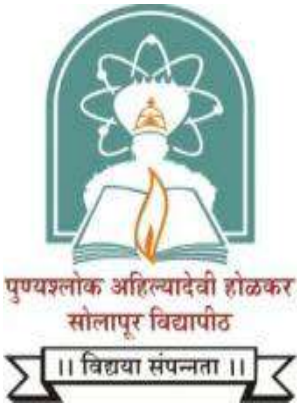
Punyashlok Ahilyadevi Holkar Solapur University, Solapur



NAAC Accredited-2015
'B' Grade (CGPA 2.62)

Name of the Faculty: Science and Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: Mechanical Engineering

Name of the Course: S. Y. B. Tech

(Syllabus to be implemented from w.e.f. June 2021)

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-III

ME211 :Applied Thermodynamics

Teaching Scheme	Examination Scheme
Lectures:03Hours/week, 03Credits	ESE: 70Marks
Practical :02Hours/week, 01Credit	ISE: 30Marks
	ICA: 25Marks

Course Introduction: Applied Thermodynamics is one of the core courses in the Mechanical Engineering curriculum, as well as one of the traditional courses, dating back from the last many centuries. In Applied Thermodynamics the significance moves from studying general concepts with illustrative examples to develop methods and performing analyses of real life problems. The objective of this subject is to apply knowledge of basic thermodynamic concepts to understand working and evaluate performance various cycles and devices used in thermal power plants and air compressors.

Course Objectives:

During this course, student is expected to:

1. To learn about of First law for reacting systems and heating value of fuels
2. To learn about vapor power cycles and their analysis.
3. To learn about flow of steam through nozzles.
4. To learn the about reciprocating compressors with and without intercooling.
5. To analyze the performance of steam boilers, steam turbines and steam condensers.

Course Outcomes:

At the end of this course, student will be able to:

1. Apply mathematics and laws of thermodynamics to solve real-life problems.
2. Evaluate steam properties and analyze the performance of steam generators using steam table
3. Apply knowledge of basic thermodynamic concepts for analysis of vapor power cycles
4. Understand thermodynamics of steam nozzles and analysis of steam turbine

5. Study of steam condensers for various applications.
6. Calculate various performance parameters of reciprocating air compressors.

Section I

Unit-1: Basic Laws of Thermodynamics **No. of lectures- 08**

Unit content: Review of basic concepts, Application of First law of Thermodynamics to chemically reacting system: the standard enthalpy (heat) of reaction, the standard enthalpy of formation**(Numerical Treatment)**

Second Law of Thermodynamics: Limitation of first law of thermodynamics, heat engine, refrigerator and heat pump, Kelvin- Plank and Clausius statements and their equivalence. Reversibility and Irreversibility, Carnot cycle. Principle of entropy increase ,Calculation of entropy change for: i) Phase change of pure substance ii) Change of state of an ideal gas iii) adiabatic mixing.**(Numerical Treatment)**

Unit-2: Formation of steam and Steam Generators **No. of lectures- 08**

Unit content: Properties of pure substance-Property diagram for phase – change processes SteamProperties (wet, saturated, superheated, degree of superheat and dryness fraction); Temperature-entropy and temperature-enthalpy diagrams, Mollier diagram.***(Theoretical Treatment)***

Classification of boilers , salient features of high pressure boilers, Evaporation, equivalent evaporation, Boiler efficiency, heat losses in boiler plant & heat balance sheet

(Numerical treatment).

Unit-3:Vapour Power Cycles **No. of lectures-04**

Unit content: Classification of cycles, vapour power cycles, Carnot vapour power cycle, simple Rankine cycle, actual Rankine cycle, Effect of operating conditions on Rankine cycle efficiency. **(Numerical Treatment)**

Section II

Unit-4: Steam Nozzles and Turbines **No. of lectures- 08**

Unit content: Types of Nozzles, flow of steam through nozzles (Theoretical Treatment)

Steam Turbines:- Advantages and classification of steam turbines, simple impulse turbine, compounding of steam turbines, Parson's reaction turbine, Velocity diagrams, work done and efficiencies (Numerical Treatment)

Unit-5: Steam Condensers **No. of lectures- 04**

Unit content: Elements of steam condensing plants, advantages of using condensers, types of

condensers, Mass of circulating water, vacuum efficiency, Condenser efficiency.(Theoretical Treatment)

Unit-6: Reciprocating Air Compressors **No. of lectures- 08**

Unit content: Uses of compressed air, classification of compressor, constructional detail of single & multistage compressor, computation of work, isothermal work done, isothermal efficiency, effect of clearance, volumetric efficiency, FAD, theoretical & actual indicator diagram, Need of multistage, work done, volumetric efficiency, condition for maximum efficiency, inter cooling. **(Numerical Treatment)**

Internal Continuous Assessment (ICA):

Any six of the following :

1. Study of Boilers
2. Study of Boilers Mountings and Accessories.
3. Study/ Trial on steam calorimeter
4. Two problemsusing Steam table software for finding steam properties.
5. Study/Trial on reciprocating air compressor
6. Flash & Fire point of a lubricant
7. Trial on Redwood viscometer
8. Study of different types of condensers.
9. Industrial visit to any process / power industry

Text Books:

1. A Course in Thermal Engineering -S. Domukundwar, Kothandraman, Dhanpat Rai &Co. Delhi.
2. Thermal Engineering -R. K. Rajput – Laxmi Publication – New Delhi (Sixth Edition)
3. Basic & Applied Thermodynamics -P.K. Nag Tata McGraw Hill Publication
4. An introduction to Thermodynamics - Y.V.C. Rao – Universities Presss.

Reference Books

1. Thermodynamics by C.P. Arora TMH New Delhi 1998 edition.
2. Thermodynamics & Heat Engine – Vol 1 &Vol 2 – R. Yadav Central Book Depot.
3. Thermodynamics- Cengel Boles, Tata McGraw Hill New Delhi.
4. Steam & Gas Turbines- R. Yadav, CPH Allahabad

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-III

ME212 :Mechanics of Materials

Teaching Scheme

Lectures:03Hours/week, 03Credits

Tutorial:01Hours/week, 01 Credit

Examination Scheme

ESE: 70Marks

ISE: 30Marks

ICA: 25Marks

Course Introduction:

This course consists of topics from the course Strength of Materials, helpful for mechanical engineers who haVE prerequisite knowledge of engineering mechanics. The study of stresses &strains in mechanical components under different types of loads is important in the design engineering. This course covers the topics of simple stresses & strains, torsion of circular shafts, strain energy and shear force and bending moment diagrams in first section. In second section, chapter of bending and stresses in beams, slope& deflection of beams and Principal stresses & strains are included. The subject emphasizes the fundamentals of strength of materials necessary for practicing mechanical engineers in the design and analysis of mechanical components. This course also inculcates problem solving skill amongst the students.

Course Objectives:

During this course, student is expected to:

1. To study different types of stress, strain and deformation induced in mechanical components due to external loads.
2. To study the distribution of various stresses in the mechanical elements such as beams and shafts etc.
3. To study effect of component dimensions and shape on stress and deformations.

Course Outcomes:

At the end of this course, student will be able to:

1. **Demonstrate** fundamental knowledge about different types of loading and stresses induced for given applications.
2. **Compute** the stresses induced in basic mechanical components subjected to various axial, torsional flexural load and strain energy under gradual, sudden and impact loading.

3. **Interpret** SFD and BMD for different types of loads and support conditions.
4. **Develop** shear force and bending moment diagrams to analyze the bending & shear stresses offered by the beam.
5. **Compute** the principal stresses & position planes in a member subjected to various types of stress system.

Section I

Unit-1: Simple stress and strain **No. of lectures-6**

Concept and types of stresses and strains, poission's ratio, Stresses and deformation in homogeneous and compound bars under axial loads, Stress-Strain diagrams,Hooke's law, Elastic constants and their relationships, Temperature stress & strain in simple bars under axial loading.

Unit-2: **No. of lectures-8**

a) Torsion of Circular Shafts: Theory of torsion and assumptions, Torsion of solid and hollow circular shafts, derivation of torsion equation,determination of torsional shear stress and angular twist for solid and hollow shafts used in power transmission applications.

b) Strain Energy and Impact Load: Concept of strain energy, proof resilience and modulus of resilience, determination of strain energy in tension and compression for axially loaded members due to gradual, sudden and impact loads.

Unit-3:Shear Force and Bending Moments **No. of lectures-6**

Concept and definitions of Shear force and bending moment in determinate beams, SF and BM diagrams for cantilever, simply supported beams with or without overhang, Calculations of maximum shear force and bending moment and point of contra flexure under i) concentrated load ii) Uniformly distributed load iii) Combination of concentrated and uniformly distributed load iv) uniformly varying load iv) Couple. Relation between the rate of loading, shear force and the bending moment.

Section II

Unit-4:Bending and Shear Stresses in Beams **No. of lectures-8**

Concept of theory of pure bending of beams, assumptions and sign Conventions, Bending stresses in beams with derivation and application to commonly used beam cross sections as circular rectangular, I-sections and T-sections.Concept of shear stresses and shear stress distribution in beam, determination of shear stresses for rectangular, I and T sections of beams.

Unit-5: Slope and Deflection of Beams **No. of lectures-6**

Concept and definitions of slope and deflection, relationship between bending moment, slope and deflection by Macaulay's method (Introductory treatment) and Moment area method, Determination of slope and deflections of i)cantilever beam ii)simply supported beam under concentrated and uniformly distributed load.

Unit-6:Principal Stresses and Strains **No. of lectures-6**

Concept of Normal and shear stresses on oblique planes, principal stresses and strains and principal planes, two dimensional stress system, determination of principal stresses and maximum shear stresses using analytical and Mohr's circle method(2-D cases only)..

