Savitribai Phule Pune University

Syllabus

FOR

SE Mechanical Engineering (Sandwich)

2015 Course

UNDER FACULTY OF ENGINEERING

EFFECTIVE FROM June 2016

Savitribai Phule Pune University
SE-Mechanical Engineering (Sandwich)
2015 Course
TERM-I

Subject Code	Subject	Teaching Scheme Hours/Week			Examination Scheme					Total Marks	Credits	
		LE	TU	PR	In-Sem (online)	End-Sem	TW	PR	OR+		LE / TU	PR / OR
207002	Engineering Mathematics–III*	4	1	-	50	50	25++	-	-	125	5	-
202043	Thermodynamics*	4	-	2	50	50	-	-	50	150	4	1
202051	Strength of Materials*	4	-	2	50	50	-	-	50	150	4	1
202061	Material Science and Metallurgy	4	-	2	50	50	25	-	25	150	4	1
202062	Fluid Mechanics and Machinery	4	-	2	50	50	25	50	-	175	4	1
202055	Audit Course*	-	-	-	-	-	-	-	-	-	-	NC
	Total	**20**	**1**	**8**	**250**	**250**	**75**	**50**	**125**	**750**	**21**	**4**
	Total of Term-I	**29 Hrs**				**750**					**25**	

TERM-II

Subject Code	Subject	Teaching Scheme Hours/Week			Examination Scheme					Total Marks	Credits	
		LE	TU	PR	In-Sem (online)	End-Sem	TW	PR	OR+		LE / TU	PR / OR
202063	Thermal Engineering	4	-	2	50	50	-	-	50	150	4	1
202064	Metrology and Quality Control	3	-	2	50	50	-	-	25	125	3	1
202065	Manufacturing Engineering	4	-	2	50	50	25	-	-	125	4	1
202066	Computer Aided Machine Drawing	-	-	2	-	-	-	50	-	50	-	1
202067	Soft Skills	-	1	-	-	-	25	-	-	25	1	-
202068	Theory of Machines	4	1	-	50	50	25++	-	25	150	4	1
203152	Electrical and Electronics Engineering*	3	-	2	50	50	25	-	-	125	3	1
	Total	**18**	**2**	**10**	**250**	**250**	**100**	**50**	**100**	**750**	**19**	**6**
	Total of Term-II	**30 Hrs**				**750**					**25**	

* Common with Mechanical Engineering.

+ Oral examination will be based on term work completed during practical and theory syllabus.

++ Term work marks will be based on term work completed during tutorial sessions.

Savitribai Phule Pune University

SE-Mechanical Engineering (Sandwich) (2015 Course)

MATERIAL SCIENCE AND METALLURGY (202061)

Teaching Scheme Hours/Week			Examination Scheme					Total Marks	Credits	
LE	TU	PR	In-Sem (online)	End-Sem	TW	PR	OR		LE / TU	PR / OR
4	-	2	50	50	25	-	25	150	4	1

Course Objectives:

1. To acquaint students with the basic concepts and properties of Material Science
2. To impart the knowledge on mechanical behavior of materials and their testing
3. To acquire knowledge in various classes of materials, their applications and required heat treatment
4. To import knowledge on Heat Treatment, microstructure and Powder Metallurgy techniques
5. To acquire knowledge in polymers composites and ceramics

Prerequisite- Engineering Science

Unit 1: Introduction to Engineering Material & Material Structure

Development in Materials Science, Classification of Material, Crystal structures (BCC, FCC and HCP systems), Imperfections in crystals - point defects, line defects, surface and bulk defects, Mechanism of plastic deformation, deformation of single crystal by slip. Degradation of materials and its Prevention

Unit 2: Mechanical Properties and their Testing

Destructive Testing: Tensile test, engineering stress-strain curve, true stress-strain curve, types of stress-strain curves, Compression test, formability, Erichsen cupping test, hardness testing, different hardness tests- Vickers, Rockwell, Brinell, Impact test, Failure - Ductile and brittle fracture, Fracture mechanics, Ductile brittle transition, Fatigue test. Crack initiation and propagation, Crack propagation rate. Creep, Generalized creep behavior, Creep test, and Stress and temperature effects

Non Destructive Testing: Visual Inspection, Magnetic particle inspection, dye penetrate inspection, ultrasonic inspection, Radiography, eddy current testing, acoustic emission inspection, Selection of NDT

Unit 3: Ferrous metals and Designation

Wrought and cast components, Allotropy of Iron, Iron-iron carbide diagram, plain carbon steels, Limitations of plain carbon steel and advantages of alloy steels. Effect of alloying elements on mechanical properties of steel, Alloy steels, Tool steels, stainless steels, Cast irons – an overview

of phases and microstructure, types, effect of alloying elements, Designation of steels and cast iron, BIS, AISI, SAE designation of steel.

Unit 4: Heat Treatment
Heat treatment of steels, cooling media, annealing processes, normalizing, hardening, tempering, Quenching and hardenability, Surface hardening processes- Carburizing, Nitriding, carbonitriding, flame hardening, induction hardening, Relationship of the microstructures with properties of steel and alloys.

