

Department of Mechanical Engineering

Course Outcomes [CO'S]

CLASS: FINAL YEAR [2019 COURSE]

SUBJECT/CODE: Heating, Ventilation, Air Conditioning and Refrigeration [402041]

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.

SUBJECT/CODE: Dynamics of Machinery [402042]

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.

SUBJECT/CODE: Turbomachinery [402043]

1. VALIDATE impulse moment principle using flat, inclined and curved surfaces and
2. INVESTIGATE performance characteristics of hydraulic turbines.
3. DETERMINE performance parameters of impulse and reaction steam turbine along with discussion of nozzles, governing mechanism & losses.
4. MEASURE performance parameters of single & multistage centrifugal pumps along with discussion of cavitation and selection.
5. EXPLAIN performance parameters of centrifugal compressor along with discussion of theoretical aspects of axial compressor.

SUBJECT/CODE: Automobile Design [402044 A]

1. DESIGN of Principal Engine Components.
2. DESIGN of Drive train.
3. DESIGN of brakes and Suspension.

SUBJECT/CODE: Design of Heat Transfer Equipment's [402042-B]

1. EXPLAIN the design aspect of heat exchanger considering fouling factor for Heat Transfer Applications.
2. SELECT and DESIGN the double tube heat exchangers for process industry.
3. DESIGN the Shell & Tube Heat Exchangers for specified conditions.
4. DESIGN the condensers and evaporators for refrigeration applications.
5. DESIGN the compact heat exchangers.
6. ANALYSE the performance of counter and cross flow cooling tower.

SUBJECT/CODE: - Modern Machining Processes [402044-C]

1. UNDERSTAND and ANALYZE the mechanism, process parameters of mechanical assisted modern machining processes.
2. UNDERSTAND the mechanism, construction and working of laser, plasma and electron beam assisted machining.
3. CLASSIFY and ANALYZE the mechanism, process parameters of the chemical and electrochemical machining.
4. RELATE and ANALYZE the mechanism and select process parameters Electrical Discharge Machining for an application.
5. ILLUSTRATE the application of micromachining processes.
6. SUGGEST appropriate nanomachining process for the specific application.

SUBJECT/CODE: Industrial Engineering [402044-D]

1. CO1. EVALUATE the productivity and IMPLEMENT various productivity improvement techniques.
2. APPLY work study techniques and UNDERSTANDS its importance for better productivity.
3. DEMONSTRATE the ability to SELECT plant location, appropriate layout and material handling equipment.
4. USE of Production planning and control tools for effective planning, scheduling and managing the shop floor control.
5. PLAN inventory requirements and EXERCISE effective control on manufacturing requirements.
6. APPLY Ergonomics and legislations for human comfort at work place and UNDERSTANDS the role of value engineering in improving productivity.

SUBJECT/CODE: Internet of Things [402044-E]

1. EXPLAIN the Applications/Devices, Protocols and Communication Models of IoT.
2. DEMONSTRATE small Mechanical Engineering IoT oriented applications using Sensors, Actuators, Microcontrollers and Cloud.
3. SELECT commonly used IoT Simulation Hardware platforms.
4. APPLICATION of Interfacing and Communication Technologies for IoT.
5. ILLUSTRATE IoT Application Development and Security of IoT Ecosystem.
6. EVALUATE Present and Future Domain specific Applications of IoT Ecosystem.

SUBJECT/CODE: Computational Fluid Dynamics [402044-F]

1. DISTINGUISH and ANALYSE the governing equations of fluid mechanics and heat transfer in various formulations.
2. ANALYZE and MODEL the conduction and advection problems.
3. ANALYZE and MODEL the Convection-Diffusion problems.
4. IDENTIFY and EVALUATE the External/Internal flow and its simulation.
5. DISTINGUISH and COMPARE concepts of stability and turbulence.
6. USE and APPLY a CFD tool for effectively solving practical Fluid-Structure Interaction Problems.

SUBJECT/CODE: Product Design and Development [40245A]

1. UNDERSTAND Product design and Product development processes.
2. UNDERSTAND Processes, tools and techniques for Market Survey & Product Specification Finalization.
3. UNDERSTAND Processes, tools and techniques for Concept Inception, Verification and selection.
4. UNDERSTAND Processes, tools and techniques for Concept Exploration & Development.
5. UNDERSTAND Processes, tools and techniques for Design Verification and Validation.
6. UNDERSTAND Processes, tools and techniques for Robust Design and Development.