Internal Continuous Assessment (ICA):

List of Experiments/Assignments/Case Studies, etc.

1. Assignment and tutorial on Simple Stresses and Strains.
2. Assignment and tutorial on Torsion of Circular Shafts and Strain Energy.
3. Assignment and tutorial on SFD and BMD.
4. Assignment and tutorial on Bending and shear stresses in Beams.
5. Assignment and tutorial on Slope and Deflection of Beams.
6. Assignment and tutorial on Principal Stresses and Strains.

Text Books:

1. Rajput R. K., **Strength of materials**, S. Chand & Co. Ltd., New Delhi.
2. Bansal R.K., **Strength of materials**, Laxmi publications (P) Ltd., New Delhi.
3. Subramanyam, **Strength of Materials**, Oxford University Press, Edition 200.

Reference Books

1. Timoshenko & Young, **Elements of Strength of Materials**, CSB Publishers
2. Ramamrutham S. **Strength of Materials** Dhanpat Raiand Co.(p) Pvt. Ltd. Delhi
3. S. S. Rattan **Mechanics of Materials**, TMH Pvt. Ltd
4. Basu A. R., Strength of materials, Dhanpat Rai & Co. (P) Ltd., Delhi.
5. Beer and Johnson, Strength of materials, Mc-Graw Hill International student series.
6. Khurmi R. S. & Gupta J. K., Strength of materials, S. Chand &Co.Ltd., New Delhi
7. Basavarajaiah and Mahadevappa, Strength of Materials, Khanna Publishers, New Delhi.
8. W. Nash Strength of Materials, Schaum's Outline Series, McGraw Hill Publication.

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-III

ME213 :Manufacturing Processes

Teaching Scheme	Examination Scheme
Lectures:03Hours/week, 03Credits	ESE : 70Marks
Practical :02Hours/week, 01 Credit	OE : 25 Marks
	ISE : 30Marks
	ICA : 25Marks

Course Introduction:

This course covers all primary manufacturing processes like casting, forging, rolling, extrusion and Drawing along with Fabrication. These processes are basics of Mechanical Engineering Programme. The basics of this processes along with their applications and equipment and machinery required for the processes is covered in brief. This course also introduces Manufacturing Techniques for plastic products. Recent trends in various processes are also discussed in brief.

Course Objectives:

During this course, student is expected to:

1.To introduce to the students the casting technique and its significance in manufacturing.

2.To introduce to the students with various plastic deformation processes and their application

3.To introduce to the students the various fabrication techniques and their significance in Industry.

4.To introduce to the students with various plastic manufacturing processes.

5.To introduce to the students with recent trends in this processes

Course Outcomes:

At the end of this course, student will be able to

1.Demonstrate the different types of pattern and explain gating system used in casting process.

2.Identify appropriate melting and molding techniques with classification of different defects in casting.

3.Explain in brief about various joining processes engineering application.

4.Illustrate and compare the types of forming processes such as rolling, forging, extrusion,

drawing etc.

5.Make use of various advanced application.

6.Illustrate different rapid prototyping techniques.

Section I

Unit-1: Basics of Casting Processes **No. of lectures-06**

Definition of casting, Basic steps in casting processes, Advantages, limitations and applications of casting process, General introduction to patterns, Types of patterns, materials used, Allowances, types of cores and core boxes, molding materials and its properties, Gating system, types of risers, Function of riser, method to improve efficiency of risers. Riser design simple numerical problems.

Unit-2:Melting, Molding and Inspection processes **No. of lectures-09**

Construction and working in brief of melting furnaces such as Cupola, Arc furnaces, induction furnaces. Green sand molding (hand and machine molding), Shell molding, Investment casting, centrifugal casting, gravity and pressure die casting processes. Stages in fettling, Common important defects in castings. Inspection procedure, Computer applications in foundry processes, foundry Mechanization.

Unit-3:Introduction to Joining processes **No. of lectures-05**

Welding processes, classification of welding process, arc welding, welding rod selection, TIG welding & MIG welding, submerged arc welding, gas welding, resistance welding, Brazing and soldering.

Section II

Unit-4:Conventional Forming Processes **No. of lectures- 09**

Introduction to forming process, Classification of forming processes, forging, types of forging, simple numerical problem on upset forging. Extrusion, Types – direct extrusion, indirect extrusion, impact extrusion, hydrostatic extrusion, Wire drawing process, Methods of tube drawing, hot rolling, cold rolling of sheets, classification of Rolling mills, theory of rolling, simple numerical problems on rolling.

Unit-5:Advanced Forming Processes **No. of lectures- 06**

Introduction to advanced forming process, High energy rate forming process- explosive, Electro-hydraulic, magnetic pulse forming. Forming with hydrostatic pressure- hydro mechanical and hydro forming process

Unit-6:Advanced Manufacturing Processes **No. of lectures-05**

Introduction to Rapid prototyping (RP), Basic principles, Classification, Steps in RP,

Advantages, disadvantages and applications of RP, Stereo lithography - Selective Laser Sintering (SLS), Selective Powder Binding (SBP), Fused Deposition Modeling (FDM), Direct Metal Laser Sintering (DMLS), Advantages, disadvantages and applications

Internal Continuous Assessment (ICA):

List of Experiments/Assignments/Case Studies, etc.

1. Design of pattern and core for a simple component.
2. Testing of silica sand for grain fineness and clay content.
3. Testing of green sand for green compression strength, permeability.
4. Study of mold for moisture content and core hardness tester.
5. Study of VI characteristic of welding process.
6. Study of manufacturing sequence of upset forging with example.
7. Demonstration of any one rapid prototyping technique.
8. Visit to Foundry and Forging unit.

Text Books:

1. TV Ramana Rao, METAL CASTING Principles and Practice, NEWAGEINTERNATIONAL
2. N.D. Titov, Foundry Practice.
3. P.L. Jain, Principles of Foundry Technology.
4. P.N.Rao, Manufacturing Technology: Foundry, Forming and Welding.
5. Production Technology by P.C.Sharma

Reference Books

1. Metal Casting Principles and Techniques, 1st Edition, Publisher: American Foundry Society
   Editor: Ian Kay
2. Fundamentals of Modern Manufacturing, M. P. Groover,John Wiley & Sons.
3. Heine, Lopar, Rosenthal, Principles of Metal Casting.
4. Metal Forming: Technology and process modelling, McGraw-Hill Education
5. Rapid Prototyping: Principles and Applications, Chee Kai Chua, World Scientific.

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-III

ME214 :Machine Drawing & CAD

Teaching Scheme

Lectures:03Hours/week, 03Credits

Drawing :04Hours/week, 02Credits

Examination Scheme

ESE: 70Marks (4 hrs. duration)

POE : 50 Marks

ISE: 30Marks

ICA: 50Marks

Course Introduction: Drawing is called as language of engineers. Drawing, as an art, is the picture is action of the imagination of the scene in its totality by an individual. Machine drawing on the other hand is the scientific representation of an object, according to certain national and

international standards of practice. This course consists of selected topics from the subject Machine Drawing and Engineering Graphics which are helpful for mechanical engineers. It contains BIS convention, free hand sketching & Production drawing which are vital in Design engineering. It covers the topics of BIS conventions, free hand sketching, Production drawing, isometric projections along with assembly and details drawing. It also includes 2D and 3D drawing using drafting software. This course emphasizes the fundamentals of various topics under machine drawing necessary for practicing mechanical engineers and inculcates problem solving skill amongst the students.

Course Objectives:

During this course, student is expected to:

1. To understand & use the principles of drawing.
2. To understand and apply drawing practices as per BIS standards.
3. To draw machine components by using principles of free hand sketches
4. To interpret and apply, limits, fits and tolerances to the various machine elements.
5. To interpret and apply technique to draw assembly drawing from given detail drawing and to draw detail drawing from given assembly drawing.
6. To operate the drafting software.

Course Outcomes:

At the end of this course, student will be able to:

1. Apply BIS Convention in drawing mechanical components and assembly drawings
2. Use geometrical, dimensions, tolerances and symbols in part and assembly drawing**.**
3. Draw assembly, details drawing and identify applications of same
4. Prepare 2D drawing and 3Dof machine components using drafting software.

Section I

Unit-1:Basics of Machine Drawing & B.I.S. Conventions No. of lectures- 08

Types of drawing, Dimensioning **:-** Placing of dimensions, Functional and Non-functional dimensions, Dimensioning common features like: Circular Arcs, Diameters, Holes, Angles, Chamfers, Tapers, Undercut, Repetitive features, Countersunk, Square, Sphere, Across flat, Threads, etc.

Study of B.I.S. (Bureau of Indian Standards) Conventions-

Significance and importance of BIS Conventions, Drawings sheet sizes and layout recommended

by BIS. Conventional representation of engineering *Materials,* spur helical and bevel gears, worm and worm wheel, rack and pinion, gear assemblies, type of helical, disc and leaf springs.

Internal and external threads, square head, spline shaft, diamond knurling BIS conventions for sectioning, type of sections, exceptional cases. BIS methods of linear- and angular dimensioning. Symbolic representation of welds as per BIS.

Unit-2: Free Hand Sketching of machine component No. of lectures- 08

Importance of sketching and entering proportionate dimensions on sketches. Free hand sketches of various types of threads, nut, bolts (square and hexagonal flanged nuts, lock nuts, dome nut, capstan nut, wing nut, castle nut, split pin, square headed bolt, cup headed bolt, T-headed bolt, Rag foundation bolt, stud, washer. Various types of rivets and riveted joints, Various types of keys, Socket and spigot (Cotter joint) , Knuckle (pin) joint, Muff coupling, Protected and unprotected Flanged, coupling, universal coupling, solid and bush bearing. Plummer block (pedestal bearing), foot step bearing. Flat and V-belt pulleys, Fast and loose pulleys, speed cone pulleys, Pipe joint for C.I. Flanged, socket and spigot type pipe joint. Union pipe joint and standard pipe-fitting. The applications of above machine components.