Unit 5: Powder Metallurgy and Non Ferrous Metals & alloys
Steps in the making of Powder metallurgical component, sintering of powder compacts, Liquid phase sintering, Applications of P/M parts. Copper and its Alloys–Properties, Brasses, Bronzes, Aluminum and their alloys–Corrosion resistance, Magnesium, Titanium, Bearing Materials.

Unit 6: Polymers, Ceramics and Composites
Structure of Polymers, Composites and ceramics materials, Mechanical behavior of polymers, Polymer types, Polymer applications. Ceramics–properties, ceramic powder preparation, applications. Composites-Particle reinforced composites, Fiber reinforced composites, Structural composites.

Term Work
1. Hardness Test (any one): Rockwell, Vickers and Brinell hardness test
2. Impact Test
3. Cupping Test of sheet materials
4. Magnetic Particle Test
5. Dye Penetrant Test
6. Observe and record microstructures - any four plain carbon steels
7. Observe and record microstructures - any two cast irons, any two non-ferrous
8. Observe and record microstructures - heat affected zone of welded joint
9. Annealing process and its microstructure
10. Normalizing of steel and its microstructure
11. Jominy End Quench Test for hardenability
12. Industrial Visit/ component study

Note: Out of above Twelve, minimum eight Lab Experiments should be conducted

Reference Books:
1) V.D. Kodgire and S.V. Kodgire, Material Science and Metallurgy for Engineers, Everest Publishing House.
2) A. K. Bhargava and C.P. Sharma, Mechanical Behavior & Testing of Materials, PHI Learning Private Ltd.
3) W.D. Callister, Materials Science and Engineering: An Introduction, John Wiley and Sons.

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FLUID MECHANICS AND MACHINERY (202062)

Teaching Scheme Hours/Week			Examination Scheme					Total Marks	Credits	
LE	TU	PR	In-Sem (online)	End-Sem	TW	PR	OR		LE / TU	PR / OR
4	-	2	50	50	25	50	-	175	4	1

Course Objectives:

1. Understand various properties of fluids, their uses and units
2. Understand basics of fluid statics, concepts of fluid pressure its measurement, units
3. Understand fluid kinematics and fluid dynamics
4. Understand flow through pipes, siphons, transmission of power, major and minor losses
5. Understand concepts of power producing devices (turbines)
6. Understand concepts of power consuming devices (pumps)

Prerequisite

1. Engineering Mathematics
2. Engineering Physics

Unit 1: Properties of Fluids

Characteristics of fluids, Mass density, Specific density, specific gravity, Dynamic viscosity, Kinematic viscosity, Surface tension, capillarity, compressibility, Vapour pressure.

Fluid Statics: Pascal's law, Pressure at a point, Total pressure, Centre of pressure, Pressure on a plane, Inclined and curved surfaces, Buoyancy, Metacenter and Metacentric height, stability of submerged and floating bodies (No numerical on Buoyancy, metacenter, floatation).

Unit 2: Introduction of Fluid Kinematics and Fluid Dynamics

Types of flows, continuity equation (Cartesian coordinate), velocity and acceleration, visualization of flow field (stream, path and streak Line); Stream function and velocity potential function. (Simple numerical).

Fluid Dynamics Euler's equation of motion along a stream line, Derivation of Bernaulli's equation, Applications of Bernaulli's equation, Venturimeter, Orifice meter, Notches, pitot tube (No derivation and numerical for notches and pitot tube).

Unit 3: Fluid Dynamics

Flow through Pipes: Darcy Weisbach equation, major and minor losses, Pipes in series Pipes in parallel and concept of Equivalent Pipe, Siphons, Transmission of Power (no derivations for minor losses).

Internal flow: Laminar and Turbulent flow physics, Velocity and shear stress distribution for laminar flow in a pipe, fixed parallel plates (simple numerical on velocity, pressure gradient and shear stress).

Unit 4: Impulse momentum Principle

Force exerted on fixed flat and curved plate, moving plate, impulse turbines: Pelton wheel, Construction, Principle of working, velocity diagrams and analysis, design aspects, governing and performance characteristics.

Unit 5: Reaction Turbines

Classifications, Francis and Kaplan turbine, constructional details, Velocity diagrams and analysis, Design aspects, Draft tubes, Governing and performance characteristics, unit quantities, Specific speed, Cavitation.
Dimensional Analysis: Buckingham π theorem, important dimensionless numbers, similarity applied to turbines and pumps.

Unit 6: Hydrodynamic Pumps

Classification, components of Centrifugal pumps, various terms associated with Centrifugal pumps, various heads, velocity triangles and their analysis, Cavitation, NPSH, specific speed, performance characteristics of Centrifugal pumps.
Non-conventional pumps: Air lift pump, Jet pump, submersible pumps, Hydraulic ram, construction and working.

