



Course Outcomes

Savitribai Phule Pune University

Syllabus for SE (Mechanical Engineering)

2019 course(To be implemented from June 2020)

SEM-I

202041 - Solid Mechanics

On completion of the course, learner will be able to

1. Define various types of stresses and strain developed on determinate and indeterminate members.
2. Draw Shear force and bending moment diagram for various types of transverse loading and support.
3. Compute the slope & deflection, bending stresses and shear stresses on a beam.
- 4 . Calculate torsional shear stress in shaft and buckling on the column.
5. Apply the concept of principal stresses and theories of failure to determine stresses on a 2-D element.
6. Utilize the concepts of SFD & BMD, torsion and principal stresses to solve combined loading application based problems.

202042 - Solid Modeling and Drafting

On completion of the course, learner will be able to

1. Understand basic concepts of CAD system, need and scope in Product Lifecycle Management
2. Utilize knowledge of curves and surfacing features and methods to create complex solid geometry
3. Construct solid models, assemblies using various modeling techniques & PERFORM mass property analysis, including creating and using a coordinate system
4. Apply geometric transformations to simple 2D geometries
5. Use CAD model data for various CAD based engineering applications viz. production drawings, 3D printing, FEA, CFD, MBD, CAE, CAM, etc.
6. Use PMI & MBD approach for communication

202043 - Engineering Thermodynamics

On completion of the course, learner will be able to

1. Describe the basics of thermodynamics with heat and work interactions.
2. Apply laws of thermodynamics to steady flow and non-flow processes.
3. Apply entropy, available and non available energy for an Open and Closed System,
4. Determine the properties of steam and their effect on performance of vapour power cycle.
5. Analyze the fuel combustion process and products of combustion.
6. Select various instrumentations required for safe and efficient operation of steam generator

202044 - Engineering Materials and Metallurgy

On completion of the course, learner will be able to

1. Compare crystal structures and ASSESS different lattice parameters.
2. Correlate crystal structures and imperfections in crystals with mechanical behaviour of materials.
3. Differentiate and DETERMINE mechanical properties using destructive and non-destructive testing of materials.
4. Identify & Estimate different parameters of the system viz., phases, variables, component, grains, grain boundary, and degree of freedom. etc.
5. Analyze effect of alloying element & heat treatment on properties of ferrous & nonferrous alloy.
6. Select appropriate materials for various applications.

203156 - Electrical and Electronics Engineering

On completion of the course, learner will be able to

1. Apply programming concepts to understand role of Microprocessor and Microcontroller in embedded systems
2. Develop interfacing of different types of sensors and other hardware devices with Atmega328 based Arduino Board
3. Understand the operation of DC motor, its speed control methods and braking
4. Distinguish between types of three phase induction motor and its characteristic features
5. Explain about emerging technology of Electric Vehicle (EV) and its modular subsystems
7. Choose energy storage devices and electrical drives for EVs

202045 - Geometric Dimensioning and Tolerance Lab

On completion of the course, learner will be able to

1. Select appropriate IS and ASME standards for drawing
2. Read & Analyse variety of industrial drawings
3. Apply geometric and dimensional tolerance, surface finish symbols in drawing
4. Evaluate dimensional tolerance based on type of fit, etc.
5. Select an appropriate manufacturing process using DFM, DFA, etc

202046 - Audit Course - III

1. Faculty mentor shall be allotted for individual courses.
2. He/She shall monitor the progress for successful accomplishment of the course.
3. Such monitoring is necessary for ensuring that the concept of self learning is being pursued by the students in true letter and spirit’.

SEM-II

207002 - Engineering Mathematics - III

On completion of the course, learner will be able to

1. Solve higher order linear differential equations and its applications to model and analyze mass spring systems.
2. 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.
3. Apply Statistical methods like correlation, regression in analyzing and interpreting experimental data applicable to reliability engineering and probability theory in testing and quality control.
4. Perform Vector differentiation & integration, analyze the vector fields and APPLY to fluid flow problems.
5. Solve Partial differential equations such as wave equation, one and two dimensional heat flow equations.

