Shree Mahavir Education Society's

Sanghavi College of Engineering, Nashik

Department of Mechanical Engineering

Course Outcomes

Final Year (2019 Pattern) : Semester-I

Course code	Course Name	Course Outcomes(Cos)
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 DESCRIBE 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.DESIGN 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.
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.
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.

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402043	Turbomachinery	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.
402044A	Elective – III (A):Automobile Design	CO1:COMPREHEND the steps involved in the design process of Principal Engine Components. CO2:GAIN the knowledge and design of Engine Sub-Systems. CO3:COMPUTE the critical dimensions of chassis components involved in the Steering System and Differential and final drive of a vehicle. CO4:SELECT the tyres and wheels required for automobile vehicle and design the various types automotive brakes. CO5:UNDERSTAND the design concepts of Automotive Suspension system CO6:POSSES the knowledge of Vehicle Packaging and System Integration, NVH.
402044B	Elective – III(B):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.
402044C	Elective – III C :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.

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402044C	Elective – III C :Modern Machining Processes	CO6.SUGGEST appropriate nanomachining process for the specific application.
402044D	Elective – III(D):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.
402044E	Elective – III E: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
402044F	Elective – III (F):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

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402045A	Elective - IV(A): 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
402045B	Elective - IV(B):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
402045C	Elective - IV C :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.

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402045D	Elective - IV(D): 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	Elective - IV E: : Augmented Reality and Virtual Reality	CO1. UNDERSTAND fundamental Computer Vision, Computer Graphics and Human Computer 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
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
402047	Project (Stage I)	CO1. IMPLEMENT systems approach. CO2. CONCEPTUALIZE a novel idea / technique into a product. CO3. THINK in terms of a multi-disciplinary environment. CO4. TAKE ON the challenges of teamwork, and DOCUMENT all aspects of design work.

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402047	Project (Stage I)	CO5. UNDERSTAND the management techniques of implementing a project. CO6. DEMONSTRATE the final product for Functionality, Designability, and Manufacturability.
Final Year (2019 Pattern) : Semester-II		
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.
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 and 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.
402050A	Elective-V (A) Quality & Reliability Engineering	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

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402050B	Elective-V(B) 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
402050C	Elective-V C: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.
402050D	Elective-V (D) 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
402050E	Elective-V (E) 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

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402050E	Elective-V (E) Organizational Informatics	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.
402050F	Elective-V (F): 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 inter connected bodies CO6. APPLY MBD tool effectively and SIMULATE it to solve and validate practical Multibody Dynamics problems and its solutions
402051A	Elective - VI (A):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
402051B	Elective - VI(B): 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.

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402051C	Elective - VI(C): 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
402051D	Elective - VI(D) : 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.
402051E	Elective - VI(E): 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 e Vehicles CO6. CLASSIFY and EVALUATE Battery Charging techniques and management
402052	Mechanical system 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

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402052	Mechanical system analysis Laboratory	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.
402053	Project (Stage II)	CO1. IMPLEMENT systems approach. CO2. CONCEPTUALIZE a novel idea / technique into a product. CO3. THINK in terms of a multi-disciplinary environment. CO4. TAKE ON the challenges of teamwork, and DOCUMENT all aspects of design work. CO5. UNDERSTAND the management techniques of implementing a project. CO6. DEMONSTRATE the final product for Functionality, Designability, and Manufacturability.