Term Work

Minimum eight experiments from the list given below, out of those minimum three experiments from 8-11:

1. Study of pressure measuring devices
2. Determination of viscosity of liquids and its variation with temperature
3. Verification of modified Bernoulli's equation
4. Calibration of venture meter / orifice meter
5. Laminar and turbulent flows by Reynold's apparatus
6. Determination of major losses through pipes
7. Determination of Metacentric height of floating object
8. Verification of momentum principle
9. Study and trial on Pelton wheel and plotting of operating/Main characteristics
10. Study and trial on any one reaction turbine and plotting of operating/main characteristics
11. Study and trial on centrifugal pump and plotting of operating characteristics

Text Books

1. Fundamentals of Fluid Mechanics, Munson, Young and Okiishi, Wiley India
2. Fluid Mechanics, Potter Wiggert, Cengage Learning
3. Fluid Mechanics, R.K. Bansal, Laxmi Publication
4. Fluid Mechanics, Cengle & Cambla, TATA McGraw Hill
5. Fluid Mechanics, White, TATA McGrawHill
6. Hydraulics and Fluid Mechanics, Modi and Seth, Standard book house

Reference Books

1. Fluid Mechanics, Kunda, Cohen, Dowling, Elsevier India
2. Fluid Mechanics, Chaim Gutfinger David Pnueli, Cambridge university press
3. Theory of hydraulic Machinery, V. P. Vasandani
4. Hydraulic Machines, J. Lal, Metropolitan Book

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THERMAL ENGINEERING (202063)

Teaching Scheme Hours/Week			Examination Scheme					Total Marks	Credits	
LE	TU	PR	In-Sem (online)	End-Sem	TW	PR	OR		LE / TU	PR / OR
4	-	2	50	50	-	-	50	50	4	1

Course Objectives:

1. Understand the types of compressors, selection, work and related efficiencies
2. To know different refrigeration systems and COP
3. Conversant with gas turbines and Jet propulsion
4. Understand all the IC Engine systems, layouts and its importance
5. Able to understand methods to test the IC Engine
6. Understand the concept of normal and abnormal combustion in engine and emission

Prerequisite:

1. Thermodynamics
2. Engineering Mathematics

Unit 1: Air Compressor

Uses of compressed air, classification of compressors, Reciprocating compressor constructional details of single and multistage compressor, computation of work done, isothermal work done, isothermal efficiency, effect of clearance, volumetric efficiency, need of multi-staging, intercooling and after-cooling.

Rotary Air Compressor: Basic principles, classification, construction, working of roots, vane, scroll, Centrifugal and axial compressors. (Descriptive treatment only).

Unit 2: Refrigeration

Definition, refrigeration load, unit of refrigeration, reverse Carnot cycle, systems of refrigeration, Vapour compression refrigeration cycle (VCR), effect of operating parameters on VCR, use of P-h charts, refrigerants and its nomenclature, classification of refrigerants, properties of refrigerants, alternative refrigerants simple vapour absorption system ,comparison of vapour compression and vapour absorption cycle.

Unit 3: Gas Turbines and Jet propulsion

Theory and fundamental s of gas turbines, principles, classifications, thermodynamic cycles, assumptions for simple gas turbine cycle analysis, work ratio ,concept of optimum and maximum pressure ratio, actual cycle, effect of operating variables on thermal efficiency, regeneration, intercooling, reheating and their effect on performance ,close and semi-closed cycle gas turbine plant, application of gas turbine.

Jet propulsion, types of jet engines, turbo jet, turboprop, turbofan, pulsejet and ram jet engines, applications of jet engine (Descriptive treatment).

Unit 4: IC Engines

Fuel feeding system, Starting system, Ignition System, Engine Cooling System, Lubrication System, Governing System.

Supercharging: Need for supercharging, supercharging and turbo charging, types of superchargers Limitations of supercharging in SI and CI engines (Descriptive treatment).

Unit 5: Testing &Performance of IC Engines

Performance parameters, Determination of brake power, indicated power, friction power. Determination of brake thermal efficiency, mechanical efficiency, volumetric efficiency, Energy Balance.

Unit 6: Combustion in S.I. engines

Stages of combustion, flame propagation, factors influencing, flame speed, abnormal combustion-pre-ignition and detonation, Octane number, types of combustion chambers in S.I. engines.

Combustion in CI engines: Stages of combustion, ignition delay and factors affecting delay period, diesel knock, Cetane number, comparison of diesel knock and detonation, types of combustion chambers for CI engines.

Emission and pollution control: Emissions from SI and CI engines and their harmful effects Catalytic converters–construction and working (elementary treatment). Contemporary and proposed emission norms. (Descriptive treatment).

Term Work:

The term work shall consist of record of minimum eight experiments from the followings.