SUBJECT/CODE: Experimental Methods in Thermal Engineering

[402045-B]

1. IDENTIFY the suitable instrument for measuring parameters as per performance characteristics.
2. ANALYZE experimental data by using different statistical techniques and estimate error.
3. CO3. DISTINGUISH different methods of temperature measurements and thermal radiation.
4. CLASSIFY various pressure measurement instruments and their comparison.
5. EXPLAIN different flow measurement methods and flow visualization techniques.
6. APPLY knowledge of modern engineering experimentation, including calibration, data acquisition, analysis and interpretation using different AI and ML techniques.

SUBJECT/CODE: Additive Manufacturing [402045-C]

1. CO1. USE and CLASSIFY the fundamentals of Additive Manufacturing Technologies for engineering applications.
2. IDENTIFY and CATEGORIZE the methodology to manufacture the products using light-based photo-curing, LASER based technologies and STUDY their applications, benefits.
3. IDENTIFY and CATEGORIZE the methodology to manufacture the products using extrusion-based deposition, inkjet-based technologies and STUDY their applications, benefits.
4. SYNTHESIZE, RECOMMEND and DESIGN the suitable material and process for fabrication and build behavior of varieties of product.
5. DESIGN and CONSTRUCT the AM equipment's for appropriate applications and the input CAD model.
6. DEVELOP the knowledge of additive manufacturing for various real-life applications.

SUBJECT/CODE: Operations Research [402045-D]

1. EVALUATE various situations of Games theory and Decision techniques and
2. APPLY them to solve them in real life for decision making.
3. SELECT appropriate model for queuing situations and sequencing situations and
4. FIND the optimal solutions using models for different situations.
5. FORMULATE various management problems and SOLVE them using Linear programming using graphical method and simplex method.
6. FORMULATE variety of problems such as transportation, assignment, travelling salesman and SOLVE these problems using linear programming approach.
7. 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.
8. APPLY concepts of simulation and Dynamic programming.

SUBJECT/CODE: Augmented Reality and Virtual Reality [402045-E]

1. UNDERSTAND fundamental Computer Vision, Computer Graphics and Human-Computer Interaction Techniques related to VR/AR.
2. UNDERSTAND Geometric Modeling Techniques.
3. UNDERSTAND the Virtual Environment.
4. ANALYZE and EVALUATE VR/AR Technologies.
5. APPLY various types of Hardware and Software in Virtual Reality systems.
6. DESIGN and FORMULATE Virtual/Augmented Reality Applications.

SUBJECT/CODE: Data Analytics Laboratory [402046]

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.

SUBJECT/CODE: Project (Stage I) [402047]

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.

SUBJECT/CODE: Computer Integrated Manufacturing [402048]

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.

SUBJECT/CODE: Energy Engineering [402049]

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.

SUBJECT/CODE: Quality & Reliability Engineering [402050]

1. UNDERSTAND basic concepts of quality and RELATE various quality tools
2. DEVELOP analytical competencies to SOLVE problems on control charts and process capability.
3. UNDERSTAND fundamental concepts of reliability.
4. EVALUATE system reliability.
5. IDENTIFY various failure modes and CREATE fault tree diagram.
6. UNDERSTAND the concept of reliability centered maintenance and APPLY reliability tests methods.

SUBJECT/CODE: Energy Audit and Management [402050-B]

1. EXPLAIN the energy need and role of energy management.
2. CARRY OUT an energy audit of the Institute/Industry/Organization.
3. ASSESS the ENCON opportunities using energy economics.
4. ANALYSE the energy conservation performance of Thermal Utilities.
5. ANALYSE the energy conservation performance of Electrical Utilities.
6. EXPLAIN the energy performance improvement by Cogeneration and WHR method.

SUBJECT/CODE: Manufacturing System and Simulation [402050-C]

1. UNDERSTAND the concepts of manufacturing system, characteristics, type, etc.
2. UNDERSTAND the concepts of Facilities, manufacturing planning & control and Support System.
3. UNDERSTAND the concepts of manufacturing towards solving productivity related problems.
4. DEVELOP a virtual model to solve industrial engineering related issues such as capacity. Utilization, line balancing.
5. BUILDING tools to view and control simulations and their results.
6. PLAN the data representation & evaluate the results of the simulation.