Unit-3:Production Drawing: Limits, Fits, & Tolerances- No. of lectures- 06

Dimensional Tolerances: Introduction to system of limits and fits. Basic concepts. Terminology**,** Tolerances, various types. Necessity of Limit system, Unilateral and Bilateral Tolerances, Relation between Tolerances and Manufacturing Processes, Methods of indicating tolerances on drawings, IT grades, Types of fits, Grades of tolerances, types of Holes & shafts based on fundamental deviations, designation of fit, Systems of fits, Selection of fits, Selection of tolerances based on fits

Geometrical Tolerances:- Need of Geometrical Tolerances, Terminology, Tolerances for Single Features such as Straightness, Flatness, Circularity, Cylindricity. Tolerances for Related Features such as Parallelism, Perpendicularity, Angularity, Concentricity, Tolerance Symbol and Value, Indicating Geometrical Tolerances on drawings.

Surface Finish:- Surface Texture, Surface Roughness Number, Roughness Symbols, Range of Roughness obtainable with different manufacturing processes.

(Note **: Numerals /calculations/problems/tasks/examples/theoretical questions on UNIT NO.3)**

Section II

Unit-4:Details and Assembly Drawing No. of lectures- 07

To prepare detail drawings from given assembly drawing. To prepare assembly drawing from given drawing of details. Preparation of detailed drawing from the given details such as: Tools post of center lathe, Tail stock, Cross head Assembly, Jigs and fixtures, connecting rod and piston of I.C. Engines, Gland and stuffing box and many more suitable/considerations with moderate difficulty level, etc.Selection and showing of all the symbols & surface finish symbols, fits, tolerancesfor dimensions to details and assembly drawings.

Unit-5: Computer aided drafting (2D)&Isometric Drafting No. of lectures- 06

Isometric Drawing: Isometric scale, Isometric projection, Isometric drawing, Circles in isometric view, Isometric views of simple object from given orthographic views

The treatment on 2D Drawing with-

1. Basic commands to draw 2-D objects like line, circle, arc, ellipse, polygon etc.
2. Edit & Modify commands: Erase, extension, break, fillet, chamfer, trim, scale, hatching etc.
3. Dimensioning & text commands
4. Viewing and other : Zoom , pan, block etc.

Computer aided drafting for Isometric Drawing.

Plotting of drawings (printing process).

Unit-6:Computer aided drafting (3D) No. of lectures- 05

Introduction to Computer aided drafting (3D). Introduction to modeling: Wireframe, Solid, Surface Modeling, Three dimensional drawing: UCS & three dimensional co-ordinates, Viewing in three dimensions, Solid modeling commands: primitive solids, extrude, revolve, sweep, loft, press pull, etc, Solid editing commands: 3D-rotate, 3D-Move. 3D-Scale, Boolean operations, Slice, Sections, etc.

Internal Continuous Assessment (ICA):

List of Experiments/Assignments/Case Studies, etc.

1. Sheet no. 1. Based on Basic of drawing & dimensioning along with BIS conventions mentioned in Unit No.1
2. Sheet no. 2: Based on Free hand sketches, drawing of various machine components mentioned in Unit No. 2
3. Sheet no. 3. Based on Production Drawing.(Dimensional and Geometrical Tolerances).
4. Sheet no. 4. Draw details drawing from given assembly & assembly drawing from the given details drawing (With limits, fits, tolerances)
5. Sheet no.5. Based on Isometric Drawing.
6. Sheet no. 6 Computer aided drafting (2D) of two simple components and print out
7. Sheet no. 7 Computer aided drafting (2D) of isometric drawing and print out
8. Sheet no. 8 Computer aided drafting (3D) of two simple components and print out

Text Books:

1. P.S. Gill, Machine Drawing., S.K. Kataria and Sons , Delhi.
2. N. D. Bhatt,. Machine Drawing. Charotor Publication House, Bombay.
3. N. Sidheshwar . P. Kannaiah and V.V. S. Sastry. Machine Drawing, Tata McGraw Hill, New Delhi
4. George Omura.,Mastering Auto CAD, BPB Publications.
5. K.L.Narayana, P.Kanniah, & K.V. Reddy,“Machine Drawing” SciTech Publications (India Pvt. Ltd.) Chennai

Reference Books

1. IS: SP46- Engineering drawing practice for schools and colleges, B.I.S.

Publications.

2. IS: 696- Code of practice for general engineering drawings B.I.S. Publications.
3. IS : 2709-Guide for selection of fits, B.I.S. Publications
4. IS:919-Recommendation for limits and fits for Engineering, B.I.S. Publications

University Theory Paper Exam. Scheme :

Question paper will contain one compulsory question – objective question for 14 Marks.

Question paper will contain one compulsory question on Unit No. 4 for 22-24 Marks.

Question paper will NOT contain any question on Unit No. 5, 6.

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-III

ME2151 : Microprocessors in Automation

Teaching Scheme	Examination Scheme
Lectures : 03 Hours/week, 03 Credits	**ESE : 70 Marks**
Practical : 02 Hours/week, 01 Credit	**ISE : 30 Marks**
	ICA : 25 Marks

Course Introduction

The course is lab-centered and students will learn by working with real hardware such as 8085/8051 boards, Arduino and Raspberry Pi Boards and PLCs. Topics covered in the course include: assembly language programming, interfacing of software with hardware; digital logic, measurement and sensing, ladder programming. There are five specific labs on the topics of: sensor interfacing, DC motor control, stepper motor control, servo-motor control, and control using PLCs.

Course Objectives

(Shall not exceed 06)

During this course, student is expected to:

1. Understand microprocessor/microcontroller architecture and assembly programming.
2. Understand construction of Arduino and Raspberry Pi and how to use it
3. Understand the construction, programming and applications of PLCs.
4. Understand applications of microprocessors/microcontrollers in automation tasks.

Course Outcomes (Shall not exceed 06)

At the end of this course, student will be able to:

1. Define microprocessor, microcontrollers, peripherals and write simple programs in assembly.
2. Accomplish simple programming tasks on Arduino and Raspberry Pi.

3. Explain applications of PLCs and program them using ladder logic.
4. Explain the need of interfacing, function and application of each interfacing component.

Section I

Unit-1: Microprocessors **No. of lectures - 8**

Fundamentals of computing system, microprocessor definition, memory and its types, Von

Neumann vs Harvard Architecture, RISC/CISC, Introduction to 8085 microprocessor, 8085 architecture and pin layout, memory, 8085 programming and instruction set, addressing and interfacing.

Unit-2: Microcontrollers **No. of lectures - 6**

Microcontrollers, Introduction to 8051 microcontroller, architecture and pin layout, interfacing and programming, instruction set, addressing modes, special registers. simple assembly programs

Unit-3: Programming with Arduino **No. of lectures - 6**

Arduino Environment: Board, shield, libraries and IDE.

Programming: Arduino programs, build, compiling, uploading

Debugging: Debug environments, UART, serial communication in Arduino

Section II

Unit-4: Programming with Raspberry Pi **No. of lectures - 6**

Raspberry Pi Environment: how to set up and configure the board

Programming: Introduction to Linux and Python programming

Interfacing: Communicate devices using the I/O pins, programming using python

Unit-5: Programmable Logic Controllers **No. of lectures - 8**

PLCs, list of manufacturers, PLC architecture, PLC Input and output (NPN/PNP), I/O Processing, Boolean algebra, Ladder Diagrams, SFCs and functional block programming, internal relays, jump and call, timers and counters, latches.

Unit-6: Interfacing **No. of lectures - 6**

Interfacing, source and sink currents, pull up and pull down configuration, motor drivers, relays, optocouplers, ADC/DAC, OPAMPs, Signal Conditioning, Signal Processing, Computer Based Instrumentation, Data Recording and Logging, DAQs

Internal Continuous Assessment (ICA):

List of Experiments/Assignments/Case Studies, etc.

1. Theory assignment microprocessor and microcontrollers.
2. One programming assignment on 8085.
3. One programming assignment on 8051.
4. One practical assignment on interfacing sensors with Arduino.
5. One practical assignment on dc motor control using Arduino.
6. One practical assignment of stepper motor control using Arduino.
7. One practical assignment on interfacing sensors with Raspberry Pi.

8. One practical assignment on dc motor control using Raspberry Pi.
9. One PLC programming assignment featuring, relays, timers etc.
10. One practical assignment on interfacing sensors and actuators with PLC.

Text Books:

1. Gaonkar Ramesh, The 8085 microprocessor, Penram International Publishing, 3rd Edition.
2. Kenneth J. Ayala, The 8051 Microcontroller, Delmar Learning, 4th Edition.
3. Banzi, Getting Started with Arduino, McGraw Hill, 2nd Edition
4. Gareth Halfacree, Eben Upton, Raspberry Pi User Guide, O'Riley, 2nd Edition
5. W. Bolton, Mechatronics, 4th edition (or later) Pearson Publishing

Reference Books

1. W. Bolton, Programmable Logic Controllers, Pearson Publishing
2. Bishop et.al, Handbook of Mechatronics, CRC Press
3. Mazidi, 8051 Microcontroller, Prentice Hall, 3rd Edition
4. Petruzella Frank, Programmable Logic Controllers, McGraw Hill, 2nd Edition

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-III

ME2152 :Internal Combustion Engines

Teaching Scheme	Examination Scheme
Lectures:03Hours/week, 03Credits	ESE:70Marks
Practical :02Hours/week, 01Credit	ISE:30Marks
	ICA:25Marks

Course Introduction: I.C. Engines are widely used for passenger vehicles, transportation, agriculture purchases. They are available in different capacities and types. Its study is vital for a Mechanical Engineer.