202047 - Kinematics of Machinery

On completion of the course, learner will be able to

1. Apply kinematic analysis to simple mechanisms
2. Analyze velocity and acceleration in mechanisms by vector and graphical method
3. Synthesize a four bar mechanism with analytical and graphical methods
4. Apply fundamentals of gear theory as a prerequisite for gear design
5. Construct cam profile for given follower motion

202048 - Applied Thermodynamics

On completion of the course, learner will be able to

1. Determine COP of refrigeration system and analyze psychrometric processes.
2. Discuss basics of engine terminology, air standard, fuel air and actual cycles.
3. Identify factors affecting the combustion performance of SI and CI engines.
4. Determine performance parameters of IC Engines and emission control.
5. Explain working of various IC Engine systems and use of alternative fuels.
6. Calculate performance of single and multi stage reciprocating compressors and discuss rotary positive displacement compressors

202049 - Fluid Mechanics

On completion of the course, learner will be able to

1. Determine various properties of fluid
2. Apply the laws of fluid statics and concepts of buoyancy
3. Identify types of fluid flow and terms associated in fluid kinematics
4. Apply principles of fluid dynamics to laminar flow
5. Estimate friction and minor losses in internal flows and determine boundary layer formation over an external surface
6. Construct mathematical correlation considering dimensionless parameters, also able to predict the performance of prototype using model laws

202050 - Manufacturing Processes

On completion of the course, learner will be able to

1. Select appropriate moulding, core making and melting practice and estimate pouring time, solidification rate and design riser size and location for sand casting process
2. Understand mechanism of metal forming techniques and calculate load required for flat rolling
3. Demonstrate press working operations and APPLY the basic principles to design dies and tools for forming and shearing operations
4. Classify and Explain different welding processes and evaluate welding characteristics
5. Differentiate thermoplastics and thermosetting and explain polymer processing techniques
6. Understand the principle of manufacturing of fibre-reinforce composites and metal matrix composites

202051 - Machine Shop

On completion of the course, learner will be able to

1. Perform welding using TIG/ MIG/ Resistance/Gas welding technique
2. Make Fibre-reinforced Composites by hand lay-up process or spray lay-up techniques
3. Perform cylindrical/surface grinding operation and CALCULATE its machining time
4. Determine number of indexing movements required and acquire skills to PRODUCE a spur gear on a horizontal milling machine
5. Prepare industry visit report
6. Understand procedure of plastic processing

202052 - Project Based Learning - II

On completion of the course, learner will be able to

1. Identify the real-world problem (possibly of interdisciplinary nature) through a rigorous literature survey and formulate / set relevant aims and objectives.
2. Analyze the results and arrive at valid conclusions.
3. Propose a suitable solution based on the fundamentals of mechanical engineering by possibly integration of previously acquired knowledge.
4. Contribute to society through proposed solutions by strictly following professional ethics and safety measures.
5. Use of technology in proposed work and demonstrate learning in oral and written form.
6. Develop ability to work as an individual and as a team member

202053 - Audit Course - IV

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Syllabus for TE Mechanical Engineering (2019 Pattern)

Implemented from Academic year 2021-22

SEM-I

Course Outcomes

302041: Numerical and Statistical Methods

On completion of the course the learner will be able to;

- 1: **Solve** system of equations using direct and iterative numerical methods.
- 2: **Estimate** solutions for differential equations using numerical techniques.
- 3: **Develop** solution for engineering applications with numerical integration.
- 4: **Design** and **Create** a model using a curve fitting and regression analysis.
- 5: **Apply** statistical Technique for quantitative data analysis.
- 6: **Demonstrate** the data, using the concepts of probability and linear algebra.

302042: Heat and Mass Transfer

On completion of the course, learner will be able to

1. **Analyze & Apply** the modes of heat transfer equations for one dimensional thermal system.
2. **Design** a thermal system considering fins, thermal insulation and & Transient heat conduction.
3. **Evaluate** the heat transfer rate in natural and forced convection & validate with experimentation results.
4. **Interpret** heat transfer by radiation between objects with simple geometries, for black and grey surfaces.
5. **Ability** to analyze the rate of mass transfer using Fick's Law of Diffusion and understands mass diffusion in different coordinate systems.
6. **Design & Analysis** of heat transfer equipments and investigation of its performance.

302043: Design of Machine Elements

On successful completion of this course, the learner will be able to:

1. **Design and Analyze** the cotter and knuckle Joints, levers and components subjected to eccentric loading.
2. **Design** shafts, keys and couplings under static loading conditions.
3. **Analyze** different stresses in power screws and apply those in the procedure to design screw jack.
4. **Evaluate** dimensions of machine components under fluctuating loads.
5. **Evaluate & Interpret** the stress developed on the different type of welded and threaded joints.
6. **Apply** the design and development procedure for different types of springs

302044: Mechatronics

On completion of the course, learner will be able to

1. **Define** key elements of mechatronics, principle of sensor and its characteristics.
2. **Utilize** concept of signal processing and make use of interfacing systems such as ADC, DAC, Digital I/O.
3. **Determine** the transfer function by using block diagram reduction technique.
4. **Evaluate** Poles and Zero, frequency domain parameter for mathematical modeling for mechanical system.
5. **Apply** the concept of different controller modes to an industrial application.
6. **Develop** the ladder programming for industrial application.