1. Trial on refrigeration test rig to find the theoretical COP, actual COP and relative COP
2. Trial on ice plant test rig
3. Trial on reciprocating air compressor to find volumetric efficiency and Isothermal efficiency
4. Test on diesel engine to determine BP, bsfc, thermal efficiency, and volumetric efficiency
5. Trial on Petrol engine–Morse test
6. Study of combustion chambers in SI and CI engines
7. Study of supercharging and turbo charging
8. Study and demonstration of exhaust gas analyzer and smoke meter
9. Study of jet engines
10. Visit to any refrigeration plant/Engine manufacturing unit

Text Books:

1. Ganesan V, Internal combustion engines, Tata McGraw Hill.
2. Mathur and Sharma, Internal combustion engines, Dhanpatrai and Company.
3. Arora and Domkundwar, Refrigeration and air conditioning, Dhanpatrai and Company
4. C P Arora, Engineering Thermodynamics, Tata McGraw Hill
5. Khurmi and Gupta, A textbook of Thermal engineering, S. Chand

Reference Books:

1. Heywood: Internal combustion Engine Fundamentals, Tata McGraw-Hill
2. C P Arora: Refrigeration and Air conditioning, Tata McGraw Hill

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METROLOGY AND QUALITY CONTROL (202064)

Teaching Scheme			Examination Scheme					Total Marks	Credits	
Hours/Week										
LE	TU	PR	In-Sem (online)	End-Sem	TW	PR	OR		LE / TU	PR / OR
3	-	2	50	50	-	-	25	125	3	1

Course Objectives

1. To develop and evaluate measurement techniques
2. To create awareness among the students regarding different gauges used in industries.
3. Knowledge of limits, fits and tolerances will aid them while assembling different parts to perform desired function developing interchangeability concept.
4. Knowledge of SQC tools will help the students in continual improvement process.

Prerequisite

1. Hand on using basic measuring instruments.
2. Algebra and trigonometric relations.
3. Machine drawing

Unit 1: Measurements standards and Comparators

Principles of engineering metrology, Types of measurement standards, Types and sources of errors, accuracy and precision, linear measuring instruments, angular measuring instruments, and their applications. **Calibration:** Concept and procedure, Traceability, Uncertainty in measurement.

Comparators- Mechanical, Pneumatic, optical, electronics (Inductive), Electrical (LVDT).Checking of geometrical forms.

Unit 2: Design of Gauges, Interferometers, Surface Finish Measurements

Design of Gauges- Taylors Principle, Types of gauges, limits, fits, Tolerance.

Interferometer- Principle, NPL Interferometer, Flatness measuring of slip gauges, Laser interferometer.

Surface Finish Measurements- Surface Texture, Measuring surface finish by stylus probe, Tomlinson and Taly-surf, Methods for analyze surface traces.

Unit 3: Metrology of screw threads, gears, and advanced methodology

Measurement of thread forms- Minor, major, effective, Flank angle, pitch, Types & effect of

screw threaded error, Floating carriage micrometer.

Gear Metrology - Gear error, Gear measurements: Gear tooth vernier, constant chord, base tangent, rolling (No Numerical), profile projector, tool maker's microscope.

Advancements in Metrology- Co-ordinate measuring machine, Universal measuring machine, Laser in metrology, Automatic inspection system, Online-Offline inspection machine vision.

Unit 4: - Introduction to Quality and Quality Tools

Deming's PDCA,PDSA cycles & Juran Trilogy approach, Quality Statements, Cost of quality & value of quality, Seven Quality Tools: check sheet, flow chart, Pareto analysis, cause & effect diagram, scatter diagram, Brain storming; Quality circle; Concurrent engineering; Malcom Balbridge national quality award.

Unit 5: – Total Quality Management

Quality function deployment, 5S, Kaizen, Kanban, JIT, Poka yoke, QMS (ISO 9000, TS 16949, ISO 14000, Quality audit); TPM, FMECA, FTA; Zero defects.

Unit 6: – Statistical quality control

Statistical quality control- Statistical concept, Frequency diagram, Concept of variance analysis, control chart for variable & attribute, Process capability, statistical process Control, Concept of Six sigma: DMAIC, Production part approval Method (PPAP)

Acceptance Sampling: Sampling Inspection, OC Curve and its characteristics, sampling methods, Sampling Plan: comparison, calculation of sample size, AOQ, Probability of Acceptance.

Term work:

A] Experiments (Write up's based on experiments conducted.) **(Any Eight)**

LIST OF EXPERIMENTS

1. To measure the angle of taper ring gage by two calibrated balls method. Measurement of angle of taper plug gauge with sine bar.
2. To calibrate the given Dial gauge using Calibration Tester.
3. To determine the flatness of given specimen using the optical flat.
4. To measure the effective diameter of screw plug gauge using floating carriage micrometer.
5. To study the gear rolling tester and then to check the given specimen gear for effective diameter, Depth of tooth, and eccentricity and to calculate the backlash. Or to measure gear tooth thickness by using gear tooth Vernier caliper.
6. To check the surface roughness of given specimen using surface roughness tester.
7. To study the working of Profile projector and then to measure the various angles of a single point cutting tool.
8. To perform alignment test on Radial drilling machine and Lathe Machine.
9. To study the toolmakers microscope and then to measure pitch and angle of screw thread.
10. Study of co-ordinate measuring machine.