Course Objectives:

During this course, student is expected to:

1. Distinguish the different types of engine constructions and their thermodynamic principles.
2. Differentiate the constructional details of various fuel systems used in different types of I. C. Engines and calculate major dimensions of carburettor and fuel injection system.
3. Apply the basic knowledge to infer the different methods for enhancing the performance of I. C. engines
4. Correlate the difference in SI and CI engine combustion processes with the design of combustion chambers used in these engines
5. Evaluate the performance parameters of I. C. engines to justify their use in different applications.
6. Categorize different alternative fuels suitable for different engine applications and compare the pollutants formed in these engines and their control methods

Course Outcomes:

At the end of this course, student will be able to:

1. Recognize and understand the reasons for differences in the **construction** of different types of internal combustion engines.
2. Evaluate differences among **operating characteristics** of different engine types and designs.
3. **Select** the appropriate **engine** for a given application.

4. Conduct **performance tests** on engines and Compare experimental results with Theoretical predictions.
5. Compare experimental results with theoretical **predictions** and make proper justifications.

Section I

Unit-1: *Introduction to I. C. Engines* **No. of lectures-05**

Introduction, Classification of I.C. Engines, Engine Cycles-Otto and Diesel Cycle, Valve timing diagram for high and low speed engines, Port timing diagram for two strokes S.I. Engines

Unit-2: *Fuel System for S. I. Engines* **No. of lectures-06**

Engine fuel requirements, Mixture requirements, Simple carburetor, and Additional systems in modern carburettor, compensating devices, Calculation of air fuel ratio (exact and approximate methods), Calculation of main dimensions of air and fuel supply (Numerical calculations of main dimensions of carburetor), Electronic Petrol injection system (MPFI).

Unit-3: *Fuel System for C. I. Engines* **No. of lectures-05**

Requirements of fuel injection system for C.I. Engines, Types of injection systems-Individual pump, Common rail and Distributor systems, Unit injector, Types of fuel nozzles- single hole, multihole, pintle and pintaux, CRDI.

Unit-4: *Supercharging* **No. of lectures-04**

Purpose of supercharging, Turbo charging, Thermodynamic cycle of supercharged and turbocharged Engines, Advantages and disadvantages, Limits of supercharging for S.I. and C.I. Engines.

Section II

Unit-5:*Combustion in SI Engines* **No. of lectures-05**

Stages of combustion in S.I. Engines, Ignition lag, Flame propagation, Factors affecting flame speed, Abnormal combustion, Octane number, HUCR, Requirements of combustion chambers of S.I. Engines and its types

Unit-6: *Combustion in C.I. Engines* **No. of lectures-05**

Stages of combustion in C.I. Engines, Delay period, Abnormal Combustion-Diesel knock, Requirements of combustion chambers for C.I. Engines and its types. Comparison of abnormal combustion in S I and C I Engines. Cetane number.

Unit-7: **Engine Testing and performance evaluation** **No. of lectures-05**

Performance parameters, Measurement of performance parameters like torque, power, and Volumetric Efficiency, Mechanical Efficiency, bsfc, Brake and Indicated Thermal efficiencies. Heat Balance Sheet. (Numerical on engine Performance and Heat Balance Sheet).

Unit-8: **Alternative Fuels and Engine Emission** **No. of lectures-05**

Various alternative fuels and their suitability for I. C. Engines. S.I. Engine emissions (HC, CO, NOx),C.I. Engines Emissions (CO, NOx, Smog, Particulate), Bharat Norms

Internal Continuous Assessment (ICA):

List of Experiments/Assignments/Case Studies, etc.

(minimum 3 from group A and B, and all from Group C)

Group A (Study group)

10. Constructional details of I.C. engines.
11. Study of Engine Cooling and Lubrication system
12. Study of Ignition systems and Starting systems
13. Study of fuel system for S.I. and C. I. engines

Group B (Trial group)

1 Constant Speed Test (Influence of load on performance)

2 Morse Test

3 Heat balance sheet

4 Test on computer controlled I.C. Engine/ Variable Compression Ratio Engine

5 Measurement of exhaust emissions of SI / CI engines

Group C

1 Assignment on recent trends in IC Engine.

2 Visit to an engine (or component) manufacturing company / repairing unit.

Text Books:

1. Internal Combustion Engines, Mathur and Sharma, DhanpatRai.
2. Engineering Fundamentals of the Internal Combustion EngineS, Willard Pulkrabeck, Prentice Hall
3. Internal Combustion Engines, R. K. Rajput, DhanpatRai Publications
4. Internal Combustion Engines, V. Ganesan, McGraw Hill

Reference Books

1. Internal Combustion Engines Fundamentals, John Heywood, McGraw Hill
2. Internal Combustion Engines Emission and Control, Eran Sher, SAE
3. Engine Emissions Purandir, Narosa
4. Alternative Fuels, S.S Thipse, Jaico
5. Internal Combustion Engines Fundamentals, Maleev, McGraw Hill
6. Internal Combustion Engines Vol. 1 and Vol. 2, C.F Taylor, MIT Press
7. Internal Combustion Engines, *Obert*, McGraw Hill
8. Internal Combustion Engines: AppliedThermo sciences, Fergusson & Kirkpatrick, Wiley
9. SAE Handbook, SAE, SAE.

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-III

ME2153 : Composite Materials

Teaching Scheme	**Examination Scheme**
Lectures : 03 Hours/week, 03 Credits	**ESE : 70 Marks**
Practical : 02 Hours/week, 01 Credit	**ISE : 30 Marks**
	ICA : 25 Marks

Course Objectives:

During this course, student is expected to:

1. To know the different types of composite materials and their applications.
2. To understand the different properties of composite materials**.**
3. To know various manufacturing processes of composites.
4. To understand process of identifying the properties of composite material
5. To understand micromechanical analysis in composite materials

Course Outcomes:

At the end of this course, student will be able to:

1. Students will understand the advantages and limitations of composite materials over conventional materials.
2. Students will be able to evaluate the mechanical properties of composite material.
3. Students will understand different manufacturing methods of composite material
4. Students will be able to understand effect of various manufacturing parameters on mechanical properties of composite materials.
5. Student will be able to understand micromechanical analysis in composite materials

Section I

Unit-1:Introduction to Composite Materials **No. of lectures-4**

Introduction , Classification, Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Recycling Fiber-Reinforced Composites

Unit-2: Macromechanical Analysis of a Lamina **No. of lectures-8**

Introduction, Review of Definitions, Stress, Strain, Elastic Moduli, Strain Energy, Hooke's Law for Different Types of Materials, Anisotropic Material, Monoclinic Material, Orthotropic

Material (Orthogonally Anisotropic)/Specially Orthotropic, Transversely Isotropic Material, Isotropic Material

Unit-3: Compliance and Stiffness Matrix **No. of lectures-8**

Hooke's Law for a Two-Dimensional Unidirectional Lamina, Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina, Hooke's Law for a Two-Dimensional Angle Lamina, Engineering Constants of an Angle Lamina..

Section II

Unit-4: Micromechanical Analysis of a Lamina **No. of lectures-8**

Introduction, Volume and Mass Fractions, Density, and Void Content Volume Fractions, Mass Fractions, Density, Void Content, Evaluation of the Four Elastic Moduli,

Unit-5: Strength of Materials Approach **No. of lectures-8**

Longitudinal Young's Modulus, Transverse Young's Modulus, Major Poisson's Ratio, In-Plane Shear Modulus, Semi-Empirical Models Longitudinal Young's Modulus Transverse Young's Modulus, Major Poisson's Ratio, In-Plane Shear Modulus

Unit-6: Manufacturing of composite materials **No. of lectures-4**

Open and closed mold processing, Hand lay-up techniques, Bag molding and filament winding. Pultrusion, Pulforming, Thermo forming, Injection molding, Types of defects.

Internal Continuous Assessment (ICA):

List of Experiments/Assignments/Case Studies, etc.

1. Assignment on types of composite material
2. Assignment on Hooke's law for different types of materials
3. Assignment on Compliance and Stiffness matrix
4. Assignment on Evaluation of the Four Elastic Moduli,
5. Assignment on Strength of Materials Approach
6. Assignment on Semi-Empirical Models
7. Assignment on Bag molding and filament winding
8. Assignment on Pultrusion, Pulforming, Thermo forming

Text Books:

1. Mechanics of Composite Materials, R M. Jones, Taylor & Francis.

2. Mechanics of composite materials, Autar K. Kaw, C R C Press New York.
3. Composite Materials handbook, Mein Schwartz, Mc Graw Hill Book Company, 1984.

Reference Books

1. Stress analysis of fiber Reinforced Composite Materials, Michael W, Hyer, Mc-Graw Hill International.
2. Composite Material Science and Engineering, Krishan K. Chawla, Springer .Fiber Reinforced Composites, P. C. Mallik, Marcel Decker

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-IV

ME221 : Engineering Mathematics –III

Teaching Scheme	**Examination Scheme**
Lectures : 03 Hours/week, 03 Credits	**ESE : 70 Marks**
Tutorial : 01Hours/week, 01 Credit	**ISE : 30 Marks**
	ICA : 25 Marks

Course Introduction:

The object of this course is to equip students with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines.

Course Objectives:

During this course, student is expected to:

1. To make the students familiarize with concepts and techniques in Ordinary differential equations.
2. To make the students familiarize with concepts and techniques in Partial differential equations.
3. To introduce to students Fourier series of periodic functions.
4. To introduce numerical methods for solving linear equations and for evaluating definite integrals
5. To make the students familiarize with concepts and techniques in Laplace transform.
6. To introduce concepts of Statistics and Probability distribution.

