONSTRATE fundamental knowledge about need and scope of industrial - organizational psychology and behavior.

CO2. ANALYZE the job requirement, have understanding of fatigue, boredom and improve the job satisfaction.

CO3. UNDERSTAND the approaches to enhance the performance.

CO4. KNOWLEDGE of theories of organizational behavior, learning and social-system

CO5. UNDERSTAND the mechanism of group behavior, various aspects of team, leadership and conflict management.

CO6. EVALUATE the organizational culture, manage the change and understands organizational development approaches.

28. 402051E: Electric and Hybrid Vehicle

CO1. UNDERSTAND the basics related to e-vehicle

CO2. CLASSIFY the different hybrid vehicles

CO3. IDENTIFY and EVALUATE the Prime Movers, Energy Storage and Controllers

CO4. DISCOVER and CATAGORIZE the Electric Vehicle Configuration with respect to Propulsion, Power distribution and Drive-Train Topologies

CO5. DEVELOP body frame with appropriate suspension system and TESTING of for eVehicles

CO6. CLASSIFY and EVALUATE Battery Charging techniques and management

29. 402052: Mechanical Systems Analysis Laboratory

CO1. 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, fault-finding, Diagnosis, Performance Analysis, and Evaluation, Maintenance, Modification, Validation, Planning, Production, Evaluation and use of a system using manual calculation, computational tools to automate product development process, redesign from customer feedback and control of technological systems.

CO2. 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.

CO3. 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.

CO4. 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.

CO5. PRIORITIZE the concept of quality and standards, including systems reliability, safety and fitness for the intended purpose.

CO6. INVENT yourself to face the challenges of future technologies and their associated Problems

30. 402053: Project (Stage II)

CO1. Implement systems approach.

CO2. To conceptualize a novel idea / technique into a product

CO3. To think in terms of a multi-disciplinary environment

CO4. To take on the challenges of teamwork, and document all aspects of design work.

CO5. To understand the management techniques of implementing a project