



**BHARATI VIDYAPEETH'S**

# **COLLEGE OF ENGINEERING**

Lavale, Pune-412115

## **Department of Mechanical Engineering**

**Third Year Engineernig Course Outcome**

**(TE 2019 Course)**

## SEM I

### 302041: Numerical and Statistical Methods

- CO1: **SOLVE** system of equations using direct and iterative numerical methods.
- CO2: **ESTIMATE** solutions for differential equations using numerical techniques.
- CO3: **DEVELOP** solution for engineering applications with numerical integration.
- CO4: **DESIGN** and **CREATE** a model using a curve fitting and regression analysis.
- CO5: **APPLY** statistical Technique for quantitative data analysis.
- CO6: **DEMONSTRATE** the data, using the concepts of probability and linear algebra.

### 302042: Heat and Mass Transfer

- CO1. **ANALYZE & APPLY** the modes of heat transfer equations for one dimensional thermalsystem.
- CO2. **DESIGN** a thermal system considering fins, thermal insulation and & Transient heat conduction.
- CO3. **EVALUATE** the heat transfer rate in natural and forced convection & validate with experimentation results.
- CO4. **INTERPRET** heat transfer by radiation between objects with simple geometries, for blackand grey surfaces.
- CO5. **ABILITY** to analyze the rate of mass transfer using Fick's Law of Diffusion and understands mass diffusion in different coordinate systems.
- CO6. **DESIGN & ANALYSIS** of heat transfer equipments and investigation of its performance.

### 302043: Design of Machine Elements

- CO1. **DESIGN AND ANALYZE** the cotter and knuckle Joints, levers and components subjected to eccentric loading.
- CO2. **DESIGN** shafts, keys and couplings under static loading conditions.
- CO3. **ANALYZE** different stresses in power screws and **APPLY** those in the procedure todesign screw jack.
- CO4. **EVALUATE** dimensions of machine components under fluctuating loads.
- CO5. **EVALUATE & INTERPRET** the stress developed on the different type of welded andthreaded joints.
- CO6. **APPLY** the design and development procedure for different types of springs

### **302044: Mechatronics**

- CO1. **DEFINE** key elements of mechatronics, principle of sensor and its characteristics.
- CO2. **UTILIZE** concept of signal processing and **MAKE** use of interfacing systems such as ADC, DAC, Digital I/O.
- CO3. **DETERMINE** the transfer function by using block diagram reduction technique.
- CO4. **EVALUATE** Poles and Zero, frequency domain parameter for mathematical modeling for mechanical system.
- CO5. **APPLY** the concept of different controller modes to an industrial application.
- CO6. **DEVELOP** the ladder programming for industrial application

### **302045-A: Advanced Forming & Joining Processes**

- CO1. **ANALYSE** the effect of friction in metal forming deep drawing and **IDENTIFICATION** of surface defects and their remedies in deep drawing operations
- CO2. **ASSESS** the parameters for special forming operation and **SELECT** appropriate special forming operation for particular applications
- CO3. **ANALYSE** the effect of HAZ on microstructure and mechanical properties of materials
- CO4. **CLASSIFY** various solid state welding process and **SELECT** suitable welding processes for particular applications
- CO5. **CLASSIFY** various advanced welding process and **SELECT** suitable welding processes for particular applications.
- CO6. **INTERPRET** the principles of sustainable manufacturing and its role in manufacturing industry

### **302045-B: Machining Science & Technology**

- CO1. **DEFINE** metal cutting principles and mechanics of metal cutting and tool life.
- CO2. **DESCRIBE** features of gear and thread manufacturing processes.
- CO3. **SELECT** appropriate grinding wheel and demonstrate the various surface finishing processes.
- CO4. **SELECT** appropriate jigs/fixtures and to draw the process plan for a given component.
- CO5. **SELECT & EVALUATE** various parameters of process planning.
- CO6. **GENERATE** CNC program for Turning / Milling processes and generate tool path using CAM software

### **302046: Digital Manufacturing Laboratory**

- CO1. **DEVELOP** a component using conventional machines, CNC machines and Additive

Manufacturing Techniques.