Course Outcomes:

At the end of this course, student will be able to:

1. **Solve** higher order linear differential equations and its applications to Free & Forced damped and undamped systems.
2. **Solve** partial differential equations of first order and partial differential equation such as wave equation.
3. **Apply** Fourier series techniques to express a function in terms of sine and cosine components so as to model simple periodic functions.
4. **Apply** numerical methods for solving linear and for evaluating definite integrals.

5. **Apply** integral transform techniques such as Laplace transform to find Laplace transform of given functions.
6. **Apply** Statistical methods like correlation, regression in analyzing and interpreting experimental data applicable to reliability engineering and probability theory in testing and quality control.

Section I

Unit-1: Linear Differential Equations (LDE) and Applications **No. of lectures-7**

LDE of n-th order with constant coefficients, Complementary Function, Particular Integral, General method, Short-cut methods (Without method of variation of parameters), Applications of LDE - Free &Forced damped and undamped systems only.

Unit-2: First Order Partial Differential equations **No. of lectures-7**

Basic concepts, Non-linear partial differential Equations of Type I: f(p, q)=0, Type II: f(p, q, z) = 0, Type III: f (p, x) = g(q, y), Linear partial differential equations – Lagranges method, Solution of partial differential equation by method of separation of variables.

Unit-3: Fourier series **No. of lectures-6**

Introduction, Definition, Dirichlet's theorem (only statement), Euler's formula, Fourier series of periodic functions in the interval (0 , 2Π) and(0, 2L), even and odd functions, half range sine and cosine series.

Section II

Unit-4: Solution of Algebraic and Transcendental Equations and Numerical Integration. **No. of lectures-6**

Introduction, Basic properties of equations. Regula-falsi method, Newton-Raphson Method, Newton's iterative formula for obtaining square root.

Newton Cotes Integration Formula: Trapezoidal rule, Simpson's Rule (1/3rd and 3/8th), Weddle's rule.

Unit-5: Laplace Transform **No. of lectures-7**

Laplace Transform **(LT):** LT of standard functions, Properties of LT: first shifting property, Change of scale property, multiplication by t, division by t, LT of derivatives and integral, Inverse Laplace Transform, Inverse Laplace transforms by partial fractions & convolution theorem.

Unit-6: Statistics and Probability **No. of lectures-7**

Coefficient of correlation: *Karl Pearson's coefficient of correlation method only* and lines of Regression of bivariate data.

Random variable, discrete and continuous random variable, Probability density function, Binomial, Poisson and Normal distributions.

Internal Continuous Assessment (ICA):

1. For ICA batch wise tutorials are to be conducted. The number of students per batch per tutorial should be as per University rules.

2. ICA shall be based on continuous assessment of six assignments (one per each unit) and performance in internal tests.

List of Experiments/Assignments/Case Studies, etc.

Text Books:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi
3. J. N. and P. N. Wartikar, "A Text of Applied Mathematics Vol. I and Vol. II", Vidyarthi Grah Prakashan, Pune.
4. N. P. Bali, Ashok Saxenaand N. Ch. S. N. Iyengar, "A Text of Applied Mathematics", Laxmi Publication, Delhi.
5. Jaggi and Mathur, "Advanced Engineering Mathematics", Dhanpatrai and Sons, Bhopal.

Reference Books

1. Erwin Kreyszig, "Advanced Engineering Mathematics', 10e, by Wiley India.
2. M. D. Greenberg, "Advanced Engineering Mathematics", 2e, by Pearson Education.
3. Peter V. O'Neil , "Advanced Engineering Mathematics", 7e, by Cengage Learning
4. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 5e, by Elsevier Academic Press

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-IV

ME222 : Manufacturing Technology

Teaching Scheme	Examination Scheme
Lectures : 03 Hours/week, 03 Credits	ESE : 70 Marks
Practical : 02Hours/week, 01 Credit	ISE : 30 Marks
	ICA : 25 Marks

Section I

Unit-1: Conventional Lathe Machine **No. of lectures - 06**

Introduction to Centre Lathe, parts and functions, specifications, accessories and attachments. Lathe operations, Taper turning methods, simple Numerical on Thread cutting. Introduction to CNC machine tools, Classification of CNC, advantages, limitations and application.

Unit-2: Hole making machine tools **No. of lectures - 08**

Classification, construction and working of Pillar type and radial drilling machines, Job & Tool holding devices and accessories, various operations. Horizontal and vertical boring machines, construction and working, Boring tools and bars, Jig boring machines. Broaching, principal, classification, pull and push type broach, advantages, limitations and application.

Unit-3: Reciprocating motion machine tools **No. of lectures - 06**

Principle, types, specifications, operations on shaper, Types of shapers, Types of planers, standard double housing plainer, construction, and operations. Introduction to construction and working of slotting machine.

Section II

Unit-4: Milling & gear manufacturing **No. of lectures- 09**

Classification of Milling Machines, construction and working of column and knee type milling Machines, Milling methods – Up milling and down milling, milling operations, Gear cutting on milling machines, Gear Hobbing, gear shaving, gear burnishing, indexing methods, Numerical on Indexing Methods.

Unit-5: Finishing Processes **No. of lectures- 05**

Classifications – Cylindrical, Center less, Surface grinder etc. Selection mounting, glazing, loading, truing, balancing, Surface finishing process, Honing, Lapping, super finishing.

Unit-6: Non-conventional Machining **No. of lectures- 06**

Introduction, classification, significance of Unconventional machining, Electrical discharge machining (EDM), Electrochemical Machining (ECM), Ultrasonic machining (USM), Abrasive Water Jet Machining (AWJM), Principle, working, applications, advantages, limitations.

Internal Continuous Assessment (ICA):

1. Setting the lathe machine for taper turning by swiveling compound rest and set over of tail stock method.
2. Setting the lathe machine for thread cutting operation.
3. Study and demonstration of attachments on milling machine.
4. Study and demonstration of various types of milling cutters.
5. Setting the milling machine for gear cutting operation.
6. Study and demonstration of various types of grinding wheels and their specifications.
7. Study of non-conventional machining processes (ECM, EDM).
8. Visit to at least one machine shop and one CNC shop.

Text Books:

1. Workshop Technology (Volume II) by Hajra Chowdhary.
2. Workshop Technology (Volume II) by Raghuvanshi.
3. Production Technology (Volume II) by Gupte-Patel.
4. Workshop Technology (Volume II) by W. A. J. Chapman.
5. Manufacturing Technology-P. N. Rao Vol. II.

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-I

ME223 :Fluid Mechanics & Fluid Machines

Teaching Scheme

Lectures:03Hours/week, 03Credits

Practical :02Hours/week, 01Credit

Examination Scheme

ESE:70Marks

ISE: 30Marks

ICA: 25Marks

Course Introduction:

Fluid mechanics is core technology subject in mechanical engineering. Conversion of fluid energy into mechanical energy and vice versa, is the scope of Fluid Mechanics & Fluid Machines. As far as applications are concerned , areas like , industrial hydraulics and pneumatics, tribology, process equipment design ,piping engineering, irrigation engineering requires basics of fluid mechanics. The content of fluid mechanics and fluid machines subject, encourages students to become involved in learning principles of fluid flow systems.

Course Objectives:

During this course, student is expected to:

1. Use various properties of fluids and related principles.
2. Understand fundamentals of Fluid Statics, Kinematics & dynamics.
3. Measure pressure, discharge and head of fluid.
4. Understand the physics of fluid flow through the pipe and its applications.
5. Establish relation between different parameters in research by performing dimensional analysis.
6. Determine various types of efficiencies of water turbines and pumps for various conditions.

Course Outcomes:

At the end of this course, student will be able to:

1. Solve issues related to fluid statics ,kinematics& dynamics .
2. Apply Bernoulli's theorem and continuity equation in real world situations
3. Measure and calculate Head loss of fluid
4. Perform dimensional analysis for research problems in fluid mechanics
5. Explain construction and working of different types of turbines, centrifugal pump
6. Analyze the performance of water turbines and centrifugal pumps for a given conditions.

Section I

Unit-1:*Fluid statics* **No. of lectures-05**

Center of pressure, Total pressure on immersed surfaces – horizontal, vertical & inclined, Principle of buoyancy, Archimedes' principle, conditions of equilibrium for submerged & floating bodies, discussions on stability, Meta-center & met centric height.

(No numerical treatment to Metacentric height)

Unit-2:*Fluid kinematics and dynamics* **No. of lectures-08**

Fluid kinematics: Types of flow with examples, Streamlines, path lines & streak lines, velocity & acceleration components, velocity potential function, equi-potential lines, Laplace equation governing potential flow, stream function, continuity equation in Cartesian co-ordinates.

Fluid Dynamics: Euler's equation along a stream line & Bernoulli's equation, applications of Bernoulli's Theorem: Venturi meter, Pitot tube ,Orifice meter (construction and working only),determination of hydraulic coefficient of an Orifice.

Unit-3: *Flow through pipes* **No. of lectures-07**

Major & minor Energy losses, Darcy-Welsbach equation, loss of head in pipe connections& fittings, equivalent pipe, Hydraulic Gradient Line (HGL) & Total Energy Line (TEL),flow through pipes in series & parallel, efficiency of power transmission, maximum transmission of fluid power througha given pipe. (No numerical treatment to HGL, TEL)

Section II

Unit-4:*Dimensional Analysis and Forces on Immersed* **No. of lectures-05**

Bodies.

Dimensions of Commonly Encountered Fluid Properties, Dimensional Analysis, Buckingham's Π theorem, Drag& Lift on immersed bodies.

Unit-5:Water Turbines **No. of lectures-08**

Impulse Water Turbine: Euler's equation for rotodynamic machines, Classification of water turbines, Pelton wheel, Work done and efficiencies of Pelton wheel, working proportions of Pelton wheel, Design ofPelton Turbine runner,

Reaction Water Turbine: Construction and Working of Francis&Kaplan turbine. Work done and efficiencies of Francis, Working Proportions of Francis turbine, Draft tube (Theoreticaltreatment only for draft tube), governing of turbine.