B] Term Work –

In addition, at least two assignments on statistical quality control.

Reference Books: Metrology

1. Hume K.J. - Engineering Metrology, Macdonald Publications
2. Jain R.K. - Engineering Metrology, Khanna Publication.
3. Narayana K.L. - Engineering Metrology.
4. Galyer J.F & Shotbolt C.R. Metrology for engineers.
5. Gupta I.C. - Engineering Metrology, Dhanpatrai Publiartions
6. Judge A.W. - Engineering Precision Measurements, Chapman and Hall
7. ASTME, - Handbook of Industrial Metrology", Prentice Hall of India Ltd

Reference Books : Quality Control

1. Juran J. M., - Quality Handbook, McGraw Hill Publications.
2. Grant S.P., - Statistical Quality Control, Tata McGraw hill Publication.
3. Dale H. Besterfield - Quality control, Pearson Education
4. Mahajan – Quality control, Dhanpatrai Publiartions
5. John Oakland – statistical Process Control Butterworth- Heinnemann.

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SE-Mechanical Engineering (Sandwich) (2015 Course)

MANUFACTURING ENGINEERING (202065)

Teaching Scheme Hours/Week			Examination Scheme					Total Marks	Credits	
LE	TU	PR	In-Sem (online)	End-Sem	TW	PR	OR		LE / TU	PR / OR
4	-	2	50	50	25	-	-	125	4	1

Course Objectives:

Students would be able to

1. Describe various casting methods and suggest appropriate method pertaining to the application
2. Understand basics of metal forming processes, selection of equipments and tooling
3. Classify, describe and configure the principles of various welding techniques
4. Describe with illustration mechanism of chip formation, differentiate between oblique and orthogonal cutting, estimate cutting forces in metal cutting
5. Demonstrate and configure the functions of milling, drilling and grinding machines and estimate machining time for various metal cutting operations
6. Identify characteristics of non-conventional machining processes, describe basic mechanisms and list-out applications.

Unit 1: Casting Processes

Sand Casting Processes:

Procedure of sand casting, Pattern Making: Types of pattern, Pattern materials, Pattern allowances, molding sand: types, Ingredients, Properties and testing. Hand and machine molding equipments.
Core making, Core types, Gating Systems, Types of gates, Design of runners and riser.
Shell molding, Investment casting, Die casting, Centrifugal casting. Continuous Casting**.**
Cleaning and finishing of castings, Defects in casting, Inspection techniques in casting.

Unit 2: Metal Forming Processes

Introduction and classification of forming processes, Hot and cold working, recrystalisation and grain growth, strain hardening and formability.
Rolling: Rolling mill stands, effect of friction in Rolling, Rolling Load and draft (Numerical)
Forging: Types of forging presses, forging operations, Rotary swaging
Extrusion: Types, process parameters and its effect
Wire and Tube Drawing: Wire drawing Set ups, Die profile, Tube drawing methods
Sheet Metal Forming: Press-working operations, Press terminology, Dies, effect of clearance, center of pressure, blank size, strip layout and press tonnage calculations (numerical) .

Unit 3: Welding Techniques

Terminology in welding, Surface preparation and various joints, HAZ, Welding Classification.
ARC Welding-FCAW, MIG, TIG, SAW, Thermit welding: Principle, Process description, Equipment,
GAS Welding and Cutting: Equipments, Types of flames, Applications.

Resistance Welding: Theory, Spot, Seam and Projection weld process, Heat balance (numerical). Soldering, brazing and braze welding, Friction welding: Processes and their comparison.Weld inspection, Welding defects and their remedies.

Unit 4: Metal Cutting Principle

Center lathe: Introduction to, types of lathes. Construction and working of lathe, attachments and accessories, lathe mechanisms. Thread cutting and taper turning methods, Machining time calculations.

Theory of Metal Cutting:tool geometry, Concept of cutting variables and their effect on cutting forces. Merchant's force circle, Estimation of cutting forces. Machinability, tool life, tool wear, economics of machining, cutting fluids.

Unit 5: Metal Cutting With Multi- Point Cutting Tools

Milling: Types of milling machines, Its construction, working and mechanisms, Cutter- types, geometry and their applications, Universal dividing head, methods of indexing. Numerical on indexing, machining time calculations.

Drilling: Types of drilling machines, Types of drill, Twist drill geometry, tool holder, operations, calculation of machining time (numerical).

Grinding: Types of machines, Selection on grinding wheels, dressing and truing, mounting of wheels and calculation of machining time (numerical).

Unit 6: Non Conventional Processes

Need and Classificationof Non-Conventional Methods of Machining, Working Principles, Equipments, Process Parameters, Material removal rate and applications of: AJM, USM, EDM, WCEDM, ECM, ECG, EBM, PAM, LBM, IBM, ECDM, Vibro-EDM, (Numerical on MRR of USM, ECM and EDM).