SUBJECT/CODE: Engineering Economics and Financial Management [402050-D]

1. UNDERSTAND the business environment, concepts of economics and demand-supply scenario.
2. APPLY the concepts of costing and pricing to evaluate the pricing of mechanical components.
3. UNDERSTAND accounting systems and analyze financial statements using ratio analysis
4. SELECT and PREPARE the appropriate type of budget and understand the controlling aspects of budget.
5. UNDERSTAND the international business and trade system functioning.
6. DEMONSTRATE understanding of financing decisions of new ventures and performance.

SUBJECT/CODE: Organizational Informatics [402050-E]

1. Demonstrate an understanding of the scope, purpose and value of information systems in an organization.
2. Understand the constituents of the information system.
3. Demonstrate the Understanding of the management of product data and features of various PLM aspects.
4. Relate the basic concepts of manufacturing system and the ERP functionalities in context of information usage.
5. Understand the manufacturing execution system and it's applications in functional areas.
6. Outline the role of the information system in various types of business and allied emerging technologies.

SUBJECT/CODE: Computational Multi Body Dynamics [402050-F]

1. APPLY the basic terminology and concepts used in Multibody Dynamics to solve varieties of motion related applications.
2. IDENTIFY and EVALUATE the types of joints, its kinematics and relevant transformations.
3. DISTINGUISH and COMPARE the formulation methods.
4. DERIVE equations of motion and EVALUATE the kinematics and dynamics of rigid planar inter-connected bodies.
5. DERIVE equations of motion and EVALUATE the kinematics of rigid Spatial inter-connected bodies.
6. APPLY MBD tool effectively and SIMULATE it to solve and validate practical.
7. Multibody Dynamics problems and its solutions.

SUBJECT/CODE: Process Equipment Design [402051-A]

1. INTERPRET the different parameters involved in design of process Equipment's.
2. ANALYZE thin and thick walled cylinder.
3. DESIGN cylindrical vessel, spherical vessel, tall vessels and thick walled high pressure vessels.
4. DESIGN different process Equipments and select pump, compressor etc. and auxiliary services.
5. EVALUATE Process parameters and their correlation.
6. APPLY the concepts of process equipment design for specific applications.

SUBJECT/CODE: Renewable Energy Technologies [402051-B]

1. DESCRIBE fundamentals, needs and scopes of renewable energy systems.
2. EXPLAIN performance aspects of flat and concentric solar collectors along with applications.
3. DESIGN solar photovoltaic system for residential applications.
4. DESIGN AND ANALYSIS of wind energy conversion system.
5. APPLY Installation practices of Wind and Solar Photovoltaic Systems for grid connection.
6. DETERMINE performance parameters of bio-energy conversion systems.

SUBJECT/CODE: Automation and Robotics [402051-C]

1. UNDERSTAND the basic concepts of Automation.
2. UNDERSTAND the basic concepts of Robotics.
3. IDENTIFY and EVALUATE appropriate Drive for Robotic Applications.
4. COMPARE and SELECT End-effectors and Sensors as per Application.
5. DEVELOPE the Mathematical Modeling Approaches of Robot.
6. EVALUATE the fundamentals of robot programming and CLASSIFY the Applications.

SUBJECT/CODE: Industrial Psychology and Organizational Behavior

[402051-D]

1. DEMONSTRATE fundamental knowledge about need and scope of industrial - organizational psychology and behavior.
2. ANALYZE the job requirement, have understanding of fatigue, boredom and improve the job satisfaction.
3. UNDERSTAND the approaches to enhance the performance.
4. KNOWLEDGE of theories of organizational behavior, learning and social-system.
5. UNDERSTAND the mechanism of group behavior, various aspects of team, leadership and conflict management.
6. EVALUATE the organizational culture, manage the change and understands organizational development approaches.

SUBJECT/CODE: Electric and Hybrid Vehicle [402051-E]

1. UNDERSTAND the basics related to e-vehicle.
2. CLASSIFY the different hybrid vehicles.
3. IDENTIFY and EVALUATE the Prime Movers, Energy Storage and Controllers.
4. DISCOVER and CATAGORIZE the Electric Vehicle Configuration with respect to Propulsion, Power distribution and Drive-Train Topologies.
5. DEVELOP body frame with appropriate suspension system and TESTING of for e-Vehicles.
6. CLASSIFY and EVALUATE Battery Charging techniques and management.

SUBJECT/CODE: Electric and Hybrid Vehicle [402051-F]

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, 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.
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.

SUBJECT/CODE: Project (Stage II) [402053]

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.