Unit-6: *Centrifugal Pumps* **No. of lectures-07**

Working principle, construction, types, various Heads, multistage pumps, Velocity triangles, Minimum starting speed, Maximum Suction Height & Net Positive Suction head , Calculations

of efficiencies, Discharge, blade angles, Heads, Power required, specific speed of pumps.

Internal Continuous Assessment (ICA):

Assignments :

1. Numerical & theoretical assignments on basics of fluid mechanics (Properties of fluids & related laws)
2. Numerical on Piezometer, Simple & inverted U tube manometer

Experiments:

Any Seven out of the following

1. Determination of meta centric height for a ship
2. Determination of Coefficient of friction for Pipes
3. Verification of Bernoulli's theorem.
4. Calibration of Venturimeter / Orifice meter.
5. Determination of Hydraulic Coefficient of an Orifice.
6. Trial on a Pelton wheel.
7. Trial on a Francis/ Kaplan turbine.
8. Trial on a centrifugal pump.
9. Two problems using CFD software

Text Books:

1. Dr. P.N. Modi and Dr. S.M. Seth - Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House.

2. Dr. R.K. Bansal - Fluid Mechanics and Hydraulic Machines - , Laxmi Publication Pvt. Ltd.,New Delhi.

3. Dr. D. S. Kumar, Fluid Mechanics & Fluid Power Engineering –, Kotaria& Sons

4. Domkundwar&Domkundwar, Fluid Mechanics and Hydraulic Machines, Dhanpatrai& Co.

5. Streeter, Wylie, Bedford - Fluid Mechanics, McGraw Hill Publication.

Reference Books

1. Frank M. White , Fluid Mechanics, McGraw Hill Publication
2. Irving Shames - Mechanics of Fluid, McGraw Hill Publication.
3. Murlidhar - Advanced Fluid Engineering, Narosa Publication.
4. S. K. Som, G. Biswas- Introduction to Fluid Mechanics and Fluid Machines, Tata McGrawHill publications

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-II

ME224 :Kinematics and Theory of Machines

Teaching Scheme	Examination Scheme
Lectures:03Hours/week, 03Credits	ESE : 70Marks
Practical :02Hours/week, 01Credit	OE : 25 Marks
	ISE : 30Marks
	ICA : 25Marks

Course Introduction:

As we get into design of machines, the very next step after understanding the need is deciding the mechanism. This course in 'Kinematics and Theory of Machines" helps in doing this job efficiently. It emphasizes on basic study and kinematic analysis of bar mechanisms, cams, gears and gear trains. Gears, gear trains and cams have been integral part of Mechanical Systems, In addition to this, they are primary elements of modern day automation industry. Further, the course helps to understand the Mechanical control system through study of governors and their characteristics. The course also focuses on balancing of masses in rotation and reciprocation. Thus, this course lays down the foundation required for 'Selecting, Analyzing and Designing Mechanisms for Developing Machines', one of the core activities of Mechanical Engineers.

Course Objectives:

During this course, learners are expected to:

1. Study fundamentals of kinematics of machines
2. Apply graphical methods to determine motion parameters of a mechanism
3. Follow procedures to generate cam profile for different motions of followers
4. Study basics of toothed gearing and procedure for gear train analysis
5. Understand relations for governor characteristics
6. Study need and method for balancing of rotary masses and reciprocating

Course Outcomes:

At the end of this course, learners will be able to:

1. Select mechanism for different applications
2. Perform velocity and acceleration analysis of mechanisms
3. Develop cam profile for given set of motion inputs

4. Select gears and design gear trains for given application
5. Explain types of governors and their characteristics
6. Do balancing of rotary and reciprocating masses

Course Curriculum:

Section I

Unit-1:Simple Mechanisms **No. of lectures-05**

Kinematic links, Kinematic pairs, Classification of pairs, Kinematic chain, Degrees of freedom, Types of constrained motion, Kutzbach's and Grubler's criteria for plane mechanisms, Structure, Mechanism, Machine, Grashoff's law for four bar mechanism, Inversion, Inversions of four barchain, single slider crank chain and double slider crank chain.`

Unit-2: Velocity and Acceleration in Mechanisms **No. of lectures-08**

Velocity and acceleration analysis of mechanisms using following graphical methods :Instantaneous Centre Method (for velocity only), Relative velocity and relative acceleration method (for velocity and acceleration), Klein's construction (for velocity and acceleration)

Unit-3: Cams **No. of lectures-07**

Applications of cams in industrial automation, Types of cams and followers, cam nomenclature, displacement, velocity and acceleration diagrams motions of the follower (Uniform velocity, Simple harmonic motion, Uniform acceleration &uniform retardation, Cycloidal motion), Construction of cam profile for radial cams with different types of followers (reciprocating followers), Construction of cam profile for oscillating roller follower.

Section II

Unit-4: *Gear & Gear trains* **No. of lectures-08**

Gear:- Geometry of motion, Gear geometry, Types of gear profile- involute & cycloidal, Theory of Spur gears, Interference in gears with involute tooth profile and methods for its prevention, Contact ratio, Path of contact (No numerical treatment for gears)

Gear Trains:- Types of Gear trains (Simple, Compound, Epicyclic, Reverted), Tabular method for finding the speeds of elements in simple and compound epicyclic gear trains.

Unit-5:*Governor* **No. of lectures-06**

Need of governors, Types of governors (Watt, Porter & Hartnell governors), Derivations related to speed of spindle in Porter governor and Stiffness of Spring in Hartnell governor, Sensitivity, Stability, Isochronism and Hunting of governor, Governor effort, Power and Controlling force diagram ofgovernors.

Unit-6:*Balancing* **No. of lectures-06**

Need for balancing of rotating masses, Graphical method for balancing of rotating masses (masses rotating in same plane and different planes), Balancing of reciprocating masses

Internal Continuous Assessment (ICA):

All the sheets (*) are compulsory, Opt any four from remaining

1. Study of Grashof's Law
2. Sheet based on Instantaneous Centre Method& Relative Velocity-Acceleration Method*
3. Sheet based on Klein's Construction*
4. Sheet based on generating cam profile for different followers and follower motions*
5. Assignment based solving gear train problems
6. Study of governor characteristics
7. Study of balancing of masses using balancing apparatus
8. Sheet based on graphical method for balancing of rotary masses*
9. Study of gyroscopic effect
10. Study of brakes

Text Books:

1. Ballaney P. L., Theory of Machines, Khanna Publications, New Delhi
2. Khurmi R. S. & Gupta J. K., Theory of Machines, S. Chand publications, New Delhi.
3. Bansal R. K., Theory of Machines, Laxmi publications, New Delhi.
4. V.P. Singh, Theory of Machines, Dhanpat Rai & Sons Co. Pvt. Ltd., Delhi.

Reference Books:

1. Rattan S. S., Theory of Machines, Tata McGraw Hill publication, New Delhi.
2. Shigley J., Theory of Machines & Mechanisms, McGraw Hill International Students' Edition.
3. Thomas Bevan, Theory of Machines, CBS publication, New Delhi

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-IV

ME2251 : Mechatronic Systems

Teaching Scheme	Examination Scheme
Lectures : 03 Hours/week, 03 Credits	**ESE : 70 Marks**
Practical : 02 Hours/week, 01 Credit	**ISE : 30 Marks**
	ICA : 25 Marks

Course Introduction:

The course is an introductory course aimed at designing mechatronic systems, which require integration of the mechanical, electrical, electronic, and computing engineering disciplines within a unified framework. Contents covered in this course include mechatronic systems, sensors and actuators, mechatronics in the industry, system modelling and control. The second part of the course deals with Programmable Logic Controllers and Communication systems. Practical courses include programming, interfacing of software with hardware, digital logic, measurement and sensing, ladder programming. There are five specific labs on the topics of: sensor interfacing, DC motor control, stepper motor control, servo-motor control, and control using PLCs.

Course Objectives:

During this course, student is expected to:

1. Understand what makes up a mechatronic system
2. Understand how model mechatronic systems
3. Learn what a PLCs is and how to program it using ladder logic etc.
4. Learn about networks and communication systems and its associated epistemology
5. Understand microprocessor/microcontroller architecture and assembly programming

Course Outcomes:

At the end of this course, student will be able to:

1. Explain types and applications of sensors and actuators in mechatronic systems
2. Explain computer networks and their applications
3. Program microcontrollers in assembly/and or C/C++/Python/Java to demonstrate interfacing with sensors and actuators
4. Program PLCs using ladder logic (both on simulators and actual hardware).
5. Explain what is interfacing and how to do it

6. Build and program a mechatronic system which will accept data from input and sensors and control an output/actuator using any microprocessor/ microcontroller board (Arduino or Raspberry Pi can also be used)

Section I

Unit-1: Mechatronic Systems and Devices **No. of lectures - 6**

Basic Definition, Key elements of Mechatronics, Historical Perspective, Examples of Mechatronics Systems: Car Engine Management, Automatic Camera, White goods and domestic appliances, various systems in a modern automobile (ABS, TCS, DAS), Modern HVACs, CNC machines and factory automation, IOT, Industry 4.0

Unit-2: Sensors and Actuators **No. of lectures - 8**

Sensors: Classification, Principle of Operation & Characteristics, Linear and rotational sensors, acceleration sensors, Force sensors, Torque Sensors, Flow Sensors, Temperature Sensors, Distance Sensors, Optical Sensors, Ultrasonic Sensors, microsensors, Selection criteria.