Term-work shall consist of completion of followings:

Note: a) Part A of term work to be performed by student in work-shop
b) Part B, C and D expected to conduct in the dept. and evaluated by subject teacher

PART A:

(i) Manufacturing of any one assembly (as per part drawing including all geometric dimensions) consisting of minimum two parts to be performed on conventional machine tools only and must involve at least three operations out of followings: Drilling, Internal/External threading, Gear cutting, cylindrical/surface grinding, slotting etc.

(ii) Inspection of the component produced is to be carried out.

PART: B

Process sheet design and preparation of operation routing of component manufactured in work-shop (Part –A) for mass production involving calculation of machining time and cycle time.

PART: C

Design and drawing of either one drill jig (or) milling fixture (or) turning fixture on a drawing sheet with at least two views along-with Bill of Material (BOM).

PART: D

Assignments on any two non-conventional machining processes involving study of process parameters and their effect on MRR and inaccuracies.

Text Books:

1. P. N. Rao, Manufacturing Technology Vol I & II -Tata McGraw Hill Publishers
2. Hajara Choudhari, Bose S. K., Elements of Workshop Technology Vol. I & II -Asia Publishing House
3. P. C. Sharma, Production Engineering - Khanna Publishers
4. P. K Mishra, Non- conventional machining, Narosa Publishing House
5. V. K Jain, Advanced machining processes, Allied Publisher, New Delhi
6. Amitabh Ghosh and AsokkumarMallik, Manufacturing science, Ellis Horwood Ltd.
7. P H Joshi, Jigs and Fixtures, Tata McGraw Hill Publications

Reference Books:

1. Chapman W.A. J., Workshop Technology Vol. I, II, III -ELBS Publishers
2. HMT- Production Technology -Tata McGraw Hill Publishing Co
3. J.T.Black- DeGormos, Materials and Processes in Manufacturing -John Willey and Sons
4. R. S. Parmar- Welding Processes and Technology -Khanna Publishers, New Delhi
5. R. K. Jain, Production technology

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SE-Mechanical Engineering (Sandwich) (2015 Course)

COMPUTER AIDED MACHINE DRAWING (202066)

Teaching Scheme			Examination Scheme					Total Marks	Credits	
Hours/Week										
LE	TU	PR	In-Sem (online)	End-Sem	TW	PR	OR		LE / TU	PR / OR
-	-	2	-	-	-	50	-	50	-	1

Prerequisites:

1. Fundamentals Engineering Drawing
2. Projection of solids
3. Basic knowledge of 2-D drafting using graphics software

Course Objectives:

1. To understand Parametric Modeling Fundamentals, Procedure, and "Shape before Size" Approach.
2. To develop an ability to Create Parametric 2-D Sketches, and Create and Edit Parametric Dimensions.
3. To develop an ability to Create Solid Models of machine components. The student should be able to apply these skills to the solution of a variety of practical problems and be able to employ their knowledge to solve more complicated problems.
4. To develop an ability to Create assembly models of simple machine (minimum 5 components). The student should be prepared to continue the study of computer aided machine drawing through further subjects/projects in further years of engineering.
5. To develop the ability to apply Limits, Fits, and Dimensional Tolerances, as well as Geometric Tolerances to components and assemblies on Engineering Drawings.
6. To develop an ability to create 2D drawings from 3D models

Course Outcomes:

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

1. Understand the importance of CAD in the light of allied technologies such as CAM, CAE, FEA, CFD, PLM.
2. Understand the significance of parametric technology and its application in 2D sketching.
3. Understand the significance of parametric feature-based modeling and its application in 3D machine components modeling.
4. Ability to create 3D assemblies that represent static or dynamic Mechanical Systems.
5. Ability to ensure manufacturability and proper assembly of components and assemblies.
6. Ability to communicate between Design and Manufacturing using 2D drawings.

Course Contents

Unit 1:Introduction

Introduction – evolution of CAD, importance of CAD in the light of allied technologies, solid modeling, introduction to Graphical User Interface (GUI) of any commercially used solid modeling software.

Unit 2: Parametric Sketching
Parametric sketching - draw and modify 2D entities, apply/modify constraints and dimensions.

Unit 3: Parametric Solid Modelling
Parametric solid modeling - fundamentals, transform the parametric 2-D sketch into a 3D solid, feature operations, Free form feature modeling, design by features, feature recognition.

Unit 4: Assembly Modelling
Assembly modeling - defining relationship between various parts of machine, creation of constraints, generation of exploded view.

Unit 5:Geometric Dimensioning and Tolerancing
Geometric dimensioning and tolerancing - Limits, Fits, Dimensional Tolerances, Geometric Tolerances, Introduction to ASME Y14.5 – 2009.

Unit 6: Production Drawing
Production drawing – generation of 2-D sketches from parts and assembly 3-D model, appropriate dimensioning and tolerancing.

Lab Work:
1. Assignment on 2-D sketching with geometrical and dimensional constraints (2 hrs.)
2. Assignment on parametric solid modeling of a machine component (4 hrs.)
3. Assignment on solid modeling of the parts of a machine (min. 5 components) (10 hrs.)
4. Assignment on assembly modeling of the parts modeled in assignment 3 using proper mating conditions and generation of exploded view. (4 hrs.)
5. Generation of production drawings of the parts and assembly with appropriate tolerance. (4 hrs.)