Elective I 302045-A: Advanced Forming & Joining Processes

On completion of the course, learner will be able to

1. **Analyse** the effect of friction in metal forming deep drawing and identification of surface defects and their remedies in deep drawing operations
2. **Assess** the parameters for special forming operation and select appropriate special forming operation for particular applications

3. **Analyse** the effect of HAZ on microstructure and mechanical properties of materials
4. **Classify** various solid state welding process and select suitable welding processes for particular applications
5. **Classify** various advanced welding process and select suitable welding processes for particular applications.
6. **Interpret** the principles of sustainable manufacturing and its role in manufacturing industry.

302045-B: Machining Science & Technology

On completion of the course, learner will be able to

1. **Define** metal cutting principles and mechanics of metal cutting and tool life.
2. **Describe** features of gear and thread manufacturing processes.
3. **Select** appropriate grinding wheel and demonstrate the various surface finishing processes.
4. **Select** appropriate jigs/fixtures and to draw the process plan for a given component.
5. **Select & evaluate** various parameters of process planning.
6. **Generate** CNC program for Turning / Milling processes and generate tool path using CAM software.

302046: Digital Manufacturing Laboratory

On completion of the course, learner will be able to

1. **Develop** a component using conventional machines, CNC machines and Additive Manufacturing Techniques.
2. **Analyze** cutting tool parameters for machining given job.
3. **Demonstrate** simulation of manufacturing process using Digital Manufacturing Tools.
4. **Select** and **Design** jigs and Fixtures for a given component.
5. **Demonstrate** different parameters for CNC retrofitting and reconditioning

302047: Skill Development

On completion of the course, learner will be able to

1. **Apply** & demonstrate procedure of assembly & disassembly of various machines.
2. **Design** & develop a working/model of machine parts or any new product.
3. **Evaluate** fault with diagnosis on the machines, machine tools and home appliances.

4. **Identify** & demonstrate the various activities performed in an industry such as maintenance, design of components, material selection.

302048: Audit Course V

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SEM-II

302049: Artificial Intelligence & Machine Learning

On completion of the course, learner will be able to

1. **Demonstrate** fundamentals of artificial intelligence and machine learning.
2. **Apply** feature extraction and selection techniques.
3. **Apply** machine learning algorithms for classification and regression problems.
4. **Devise and develop** a machine learning model using various steps.
5. **Explain** concepts of reinforced and deep learning.
6. **Simulate** machine learning model in mechanical engineering problems.

302050: Computer Aided Engineering

On completion of the course, learner will be able to

- 1: **Define** the use of CAE tools and describe the significance of shape functions in finite element formulations.
- 2: **Apply** the various meshing techniques for better evaluation of approximate results.
- 3: **Apply** material properties and boundary condition to SOLVE 1-D and 2-D element stiffness matrices to obtain nodal or elemental solution.
- 4: **Analyze** and apply various numerical methods for different types of analysis.
- 5: **Evaluate** and solve non-linear and dynamic analysis problems by analyzing the results obtained from analytical and computational method.
6. **Generate** the results in the form of contour plot by the USE of CAE tools.

302051: Design of Transmission Systems

On completion of the course, learner will be able to

1. **Apply** the principle of Spur & Helical gear design for industrial application and PREPARE a manufacturing drawing with the concepts of GD&T.
2. **Explain** and design Bevel & Worm gear considering design parameters as per design standards.
3. **Select** design Rolling and Sliding Contact Bearings from manufacturer's catalogue for a typical application considering suitable design parameters.
4. **Define** and design various types of Clutches, Brakes, used in automobile.
5. **Apply** various concepts to design Machine Tool Gear box, for different applications
6. **Elaborate** various modes of operation, degree of hybridization and allied terms associated with hybrid electric vehicles

Elective 302052-A: Composite Materials

On completion of the course, learner will be able to

1. **Define** & compare composites with traditional materials.
2. **Identify** & estimate different parameters of the Polymer Matrix Composite
3. **Categories** and apply Metal Matrix Process from possessions landscape.
4. **Determine** volume/weight fraction and strength of Composites.
5. **Select** appropriate testing and inspection method for composite materials.
6. **Select** composites materials for various applications.