Actuators: Classification of Actuators, Hydraulic and Pneumatic Actuators, DC Motors, AC Motors, Stepper Motors, Switches, Solenoids, Piezoelectric Actuators, VFDs, micro actuators

Unit-3: Microcontrollers **No. of lectures - 6**

Microprocessors and Microcontrollers, 8085 microprocessor, 8085 architecture, microcontrollers, the 8051 microcontroller, Arduino and Raspberry PI development boards, interfacing sensors and actuators with 8051 and Arduino and Raspberry PI.

Section II

Unit-4: Interfacing **No. of lectures - 6**

Signal Conditioning Interfacing, Signal Processing, source and sink currents, pull up and pull-down configuration, motor drivers, relays, optocouplers, ADC/DAC, OPAMPs, DAQ, loggers

Serial and Parallel communications, bit and baud rate, protocols, data flow, handshaking, signal transmission, TIA/EIA Serial Standards (RS 232, RS422, RS485), IEEE 488 General Purpose Interface bus, USB

Unit-5: **No. of lecture s- 8**

PLC architecture, I/O Processing, NPN/PNP sourcing and sinking, Ladder Diagrams, SFC, FBD Internal Relays, Jump and Call, Timers, Counters, Shift Registers and Data Handling, Programs for temperature control, sequencing etc., PLC Vs. PC based systems, top manufacturers.

Unit-6: **No. of lectures - 6**

Computer Networks, Network topologies, OSI model, Internet terminology, LAN, WAN, MAN, CAN bus, PROFI bus, Fieldbus, Modbus and SCADA, devices such as routers, switches,

gateways, hubs, modems, introduction to IOT and applications.

Internal Continuous Assessment (ICA):

List of Experiments/Assignments/Case Studies, etc.

1. Survey assignment on mechatronic products
2. Survey assignment on sensors, actuators
3. One practical assignment on interfacing sensors with microcontrollers.
4. One practical assignment on dc motor control and stepper motor control using microcontrollers
5. One PLC programming assignment
6. One practical assignment on interfacing sensors and actuators with PLC
7. One theory assignment on communication systems
8. One practical assignment which includes building small Mechatronics systems which microprocessor/microcontroller receives input from sensors and controls actuators.

Text Books:

1. W. Bolton, Mechatronics, Pearson Publishing, 4th Edition
2. Shetty & Kolk, Mechatronics System Design, Cengage Learning, 2nd Edition
3. Mazidi, 8051 Microcontroller, Prentice Hall, 3rd Edition
4. Banzi, Getting Started with Arduino, McGraw Hill

Reference Books

1. Bishop et.al, Handbook of Mechatronics, CRC Press, 2nd Edition
2. Gaonkar Ramesh, The 8085 microprocessor, Penram International Publishing, 2nd Edition
3. W. Bolton, Programmable Logic Controllers, Pearson Publishing, 3rd Edition
4. Tanenbaum & Weterhall, Computer Networks, Prentice Hall, 4th Edition

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-IV

ME2252 :Power Plant and Energy Engineering

Teaching Scheme	**Examination Scheme**
Lectures:03Hours/week, 03Credits	**ESE:70Marks**
Practical :02Hours/week, 01Credit	**ISE: 30Marks**
	ICA: 25Marks

Course Introduction:

Availability of power is the one key area where most of the Indian industry is facing problems. In India, even today, short fall of power generation is about 30 percent. Fuel supply and distribution is also an area where country is still developing smooth lines of supply. Since power and energy is required by every sector of economy, the growth in this sector is must if Indian economy grows in any sector. Many of the job opportunity in private as well as public sector are therefore waiting for students in this field. Hence, this course attempts to provide them basic knowledge of the technologies available at plant level and would also acquaint them with the latest technological advances taking place in this sector.

Course Objectives: During this course, student is expected to:

1. Study of Power Station performance evaluation & economic analysis.
2. Study of various non-conventional energy sources & principles of energy
3. Explain various loads on power plant.
4. Illustrate Significance of different load curves and load factors on power plant.
5. Explain variable load on power plant.
6. Study & explain economics of power plant.

Course Outcomes:

At the end of this course, student will be able to:

1. Describe forms of energy source and their impact on environment.
2. Calculate performance parameters related to power plant.
3. Explain the economics of power plant & categorize power plant as base load & peak load plant.
4. Compare various renewable energy sources with their features.
5. Recognize energy conservation opportunities and explain energy audit concept.

Section I

Unit-1:Introduction **No. of lectures- 5**

Classification of energy sources Organization of Power Sector in India, NTPC, NHPC, NPCIL and their role in Power development in India, Role of private sector in energy management, Power distribution, Power Grid Corporation of India (PGCIL)

Unit-2:Loads on Power Plant **No. of lectures- 8**

Introduction, classification of loads on power plant, Different load curves and load factors, Effect of variable load on power plant, design & operation, comparison of the thermal, hydroelectric, nuclear and diesel power plants. (Numerical treatment)

Classification of plants, Requirements of peak load plant, Pumped storage plants,

Compressed air storage plants, Load sharing between base load & peak load power stations.

Unit-3:Economic Analysis of Power Plants **No. of lectures- 7**

Introduction, Cost of electric energy, Fixed and operating cost, Methods of determining depreciation, Selection of site for Power station (thermal, hydro, nuclear), Tariff methods. (Numerical treatment) Selection of Boilers, Selection of Prime movers, selection of size and number of generating units

Section II

Unit-4:Solar Energy **No. of lectures-8**

a) Solar radiation outside the earth's atmosphere & at the earth's surface, Solar radiation measurement – Pyranometer & Pyrheliometer, solar radiation geometry. LAT & SCT, Solar concentrators-Method and classification, Types of concentrators.

b) Liquid flat plate collector – General, Performance analysis, Effects of various parameters. (Numerical treatment)

Solar Power Plant: Introduction, components, Types of Collectors & Solar Ponds, Low & High Temperature Solar Power Plant. Photovoltaic Power System, Heliostat

Unit-5:Other Non-Conventional Power Plants **No. of lectures-7**

Wind Power plant: Introduction, Power of wind, Basic components of 'WECS', Classification of WEC systems. Horizontal axis machines, Vertical axis machines, Advantages & Disadvantages of WECS,Application of wind energy.

Tidal energy, wave energy, OTEC, geothermal, magneto hydrodynamics, hybrid power plants, Challenges in commercialization of Non-Conventional Power Plants.

Unit-6:Energy conservation and Energy Audit **No. of lectures- 5**

Energy Conservation- Introduction, energy conservation act 2001 & its feature, energy conservation in industries

Energy Audit- Introduction, need of energy audit, Types of energy audit,Energy management (audit) approach-understanding energy costs, Bench marking, Role of Bureau of Energy Efficiency (BEE)

Internal Continuous Assessment (ICA):

Group - I: Any two Experiment from Expt. No. 1 to 5

14. Solar radiation & its measurement
15. Efficiency measurement of standalone solar P-V system
16. Test on solar water heater
17. Study of components of windmill
18. Trial on Diesel Power Plant.

Group - II: Minimum Six Assignments based on following topics

1. Study of typical load curve (Residential/Commercial/Industrial)
2. Economic Analysis of power plants (Numerical Treatment)
3. Study of Biogas plants
4. Study of Nuclear Power Plants.
5. Study of solar collectors
6. Study of solar thermal applications- solar water heating, space heating, power
7. Study of solar pond / solar photovoltaic
8. Study of various Energy storage devices.
9. Study of instruments of a power plant water purity, PH meter, Gas analysis, Measurement of smoke & dust.
10. **Industrial Visit:** The report based on any Industrial Visit to renewable energy appliances or power generation transmission station

Text Books:

5. A course in Power Plant Engineering – Arora Domkundwar, Dhanpat Rai & Co.
6. Solar Energy – S. P. Sukhatme, Tata McGraw Hill Co.
7. Solar Energy – G. D. Rai, Khanna Publisher.
8. Energy Technology – S. Rao & Dr. B. B. Purulekar, Khanna Publishers.
9. Power Plant Engineering – P. K. Nag, Tata McGraw Hill Publishing Co.

10. Power Plant Engineering- R. K. Rajput, Laxmi Publications, New Delhi.
11. Generation of Electrical Energy – B. R. Gupta, S. Chand & Co. Ltd.

Reference Books

5. Power Plant Technology – M. M. El Wakil
6. Bureau of Energy Efficiency Manual
7. Non-conventional Energy Sources- G. D. Rai, Khanna Publisher
8. Principles of Power System- V.K. Mehta
9. Power System Analysis - Grainger John J, and Stevenson Jr. W.D. Tata McGraw Hill

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-II

ME2253 : Solid Mechanics

Teaching Scheme	**Examination Scheme**
Lectures : 03 Hours/week, 03 Credits	**ESE : 70 Marks**
Practical : 02 Hours/week, 01 Credit	**ISE : 30 Marks**
	ICA : 25 Marks

Course Introduction:

This course covers analysis of plane stress and plane strain. Additionally students will study material properties for isotropic materials and their relations. Applications of Airy stress function in rectangular coordinates and polar coordinates will be studied by solving 2D problems. The theory of failure which is important to assess reliability of any component will be studied. The shear stress distribution will be studied for finding the shear center of thin walled sections. Determination of crippling load for design of column and various energy methods to be used depending upon application, will also be studied.

Course Objectives:

(Shall not exceed 06)

During this course, student is expected :

1. **To understand stress tensor, deformation analysis and thermal stresses**
2. To understand the two dimensional stress analysis.
3. To understand stresses in rotating disks and its applications
4. To understand the concept of shear centre and its applications
5. To solve complex problems in the field of structural elements particularly columns
6. To understand the various energy methods and applications.

Course Outcomes:

(Shall not exceed 06)

At the end of this course, student will be able :

1. To analyse the principal stresses and thermal stresses
2. To Investigate the distribution of the two dimensional stresses using Airy stress function
3. To analyse the stresses in rotating disks and pressurized cylinders

4. To locate the shear centre in design of thin open cross sections subjected to the transverse loading.
5. To analyse the crippling load in the design of columns.
6. To use the energy methods based on application.

