

COMPUTER AIDED MACHINE DRAWING

Sub Code: 15 IM/IP 42
Hrs/week: 04 (1hr. Instruction +3hrs.Practical)
Total Lecture Hrs: 50

IA Marks: 20
Exam Hours: 03
Exam Marks: 80

PART A

MODULE 1

Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap.

Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids). True shape of sections.

Orthographic Views: Conversion of pictorial views into orthographic projections. of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines.

10 Hours

MODULE 2

Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External) BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

10 Hours

PART B

MODULE 3

Keys & Joints: Parallel key, Taper key, Feather key, Gibhead key and Woodruff key

Riveted Joints: Single and double riveted lap joints, butt joints with single/double coverstraps(Chain and Zigzag, using snap head rivets).

Cotter joint (socket and spigot), knuckle joint (pinjoint) for two rods.

10 Hours

MODULE 4

Couplings: Split Muff coupling, protected type flanged coupling and universal coupling (Hooks' Joint).

PART C

10 Hours

MODULE 5

(Part drawings should be given)

1. Plummer block (Pedestal Bearing)
2. Screw jack (Bottle type)
3. Machine vice

10 Hours

TEXT BOOKS:

1. 'A Primer on Computer Aided Machine Drawing-2007', Published by VTU, Belgaum.
2. 'Machine Drawing', N.D.Bhat&V.M.Panchal

REFERENCE BOOKS:

1. 'A Text Book of Computer Aided Machine Drawing', S. Trymbaka Murthy, CBSPublishers, New Delhi, 2007
2. 'Machine Drawing', K.R. Gopala Krishna, Subhash Publication.

NOTE:

Sketching of the component drawing should be done in A3/A4 sheet in the instruction class. The drawing should be reproduced using suitable software tool.

Internal Assessment: 20 Marks

Manual sketching - 40% weightage and Computer printouts - 60% weightage

All the sheets should be drawn in the class using software. Sheet sizes should be A3/A4. All sheets must be submitted at the end of the class by taking printouts.

Scheme of Examination:

Two questions to be set from each PartA, partB and PartC.

Student has to answer one question each from PartA ,PartB for 15 marks each and one questionfrom Part C for 50 marks.

Part A1X15 = 15 Marks

Part B 1X15 = 15 Marks

Part C 1X50 = 50 Marks

Total = 80 Marks

Perquisites: Computer aidedEngineering DrawingCAED 14/24.

Course Outcomes

At the end of this course, students will be able to;

1. **Create** orthographic views of simple machine parts from the given pictorial view/representation.
2. **Construct** 2D drawings of fasteners, joints, keys and couplings.

3. **Create** models of simple mechanical devices such as screw jack, Plummer block, machine vice, etc., given the part drawings.

KINEMATICS OF MACHINES

Sub Code: 15 IM/IP 43

Hrs/week: 04

Total Lecture Hrs: 50

IA Marks: 20

Exam Hours: 03

ExamMarks:80

MODULE 1

Introduction: Definitions Link or element, kinematic pairs, Degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine.

Kinematic Chains and Inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

10 Hours

MODULE 2

Mechanisms: Quick return motion Mechanisms- Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism.

Straight line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion Mechanisms - Geneva wheel mechanism and Ratchet and Pawl mechanism. Toggle mechanism.

10 Hours

MODULE 3

Velocity and Acceleration Analysis of Mechanisms (Graphical Methods) Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles in a common link, relative velocity and accelerations of coincident Particles on separate links. Angular velocity and angular acceleration of links, velocity of rubbing.

10 Hours

MODULE 4

Spur Gears: Gear terminology, law of gearing, Characteristics of involute action, Path of contact. Arc of contact, Contact ratio of spur, helical, bevel and worm gears, Interference in involute gears. Methods of avoiding interference, Back lash. Comparison of involute and cycloidal teeth. Profile Modification, Numerical problems.

Gear Trains: Simple gear trains, Compound gear trains for large speed. reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains, Numerical Problems.