302052-B: Surface Engineering

On completion of the course, learner will be able to-

1. **Define** the basic's principle & mechanism of surface degradation.
2. **Analyse** & select correct corrosion prevention techniques for a different service condition.
3. **Demonstrate** the role of surface engineering of materials to modify/improve the surface properties.
4. **Select** the suitable surface heat treatments to improve the surface properties.
5. **Apply** the surface modification technique to modify surface properties.
6. **Analyse** & evaluate various surface coating defects using various testing/characterization method

302053: Measurement Laboratory

On completion of the course, learner will be able to-

1. **Evaluate** causes of errors in Vernier calipers, micrometers by performing experiments in standard metrological conditions, noting deviations at actual and by plotting cause and effect diagram, to reduce uncertainty in measurement.
2. **Analyze** strain measurement parameters by taking modulus of elasticity in consideration to acknowledge its usage in failure detection and force variations.
3. **Examine** surface Textures, surface finish using equipment's like Talysurf and analyze surface finish requirements of 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.
4. **Measure** the dimensional accuracy using Comparator and limit gauges and appraise their usage in actual measurement or comparison with standards set to reduce measurement lead time.
5. **Perform** Testing of Flow rate, speed and temperature measurements and their effect on performance in machines and mechanisms like hydraulic or pneumatic trainers, lathe machine etc. to increase repeatability and reproducibility.
6. **Compile** the information of opportunities of entrepreneurship/business in various sectors of metrology like calibrations, testing, coordinate and laser metrology etc in an industry visit report.

302054: Fluid Power & Control Laboratory

On completion of the course, learner will be able to

1. **Define** working principle of components used in hydraulic and pneumatic systems.
2. **Identify** & explain various applications of hydraulic and pneumatic systems.
3. **Select** an appropriate component required for hydraulic and pneumatic systems using manufactures' catalogues.
4. **Simulate** & analyse various hydraulic and pneumatic systems for industrial/mobile applications.
5. **Design** a hydraulic and pneumatic system for the industrial applications.
6. **Design** & demonstrate various IoT, PLC based controlling system using hydraulics and pneumatics

302055: Internship/Mini project

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.

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Mini project

On completion of the course, learner will be able to

1. **Explain** plan and execute a Mini Project with team.

2. **Implement** hardware/software/analytical/numerical techniques, etc.

3. **Develop** a technical report based on the Mini project.

4. **Deliver** technical seminar based on the Mini Project work carried out.

302056: Audit Course VI

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Syllabus for BE Mechanical Engineering

(2019 Pattern) Implemented from Academic year 2022-23

SEM-I

402041: Heating, Ventilation, Air Conditioning and Refrigeration

On completion of the course the learner will be able to;

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 describe Transcritical and ejector refrigeration systems.
4. Estimate cooling load for air conditioning systems used with concern of design conditions and indoor quality of air.
5. Design air distribution system along with consideration of ventilation and infiltration.
6. Explain the working of types of desiccants, evaporative, thermal storage, radiant cooling, clean room and heat pump systems

402042: Dynamics of Machinery

On completion of the course, students will be able to -

1. Apply balancing technique for static and dynamic balancing of multi cylinder inline and radial engines.
2. Analyze the gyroscopic couple or effect for stabilization of Ship, Airplane and Four wheeler vehicles.
3. Estimate natural frequency for single DOF un-damped & damped free vibratory systems.
4. Determine response to forced vibrations due to harmonic excitation, base excitation and excitation due to unbalance forces.
5. Estimate natural frequencies, mode shapes for 2 DOF un-damped free longitudinal and torsional vibratory systems.
6. Describe noise and vibration measuring instruments for industrial / real life applications along with suitable method for noise and vibration control.

402043: Turbomachinery

Course Outcomes:

On completion of the course the learner will be able to;

- 1: Validate impulse moment principle using flat, inclined and curved surfaces and investigate performance characteristics of hydraulic turbines.
- 2: Determine performance parameters of impulse and reaction steam turbine along with discussion of nozzles, governing mechanism & losses.
- 3: Measure performance parameters of single & multistage centrifugal pumps along with discussion of cavitation and selection.
- 4: Explain performance parameters of centrifugal compressor along with discussion of theoretical aspects of axial compressor.

402044A: Automobile Design

Course Outcomes:

On completion of the course the learner will be able to;

- 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: Design of Heat Transfer Equipments

Course Outcomes:

On completion of the course the learner will be able to;

- 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.

402044C - Modern Machining Processes

Course Outcomes

On completion of the course, learner will be able to

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.

