

CAYMET's

Siddhant College of Engineering

Savitribai Phule Pune University, Pune

Third Year Mechanical Engineering (2019 Course)

**COURSE OBJECTIVE & OUTCOMES**

**SEM I**

**Subject Code & Name -302041: Numerical and Statistical Methods**

**Course Objectives**

1. UNDERSTAND applications of systems of equations and solve mechanical engineering applications.
2. APPLY differential equations to solve the applications in the domain of fluid mechanics, structural, etc.
3. LEARN numerical integration techniques for engineering applications.
4. COMPARE the system's behavior for the experimental data.
5. INTERPRET Statistical measures for quantitative data.
6. ANALYZE datasets using probability theory and linear algebra.

**Course Outcomes**

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.

**Subject Code & Name -302042: Heat and Mass Transfer**

**Course Objectives**

1. IDENTIFY the laws for different modes of heat transfer.
2. UNDERSTAND the properties and economics of thermal insulation and ANALYZE heat transfer through fins and thermal systems with lumped heat capacitance.
3. ANALYZE the natural and forced convective mode of heat transfer in various geometric configurations.
4. UNDERSTAND AND REALIZE various laws with their interrelations and analyze Radiation heat transfer in black and grey bodies/surfaces with or without radiation shields.
5. UNDERSTAND the fundamentals and laws of mass transfer and its applications.
6. ANALYZE various performance parameters for existing heat exchanger and DEVELOP methodologies for designing a heat exchanger under prescribed conditions and for a particular application, with references TEMA standards

**Course Outcomes**

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

**Subject Code & Name -302043: Design of Machine Elements**

**Course Objectives**

1. UNDERSTAND the various design considerations, design procedure and select materials for a specific application
2. CALCULATE the stresses in machine components due to various types of loads and failure
3. ANALYZE machine components subjected to variable loading for finite and infinite life
4. DESIGN various machine components such as shafts, couplings, keys, screws, joints, springs

**Course Outcomes**

On completion of the course, 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.

**Subject Code & Name -302044: Mechatronics**

**Course Objectives**

1. UNDERSTAND the key elements of mechatronics, principle of sensor and its characteristics.
2. UNDERSTAND the concept of signal processing and use of interfacing systems such as ADC, DAC, Digital I/O.
3. UNDERSTAND the block diagram representation and concept of transfer function.
4. UNDERSTAND the system modeling and analysis in frequency domain.
5. UNDERSTAND the system modeling and analysis in time domain, controller modes and its industrial applications..
6. UTILIZE the concepts of PLC system and its ladder programming and significance of PLC system in industrial application

**Course Outcomes**

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.

**Subject Code & Name -302045-A: Advanced Forming & Joining Processes**

**Course Objectives**

1. UNDERSTAND advances in sheet metal forming operations
2. UNDERSTAND the advanced special metal forming processes.
3. UNDERSTAND weld metallurgy and weld characterization techniques.
4. UNDERSTAND and describe various advanced solid state welding processes.
5. CLASSIFY AND DESCRIBE various advanced welding processes.

6. KNOW about sustainable manufacturing and its role in manufacturing industry.

### **Course Outcomes**

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.

### **Subject Code & Name - 302045-B: Machining Science & Technology**

#### **Course Objectives**

1. KNOW about fundamentals of metal cutting process, tool wear and tool life.
2. IMPART the knowledge of machining phenomenon like milling, gear and thread manufacturing, grinding, super finishing, etc.
3. UNDERSTAND the basic concepts, importance and functions of Jigs, Fixtures.
4. PREPARE list of operations, tools, set of manufacturing instructions and selection of quality assurance method.
5. GENERATE CNC program for appropriate machining processes like turning and milling.

#### **Course Outcomes**

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.

### **Subject Code & Name - 302046: Digital Manufacturing Laboratory**

#### **Course Objectives**

1. ACQUIRE skills to handle conventional machines and CNC machine for manufacturing of a component.
2. PREPARE manual part program for given component as per ISO standards.
3. ACCUSTOM skills of Additive manufacturing technology.
4. APPRECIATE the influence of cutting tool parameters on the performance.
5. APPLY Digital Manufacturing tools for process simulation of manufacturing processes.
6. SELECT appropriate type of jigs and fixtures for a given component

#### **Course Outcomes**

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.

**Subject Code &Name - 302047: Skill Development**

**Course Objectives**

1. INTRODUCE the skills required in an industry such as design, development, assembly & disassembly.
2. DEVELOP the skills required for fault diagnose of engine and transmission of different automotive and various home appliances.
3. ESTABLISH the skills required for maintenance of any machine tool.
4. CREATE awareness about industrial environment.

**Course Outcomes**

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.