10 Hours

MODULE 5

Cams: Types of cams, Types of followers. Displacement, Velocity and, Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-

facefollower, Disc cam with oscillating roller follower. Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

10 Hours

TEXT BOOKS:

1. Dr. R.K. Bansal “Theory of Machines” Laxmi Publications
2. R.S.Khurmi and J.K.Gupta “Theory of Machines” S.Chand and Co.

REFERENCE BOOKS:

- 1.S.S. Rattan “Theory of Machines” Tata McGraw-Hill, New Delhi and 2nd edition 2005.
- 2.Sadhu Singh “Theory of Machines” Person Education (Singapore) Pvt. Ltd Indian Branch, New Delhi, 2nd Ed.2006.

NOTE:

Internal Assessment: 20 Marks (15 marks for test: 5 marks for additional activity)

Scheme of Examination:

- Two full question (with a maximum of four sub question) of twenty marks each to be set from each module. Each question should cover all content of the respective module.
- Student has to answer five full question choosing one full question from each module

Course Outcomes:

At the end of this course, students will be able to;

1. *Describe* the concepts of machines, mechanisms and related terminologies.
2. *Identify* the mechanisms and predict their motions in mechanical components.
3. *Analyze* planar mechanisms for displacement, velocity and acceleration graphically.
4. *Analyze* various motion transmission elements like gears, gear trains and cams.

COMPUTER AIDED DESIGN AND MANUFACTURING (CAD / CAM)

Sub Code: 15 IM/IP46
Hrs / Week: 4Hrs
Total Hrs: 50

IA Marks: 20
Exam: 3 Hrs
SEE Marks: 80

MODULE 1

INTRODUCTION: Role of computers in design and manufacturing. Influence of computers in manufacturing environment. Product cycle in conventional and computerized manufacturing environment. Introduction to CAD, Introduction to CAM. Advantages and disadvantages of CAD and CAM.

HARDWARE IN CAD: Basic Hardware configuration in CAD, working principles, - input and output Devices. **10Hrs**

MODULE 2

COMPUTER GRAPHICS: Software configuration of a graphic system, function of a Graphics package, construction of geometry, wire frame and solid modelling, CAD/CAM integration. Describe modelling facilities. Introduction to exchange of modelling data – Basic features of IGES, STEP, DXF, DMIS.

NC, CNC, DNC TECHNOLOGY: NC, CNC, DNC modes, NC elements, advantages and limitations of NC, CNC. Functions of computer in DNC. **10Hrs**

MODULE 3

CNC MACHINES TOOLING: Turning tools geometry, milling tooling systems, tool pre-setting, ATC work holding.

CNC Machines: Overview of different CNC machines, CNC turning centres, high speed machine tools, MCE. **10 Hrs.**

MODULE 4

CNC PROGRAMMING: Part program fundamentals – steps involved in development of a part program. Manual part programming, milling, turning Center programming. **10Hrs.**

MODULE 5

INTRODUCTION TO ROBOTICS: Introduction, Robot Configuration, Robot Motions, Programming the Robots, Robot- Programming Languages, End effectors, Work Cell, Control and Interlock, Robot Sensor, Robot Applications. **10**

Hrs.

TEXT BOOKS:

1. CAD / CAM Principles and Applications by P.N.Rao, TMH, New Delhi, 2002
2. CAD/CAM, Mikell P-groover, Emory W. ZimrnersJr Pearson Education inc, 2003

REFERENCE BOOKS:

1. CAD/CAM/CIM By P.Radhakrishnan S Subramanyan,V.Raju.

NOTE:

Internal Assessment: 20 Marks (15 marks for test: **5 marks**foradditional activity)

Scheme of Examination:

- Two full question (with a maximum of four sub question) of twenty marks each to be set from each module. Each question should cover all content of the respective module.
- Student has to answer five full question choosing one full question from each module

COURSE OUTCOMES

At the end of this course, students will be able to;

1. Understand the concepts of CAD and the required hardware
- 2 understand CAM and CNC machines
- 3 program CNC machines
- 4 Understand and program the robot