402044D: Industrial Engineering

Course Outcomes

Learner will be able to:

1. 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.

402044E: Internet of Things

On completion of the course the learner will be able to;

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

402044F: Computational Fluid Dynamics

On completion of the course the learner will be able to;

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

402045A: Product Design and Development

On completion of the course the learner will be able to;

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

402045C: Additive Manufacturing

On completion of the course, learner will be able to

1. 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 verities 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

402045D: Operations Research

On completion of the course, learner will be able to

1. Evaluate various situations of Games theory and Decision techniques and apply them to solve them in real life for decision making.
2. Select appropriate model for queuing situations and sequencing situations and find the optimal solutions using models for different situations.
3. Formulate various management problems and solve them using Linear programming using graphical method and simplex method.
4. Formulate variety of problems such as transportation, assignment, travelling salesman and Solve these problems using linear programming approach.
5. 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.
6. Apply concepts of simulation and Dynamic programming

402045E: Augmented Reality and Virtual Reality

On completion of the course the learner will be able to;

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

402046: Data Analytics Laboratory

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

- 1: Understand the basics of data analytics using concepts of statistics and probability.
- 2: Apply various inferential statistical analysis techniques to describe data sets and withdraw useful conclusions from acquired data set.
- 3: Explore the data analytics techniques using various tools
- 4: Apply data science concept and methods to solve problems in real world context
- 5: Select advanced techniques to conduct thorough and insightful analysis and interpret the results

402047: Project (Stage I)

On completion of the course the learner will be able to;

1. Implement systems approach.
2. Conceptualize a novel idea / technique into a product.
3. Think in terms of a multi-disciplinary environment.
4. Take ON the challenges of teamwork, and DOCUMENT all aspects of design work.
5. Understand the management techniques of implementing a project.
6. Demonstrate the final product for Functionality, Designability, and Manufacturability

402054: Audit Course VII

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SEM-II

402048: Computer Integrated Manufacturing

On completion of the course the learner will be able to;

1. Explain CIM and factory automation.
2. Understand the integration of hardware and software elements for CIM
3. Apply CNC program for appropriate manufacturing techniques.
4. Analyze processes planning, quality and MRP integrated with computers.
5. Interpret flexible, cellular manufacturing and group technology.
6. Analyze the effect of IOT, Industry-4.0 and cloud base manufacturing

402049: Energy Engineering

On completion of the course the learner will be able to;

- 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

402050A: Quality & Reliability Engineering.

On completion of the course the learner will be able to:

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.

402050B: Energy Audit and Management

On completion of the course the learner will be able to;

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. Analyze the energy conservation performance of Thermal Utilities
5. Analyze the energy conservation performance of Electrical Utilities
6. Explain the energy performance improvement by Cogeneration and WHR method

402050C: Manufacturing System and Simulation

On completion of the course the learner will be able to;

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

402050D: Engineering Economics and Financial Management

On completion of the course, students will be able to -

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

402050E: Organizational Informatics.

Learner will be able to:

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.

402050F: Computational Multi Body Dynamics

On completion of the course the learner will be able to;

- 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: Process Equipment Design

On completion of the course the learner will be able to

1. Interpret the different parameters involved in design of process Equipments.
2. **Analyze** thin and thick walled cylinder
3. Design cylindrical vessel, spherical vessel, tall vessels and thick walled high
4. Design different process Equipments and select pump, compressor etc. and
5. Evaluate Process parameters and their correlation
6. Apply the concepts of process equipment design for specific applications

402051B: Renewable Energy Technologies

On completion of the course the learner will be able to;

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

402051C: Automation and Robotics

On completion of the course the learner will be able to;

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

402051D: Industrial Psychology and Organizational Behavior

On completion of the course the learner will be able to;

- 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: Electric and Hybrid Vehicle

On completion of the course the learner will be able to;

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 categorize 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 Systems Analysis Laboratory

On completion of the course the learner will be able to;

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.

402053: Project (Stage II)

1. Presentation of work in the form of Project Report (s),
2. Understanding individual capacity, Role & involvement in the project, Team Work (Distribution of work, intra-team communication and togetherness),
3. Participation in various contests, Publications and IPR, Manuals (Project Report, Quick reference, System, Installation guide) among other parameters.
- 4.
5. Team members with guide information shall be added at the end of the report

402055: Audit Course VIII

1. Faculty mentor shall be allotted for individual courses
2. He/She shall monitor the progress for successful accomplishment of the course.
3. Such monitoring is necessary for ensuring that the concept of self-learning is being pursued by the students
'in true letter and spirit