Text Books:

1. Bhat N. D., Machine Drawing, Charotar Publications, New Delhi 2014
2. Ajeet Siingh, Machine Drawing, Mc Graw Hill Publications, New Delhi 2012
3. ASME Y14.5 -2009, ASME, 2009

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SOFT SKILLS (202067)

Teaching Scheme			Examination Scheme					Total Marks	Credits	
Hours/Week										
LE	TU	PR	In-Sem (online)	End-Sem	TW	PR	OR		LE / TU	PR / OR
-	1	-	-	-	25	-	-	25	1	-

Course Objectives:

- To develop students overall personality.
- To understand and aware about importance, role and contents of soft skills through instructions, knowledge aquisitiion, demonstration and practice.
- To improve writing and documentation skills.

Course Outcomes:

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

- Improved communication, interaction and presentation of ideas.
- Right attitudinal and behaviouralchange
- Developed right-attitudinal and behavioral change

Course Contents

Term Work/Assignments

Term work will consist the record of any 6 assignments of following exercises

1. SWOT analysis

Student should do his/her SWOT analysis & submit the report.

Method of Execution

Explain the meaning & benefits of SWOT analysis to students. Give them time to think on their strength, weakesses, opportunities & threats. Ask them to write their own SWOT anlalysis

2. Listening Skills

Listen to a short audio book and make notes out of it & make a report.

Method of Execution

Ask every students to download any freely available english audio book of one hour duration. Also ask them to listen it carefully and write it's review on journal paper

3. Oral presentation skills/Speaking Skills

Hold the poster of any inspirational personality & speak about his/her life for five minutes.

Method of Execution

The personality can be from the fields like sports, politics, literature, entertainment etc. Ask every students to read & study about therespective personality & deliver the oral presentation infront of his/her batchmates.

4. Resume writing

Design a cover letter & resume for yourself.

Method of Execution

Show some of the different resumes according to respective job profiles to students & ask them to prepare their own resume. Also guide them to write a cover letter for any job application.

5. Corporate / Business Etiquettes

Apply to any five internship openings over internet by writing an email to the company HR. Students must submit email print.

Method of Execution: Tell students about any five recent internship openings & ask them to apply for same through email with resume as an attachment. Ask students to take a sent mail print for submission record

6. Group Discussion

Organize the group discussion on a current topics in a batch of ten students & ask every student to make minutes of meeting & submit.

Method of Execution: Take some of the current topics for group discussion, divide students in two batches of ten students in each, Allot 10 minutes time & one topic for discussion, meanwhile instructor have to assess each student's performance & give feedback to respective student. Also ask students to write the minutes of the meeting from same GD

7. Team Activity

Make a 20 minutes english video documentary & post it on a social media. Also provide the link of the same as submission record.

Method of Execution: Make a group of four students & guide them to choose a topic for making a video documenatry. Video can be posted on facebook, twitter or youtube.The video can be recorded on cellphone as well

Text Books:

1. Basics Of Communication In English : Francis Sounderaj, MacMillan India Ltd.2
2. English for Business Communication : Simon Sweeney , Cambridge University Press
3. An Introduction to Professional English And Soft Skills: Das, Cambridge University Press

Reference:

1. A course in Listening and Speaking Vol I &Vol II, V.Sasikumar, P. Kiranmai, Geetha Rajeevan, Cambridge University Press
2. Cambridge English For Job Hunting : ColmDownes, Cambridge University Press
3. The Complete Letter Writer :MacMillan India Ltd
4. E Writing – 21st Century Tools for Effective Communication :Booher , MacMillan India
5. NASSCOM-Global Business Foundation Skills: Cambridge University Press

Savitribai Phule Pune University

SE-Mechanical Engineering (Sandwich) (2015 Course)

THEORY OF MACHINES (202068)

Teaching Scheme			Examination Scheme					Total Marks	Credits	
Hours/Week										
LE	TU	PR	In-Sem (online)	End-Sem	TW	PR	OR		LE / TU	PR / OR
4	1	-	50	50	25	-	25	150	4	1

Prerequisites:

1. Engineering Mathematics
2. Engineering Physics
3. Engineering Mechanics

Course Objectives:

1. To make the student conversant with commonly used mechanism for industrial application.
2. To develop competency in drawing velocity and acceleration diagram for simple and complex mechanism.
3. To develop analytical competency in solving kinematic problems using complex algebra method.
4. To develop competency in graphical and analytical method for solving problems in static and dynamic force analysis.
5. To develop competency in conducting laboratory experiments for finding moment of inertia of rigid bodies,

Course Outcomes:

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

1. Identify mechanisms in real life applications.
2. Perform kinematic analysis of simple mechanisms.
3. Perform static and dynamic force analysis of slider crank mechanism.
4. Determine moment of inertia of rigid bodies experimentally.
5. Analyze velocity and acceleration of mechanisms by vector and graphical methods.