Section I

Unit-1: Stress and strain **No. of lectures- 6**

Unit Content: Stress at a point, Hooke's law, Cauchy stress tensor, analysis of deformation and definition of strain components, principal stresses and strains, constitutive relationship between stress and strain, Mohr's circle representation. Thermal stresses, Thermal stresses in composite bar

Unit-2 Plane stress analysis **No. of lectures- 7**

Unit Content: Governing equation of equilibrium and compatibility equation. Two dimensional problems in Rectangular co-ordinates. Airy stress function, Applications to polynomials in rectangular co-ordinates, Saint Venant's Principle

Unit-3: Pressurized Cylinders and rotating disks **No. of lectures- 7**

Governing Equations, stresses in thick walled cylinder under internal and external pressure, stresses in rotating flat solid disk, flat disk with central hole, disk with uniform strength.

Section II

Unit-4: Shear Center **No. of lectures- 6**

Unit Content: Shear stress distribution and Shear center for thin walled open sections. Numericals based on concept of shear center

Unit-5: Axially Loaded Columns **No. of lectures- 8**

Unit Content: Concept of critical load and buckling, crippling and crushing stress, Euler and Rankine theory, Assumption made & sign conventions. concept of various end connections and equivalent length, Slenderness ratio, safe load on a column, Rankine's formula for critical load of any column, determination of crippling load using Euler's and Rankine's formulae.

Unit-6: Energy Theorems **No. of lectures- 6**

Unit Content General Considerations, Elastic Potential Energy in Slender Members, Theorems for Structures with Linear Elastic Behaviour, Castigliano's Theorem, Maxwell's Theorem, Theorems of Virtual Displacements and Virtual Forces, Theorem of Virtual Displacements, Theorem of Virtual Forces

Internal Continuous Assessment (ICA):

List of Experiments/Assignments/Case Studies, etc.

1. Assignment on analysis of deformation and definition of strain components,
2. Assignment on thermal stresses in composite bar
3. Assignment on two dimensional problems in rectangular co-ordinates
4. Assignment on Numericals based on Airy stress function
5. Assignment on stresses in rotating flat solid disk
6. Assignment on Shear center for thin walled open sections
7. Assignment on Axially Loaded Columns
8. Assignment on energy theorem

Text Books:

1. S. Timoshenko & J.W. Goodeer, "Theory of Elasticity", MGH books co Ltd.
2. L. S. Srinath, "Advanced Mechanics of Solids", McGraw Hill Education.
3. J.P.Den Hartog, "Advanced Strength of Materials." MGH books co Ltd.
4. F.B. Seely&Smlth, "Advanced mechanics of materials", John Wiley & Sons.

5 Dr. Sadhu Singh , " Theory of Elasticity" Khanna Publishers

Reference Books

1. Kelly, "Solid Mechanics", John Wiley & Sons.
2. Aleksey D. Drozdov, "Mechanics of Viscoelastic Solids", John Wiley & Sons.
3. P. H. Jain, "Strength of Material", Soham Publications.
4. R. S. Khurmi, "Strength of Material", S Chand Publications.

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-IV

ME 226 MECHANICAL WORKSHOP-I

Teaching Scheme	Examination Scheme
Practical : 02 Hours/week, 01 Credit	ICA : 50 Marks

Course Prerequisite:- fundamental machine shop instruction involving safety use and care of hand and measuring tools basic operation of all conventional machines and grinding of single pointtools, screw threads and taper turning and their application classes of fits and tolerances arestressed students will be provided the opportunity to learn and practice bench work skills.

Course Objectives:

1. To get hands on experience on conventional machines like lathe machine, drilling machine etc. and machining techniques such as drilling, turningetc., studied in theory subjects.
2. To develop skills to operate different machine tools.
3. To get hands on experience in pattern making, joining processes and forming processes.
4. To develop skills in pattern making and sheet metal work.

Course Outcomes:

At the end of this course, the student will be able

1. To operate different machine tools such as grinders, lathes, drilling machines etc.
2. To machine the component as per specified dimensions.
3. To develop the skills necessary for engineering practices like joining and forming processes.
4. To Choose and apply the appropriate methods for pattern making & sheet metal working I. Preparation of Wooden pattern (single piece) for a simple component:

Part A –This shall cover – Study of component drawing, preparing casting drawing, Allowancetable, Pattern drawing, Deciding parting line & Deciding pattern making process. (2 Turns)

Part B – Actual manufacturing of pattern. (2 Turns)

II. Study of gas welding & gas cutting equipment, Study of arc welding equipment, Study &demonstration of resistance welding, Study of various types of welding joints & demonstration of gas & arc welding, Manufacturing of one job on arc welding. (2 turns)

III. Demonstration Study of sheet metal operations like bending, shearing, lancing, perforating, punching etc...

IV. One sheet metal job consisting of at least 3 operations. (2 Turns)

(Either performed manually or on press) Demonstration:

OR

IV. Study of various hand forging operations like upsetting, drawing dawn, piercing, swaging etc...One job involving 3 operations. (Either performed manually or on press) (2 Turns)

V. One job in M.S. consisting of following basic operations shall be performed by students: Turning, Step turning, taper turning, Chamfering, Grooving and Knurling. At least one dimension of the job shall carry close tolerance. (4 Turns)

Note: Students shall prepare a work book involving brief write up regarding machine/machinesemployed for job. Students should prepare a work book which involves a process sheet for eachjob and inspection report of the job. Based on the job performed, attendance record, work book,internal viva, faculty members may evaluate the term work.

• Books:

1. Workshop Technology (Volume II) by Raghuvanshi.

2. Workshop Technology (Volume II) by HajraChowdhary.

3. Workshop Technology (Volume II) by W.A.J.Chapman.

4. Production Technology by P.C. Sharma.

5. Production Technology – HMT Handbook. 6. Production Technology (Volume II) by Gupte-Patel.

6. P.L. Jain, Principles of Foundry Technology.

7. P.N. Rao, Manufacturing Technology: Foundry, Forming and Welding.

8. Workshop Technology (Volume II) by W.A.J. Chapman. 6. Production Technology – HMTHandbook.

• Reference Books:

1. Manufacturing Processes & systems by Phillip F. Ostwald, Jairo Munoz-Wiley India.

2. Fundamentals of modern Manufacturing by Mikel P. Groover-Wiley India

Punyashlok Ahilyadevi Holkar Solapur University

Second Year B.TECH. (Mechanical Engineering)

Semester-II

ME227 :Electrical Technology

Teaching Scheme

Practical :02Hours/week, 01Credit

Examination Scheme

ICA: 25Marks

OE : 25 Marks

Course Introduction:

This course focuses on the fundamental concepts and applications of electrical machines and concept of digital electronics in the field of Mechanical engineering. The course introduces basic working principles, construction details and characteristics of Decimators, AC motors, Induction motor & its selection criteria for industrial applications. Due to wide applications of digital electronics the course also covers the basic knowledge of digital circuits, signal conditioning microprocessors and microcontrollers.

Course Objectives:

During this course, student is expected to:

1. To understand essential concepts and applications of AC and DC motors in mechanical Engineering.
2. To understand starting, characteristics, speed control and testing methods of DC, single phase and three phase electrical motors in mechanical Engineering.
3. To understand the need for signal conditioning and interfacing.
4. To understand programming and interfacing of microprocessors and microcontrollers.
5. To understand embedded system terminologies and interfacing with Arduino uno board

Course Outcomes:

At the end of this course, student will be able to:

6. Identify and select suitable DC motor /AC motor / induction motor and its speed control method for given industrial application.
7. Calculate performance parameters of DC motor/ single phase induction motor/three phase induction motor through load test.
8. Explain interfacing and write basic program using microprocessors 8085 trainer/ microcontrollers 8051/simulator.
9. Interface sensor with Arduino Uno microcontroller board

10. Interface and control Electrical motors with Arduino Uno board

Internal Continuous Assessment (ICA):

Minimum six experiments from each section will be conducted and assessment should be based on the same.

Section I

19. Study of DC series and DC shunt motors.
20. Speed control of DC shunt motors by flux control and armature control.
21. Speed control of DC shunt motors by armature voltage control method.
22. Study of starters used for DC shunt motors.
23. Load test on DC Motor
24. Study of starters used for three phase induction motor.
25. Load test on single phase and three phase induction motor.
26. Study characteristics and applications of different types of AC and DC motors.

Section II

27. Build and test combinational logic & sequential logic circuits in simulator and on bread board.
28. Basic programming on 8085 trainer/simulator as an introduction to microprocessor and assembly programming.
29. Basic programming on 8051 trainer/simulator as a basic introduction to microcontroller.
30. Interface IR sensor, sound sensor, range sensor with Arduino Uno microcontroller board.
31. Interface and control stepper motor with Arduino Uno board.
32. Interface and control DC motor using PWM with Arduino Uno board.
33. Interface and control single phase induction Motor using Arduino Uno board.
34. Build a small circuit which will demonstrate interfacing both sensors and actuators with the Arduino UNO board

Text Books:

1. Electric Drives, Vedam Subramaniam 3rd Edition, McGraw Hill
2. Make: Getting Started With Arduino, Massimo Banzi& Michael Shiloh, Shroff Maker Media
3. Microprocessor Architecture, Programming, and Applications with the 8085" R Gaonkar
4. 8051 and embedded systems, M Mazidi, Pearson India.

Reference Books

1. Electric Machinery, A Fitzgerald, Charles Kingsley, Stephan Umans, McGraw Hill
2. Electric Machines and Drives: A First Course, Ned Mohan, Wiley India.
3. Digital Logic & Computer Design, Morris Mano, Pearson India.
4. Mechatronics, W Bolton, 4th Edition, Pearson India.