## SEM II

### **Subject Code &Name -302049: Artificial Intelligence & Machine Learning**

#### **Course Objectives**

1. ACQUAINT with fundamentals of artificial intelligence and machine learning.
2. LEARN feature extraction and selection techniques for processing data set.
3. UNDERSTAND basic algorithms used in classification and regression problems.
4. OUTLINE steps involved in development of machine learning model.
5. FAMILIARIZE with concepts of reinforced and deep learning.
6. IMPLEMENT AND ANALYZE machine learning model in mechanical engineering problems.

#### **Course Outcomes**

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.

### **Subject Code &Name -302050: Computer Aided Engineering**

#### **Course Objectives**

1. UNDERSTAND the basic concepts of Computer Aided Engineering (CAE) and CHARACTERISTICS of various elements required for analysis.
2. NURTURE students about the discretization process and criteria for quality mesh.
3. UNDERSTAND the approaches of Finite Element Method (FEM) and to find displacement and stresses over the body.
4. DEVELOP the knowledge and skills needed to effectively evaluate the results using Finite Element Analysis (FEA).
5. APPLY computational technique to solve complex solid mechanics problems and its loading states.
6. STUDY the applications of CAE in the various domains of the Mechanical Engineering.

#### **Course Outcomes**

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 tool.

### **Subject Code &Name -302051: Design of Transmission Systems**

#### **Course Objectives**

1. APPLY fundamentals for the design and/or selection of elements in transmission systems.
2. UNDERSTAND the philosophy that real engineering design problems are open-ended and challenging.
3. DEMONSTRATE design skills for the problems in real life industrial applications.
4. DEVELOP an attitude of team work, critical thinking, communication, planning and scheduling through design projects.

5. PERCEIVE about safety, ethical, legal, and other societal constraints in execution of their design projects.
6. BUILD a holistic design approach to find out pragmatic solutions to realistic domestic and industrial problems

#### **Course Outcomes**

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 concept 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.

#### **Subject Code &Name -302052-A: Composite Materials**

##### **Course Objectives**

1. DESCRIBE what are composite materials and their differences with respect to conventional materials.
2. COMPREHEND the challenges associated with Polymer Matrix composites.
3. UNDERSTAND the requirement of Metal Matrix Composites
4. RECOGNIZE design and properties aspect of composites
5. UNDERSTAND the testing, inspection and standard in Composites
6. ORIENT to the specific Application of Composites

##### **Course Outcomes**

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. CATEGORISE 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.

#### **Subject Code &Name -302052-B: Surface Engineering**

##### **Course Objectives**

1. DEVELOP fundamental understanding and role of materials to allow surface selection for mechanical contact surfaces
2. UNDERSTAND surface modification and coating method to enhance surface performance
3. RECOGNIZE method for testing surface properties

##### **Course Outcomes**

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

### **Subject Code &Name -302053: Measurement Laboratory**

#### **Course Objectives**

1. DEVELOP necessary skills for calibration and testing of instruments
2. APPLY fundamentals of measuring methods by collecting data ,analysis and interpretation
3. APPLY knowledge of Designing limiting gauges
4. APPLY knowledge of Electronic/Electrical measuring instruments

#### **Course Outcomes**

On completion of the course, learner will be able to

1. EVALUATE causes of errors in Verniercalipers, 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 verniercalipers, 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 entrepreneurships/business in various sectors of metrology like calibrations, testing, coordinate and laser metrology etc in an industry visit report.

### **Subject Code &Name -302054: Fluid Power & Control Laboratory**

#### **Course Objectives**

1. UNDERSTAND working principles of control devices and accessories.
2. SELECT different components from manufactures' catalogues.
3. DEMONSTRATE the capabilities to simulate and design fluid power systems.
4. UNDERTAKE digitalization of fluid power system.

#### **Course Outcomes**

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 pneumatic.

### **Subject Code &Name -302055: Internship/Mini project**

#### **Course Objectives**

Internship provides an excellent opportunity to learner to see understand the conceptual aspects learned in classes and deployed into the practical world. Industry/on project experience provides much more professional experience as value addition to classroom teaching.

1. To encourage and provide opportunities for students to get professional/personal experience through internships.
2. To learn and understand real life/industrial situations.
3. To get familiar with various tools and technologies used in industries and their applications.
4. To nurture professional and societal ethics.
5. To create awareness of social, economic and administrative considerations in the working environment of industry organizations.

#### **Course Outcomes**

On completion of the course, learners should be able to

1. DEMONSTRATE professional competence through industry internship.
2. APPLY knowledge gained through internships to complete academic activities in a professional manner.
3. CHOOSE appropriate technology and tools to solve given problem.
4. DEMONSTRATE abilities of a responsible professional and use ethical practices in day to day life.
5. DEVELOP network and social circle, and DEVELOPING relationships with industry people.
6. ANALYZE various career opportunities and DECIDE career goals.

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