Course Contents

Unit 1: Fundamentals of Kinematics and Mechanisms

Kinematic link, Types of links, Kinematic pair, Types of constrained motions, Types of Kinematic pairs, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom (Mobility), Kutzbach crieterion, Grubler's criterion. Four bar chain and its inversions, Grashoff's law, Slider crank chain and its inversions, Double slider crank chain and its inversions. Straight line mechanisms such as: Peaucellier Mechanism, Scott Russell Mechanism, Grasshopper Mechanism, watt mechanism. Equivalent linkage of mechanisms, Steering gear mechanisms: Condition for correct steering, Davis steering gear mechanism, Ackermann steering gear mechanism.

Unit 2: Static and Dynamic Force Analysis

Theory and analysis of Compound Pendulum, Concept of equivalent length of simple pendulum, Bifilar suspension, Trifilar suspension.

Dynamics of reciprocating engines: Two mass statically and dynamically equivalent system, correction couple, static and dynamic force analysis of reciprocating engine mechanism (analytical method only), Crank shaft torque, Introduction to T-θ diagram.

Friction: Friction in turning pair, friction circle, friction axis, friction in slider crank mechanism.

Unit 3: Friction Clutches, Brakes and Dynamometer

Pivot and collar friction, Classification of Clutches, torque transmitting capacity of - plate clutch, cone clutch and centrifugal clutch, Classification of brakes, braking torque of - shoe brakes, internal shoe brake, disc brake, brake power of absorption and transmission type dynamometers – prony brake, rope brake, belt transmission, epicyclic train and Bevis-Gibson torsion

Unit 4: Kinematic Analysis of Mechanisms: Analytical Method

Analytical method for displacement, velocity & acceleration analysis of slider crank Mechanism. Position analysis of links with vector and complex algebra methods, Loop closure equation, Chase solution, Velocity and acceleration analysis of four bar and slider crank mechanisms using vector and complex algebra methods.

Hooke's joint, Double Hooke's joint.

Unit 5: Velocity and Acceleration Analysis of Simple Mechanisms: Graphical Methods-I

Relative velocity method: Relative velocity of a point on a link, Angular velocity of a link, Sliding velocity, Velocity polygons for simple mechanisms.

Relative acceleration method: Relative acceleration of a point on a link, Angular acceleration of a link, Acceleration polygons for simple mechanisms. (limit to only 4 link mechanisms)

Instantaneous center of rotation (ICR) method: Definition of ICR, Types of ICRs, Methods of locating ICRs (limit to only 6 link mechanisms), Kennedy's Theorem, Body and space centroid.

Unit 6: Velocity and Acceleration Analysis of Mechanisms: Graphical Methods-II

Velocity and acceleration diagrams for the mechanisms involving Coriolis component of acceleration. (limit to only 4 link mechanisms) Klein's construction.

Text Books:

1. Thomas Bevan, Theory of Machines, CBS Publisher and Distributors, Delhi.
2. S. S. Ratan, Theory of Machines, Tata McGraw Hill.
3. Ashok G. Ambekar, Mechanism and Machine Theory, Prentice Hall, India
4. Sadhu Singh, Theory of Machines, Pearson

Reference:

1. Shigley J. E. and Uicker J.J., Theory of Machines and Mechanism, McGraw Hill Inc.
2. Shigley J. E. Mechanical Engineering Design, McGraw Hill Inc.
3. Ghosh Amitabh and Mallik A. K. Theory of Machines and Mechanism, East-West Press.
4. Wilson C.E. and Sandler J. P. Kinematics and Dynamics of Machinery, Person Education.
5. Erdman A.G. and Sandor G.N., Mechanism Design, Analysis and Synthesis Volume-I, Prentice –Hall of India

Term Work based on following Tutorials to be submitted in the form of Journal:

1. Draw (any 4) configurations of mechanisms and determine types of pairs, links, degree of freedom.
2. To determine experimentally the mass moment of inertia of a connecting rod using a compound pendulum method.
3. To determine experimentally the mass moment of inertia of a flat bar using bifilar suspension method or to determine experimentally the mass moment of inertia of a flywheel/gear/circular disc using trifilar suspension method.
4. Numerical based on Friction Clutches, Brakes and Dynamometer Or to measure torque transmitting capacity of friction clutch experimentally.
5. Numerical based on - single and double Hooke's joint.
6. One problem on velocity and acceleration analysis using: Vector algebra and Complex algebra and comparison of results.
7. **Two problems** on velocity and acceleration analysis using relative velocity and acceleration method.
8. **Two problems** on velocity analysis using ICR method.
9. **Two problems** on velocity and acceleration analysis using relative velocity and acceleration method involving Coriolis component.
10. Problems on velocity and acceleration analysis using Klein's construction for uniform and non-uniform crank velocity.

Note: 1. <u>Sr. No. 1,7,8,9 and 10 Problems</u> based on Graphical methods are to be solved on half imperial drawing sheets.

2. Oral based on above Term work conducted in the tutorial class