CO2.**ANALYZE** cutting tool parameters for machining given job.

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

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

CO5.**DEMONSTRATE** different parameters for CNC retrofitting and reconditioning

### **302047: Skill Development**

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

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

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

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

## SEM II

### 302049: Artificial Intelligence & Machine Learning

CO1. **DEMONSTRATE** fundamentals of artificial intelligence and machine learning.

CO2. **APPLY** feature extraction and selection techniques.

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

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

CO5. **EXPLAIN** concepts of reinforced and deep learning.

CO6. **SIMULATE** machine learning model in mechanical engineering problems.

### 302050: Computer Aided Engineering

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

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

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

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

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

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

### 302051: Design of Transmission Systems

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

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

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

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

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

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

### **302052-A: Composite Materials**

- CO1. **DEFINE & COMPARE** composites with traditional materials.
- CO2. **IDENTIFY & ESTIMATE** different parameters of the Polymer Matrix Composite
- CO3. **CATEGORISE** and **APPLY** Metal Matrix Process from possessions landscape.
- CO4. **DETERMINE** volume/weight fraction and strength of Composites.
- CO5. **SELECT** appropriate testing and inspection method for composite materials.
- CO6. **SELECT** composites materials for various applications.

### **302052-B: Surface Engineering**

- CO1. **DEFINE** the basic's principle & mechanism of surface degradation.
- CO2. **ANALYSE & SELECT** correct corrosion prevention techniques for a different servicecondition.
- CO3. **DEMONSTRATE** the role of surface engineering of materials to modify/improve the surface properties.
- CO4. **SELECT** the suitable surface heat treatments to improve the surface properties.
- CO5. **APPLY** the surface modification technique to modify surface properties.
- CO6. **ANALYSE & EVALUTE** various surface coating defects using various testing/characterization method.

### **302053: Measurement Laboratory**

- CO1. **EVALUATE** causes of errors in Vernier calipers, micrometers by performing experiments in standard metrological conditions, noting deviations at actual and by plotting cause and effect diagram, to reduce uncertainty in measurement.
- CO2. **ANALYZE** strain measurement parameters by taking modulus of elasticity in consideration to acknowledge its usage in failure detection and force variations.
- CO3. **EXAMINE** surface Textures, surface finish using equipment's like Talysurf and analyze surface finish requirements of metrological equipment's like gauges, jaws of vernier calipers, micrometers, magnifying glasses of height gauge and more, to optimize surface finish accuracy requirements and cost of measurement.
- CO4. **MEASURE** the dimensional accuracy using Comparator and limit gauges and appraise their usage in actual measurement or comparison with standards set to reduce measurement lead time.
- CO5. **PERFORM** Testing of Flow rate, speed and temperature measurements and their effect on performance in machines and mechanisms like hydraulic or pneumatic trainers, lathe machine etc. to increase repeatability and reproducibility.
- CO6. **COMPILE** the information of opportunities of entrepreneurships/business in various

sectors of metrology like calibrations, testing, coordinate and laser metrology etc in an industry visit report.

### **302054: Fluid Power & Control Laboratory**

- CO1. **DEFINE** working principle of components used in hydraulic and pneumatic systems.
- CO2. **IDENTIFY & EXPLAIN** various applications of hydraulic and pneumatic systems.
- CO3. **SELECT** an appropriate component required for hydraulic and pneumatic systems using manufactures' catalogues.
- CO4. **SIMULATE & ANALYSE** various hydraulic and pneumatic systems for industrial/mobile applications.
- CO5. **DESIGN** a hydraulic and pneumatic system for the industrial applications.
- CO6. **DESIGN & DEMONSTRATE** various IoT, PLC based controlling system using hydraulics and pneumatics.

### **302055: Internship/Mini project**

- 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.

**OR**

### **302055 Mini project**

- CO1. **EXPLAIN** plan and execute a Mini Project with team.
- CO2. **IMPLEMENT** hardware/software/analytical/numerical techniques, etc.
- CO3. **DEVELOP** a technical report based on the Mini project.
- CO4. **DELIVER** technical seminar based on the Mini Project work carried out.