Manufacturing Process II

CODE 15 IM/IP 44

Total Hrs.: 50

Exam Hours: 03

Hrs/ Week: 03

IA Marks: 20

Exam Marks: 80

Module 1

Classification of metal removal process and machines: Concept of orthogonal and oblique cutting Geometry of single point cutting tool and tool angles, tool nomenclature. Mechanism of Chip Formation: Type of chips. Mechanics of metal cutting, Merchant's circle diagram and analysis, Ernst Merchant's solution, shear angle relationship, Tool Wear and Tool failure, tool life. Effects of cutting parameters on tool life. Tool Failure Criteria, Taylor's Tool Life equation. **(10 Hrs)**

Module 2

Desired properties and types of cutting tool materials – HSS, carbides coated carbides, ceramics. Cutting fluids. Desired properties, types and selection. Heat generation in metal cutting, factors affecting heat generation. Heat distribution in tool and work piece and chip.

Turning (Lathe), Shaping Machines: Classification, constructional features of Turret and Capstan Lathe. Tool Layout, shaping Machine, Different operations on lathe, shaping machine. **(10 Hrs)**

Module 3

Drilling machines: drilling & related operations, Classification of drilling machine, constructional features and working principle of Radial, multi spindle, Gang, Deep hole and automatic drilling machine, Types of drill & drill bit nomenclature.

Milling machines: Classification, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concepts. Various milling operations.

Indexing: Simple, compound, differential and angular indexing calculations. Simple problems on simple and compound indexing. **(10 Hrs)**

Module 4

Grinding machines: Types of abrasives, Grain size, bonding process, grades and structure of grinding wheels, grinding wheel types. Classification, constructional features of grinding machines (Centerless, cylindrical and surface grinding).

Broaching process - Principle of broaching. Details of a broach. Types of broaching machines constructional details. Applications. Advantages and Limitations. **(10 Hrs)**

Module 5

Finishing and other Processes Lapping and Honing Operations Principles, arrangement of setup and application. Super finishing process, polishing, buffing operation and application.

Non-traditional machining processes: Need for non-traditional machining, Principle, equipment & operation of Laser Beam, Plasma Arc Machining, Electro Chemical Machining, Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining, Electron Beam Machining, Electron Discharge Machining and Plasma Arc Machining. **(10 Hrs)**

Hrs)

NOTE:

Internal Assessment: 20 Marks (15 marks for test: 5 marks for additional activity)

Scheme of Examination:

- Two full question (with a maximum of four sub question) of twenty marks each to be set from each module. Each question should cover all content of the respective module.
- Student has to answer five full question choosing one full question from each module

TEXT BOOKS:

1. Elements of Workshop Technology: Machine Tools (Volume – 2) by S. K. Hajra Choudhary, A. K. Hajra Choudhary, Nirjhar Roy, Media promoters (2010).
2. Manufacturing Processes for Engineering Materials, 4th Edition by Serop Kalpak Jain, Steven R. Schmidt, published by Pearson (2007).
3. Fundamentals of Metal Machining and Machine Tools by G. Boothroyd, McGraw Hill, 2000.

REFERENCE BOOKS:

1. Ghosh, A., & Mallik, A. K., Manufacturing Science, East West Press Private Limited.
2. Pandey & Singh, Production Engineering Science, Standard Publishers Distributer, Delhi.
3. Karl H. Heller, All about Machine Tools, Wiley Eastern Ltd., New Delhi
4. Trent, E. M. Metal cutting: Butterworth Heinemann

Course Outcomes

At the end of this course, students will be able to;

1. To understand Tool Nomenclature, different types of machine tools, types, applications and operations
2. Ability to understand failure criteria, heat generation and selection of cutting fluids.
3. To understand the tool life of different cutting tool materials and Indexing in milling machine.
4. To understand the working of shaping and grinding.
5. To understand the principles, advantages, application and limitations of Nonconventional Machining.

Materials Science and Metallurgy

Sub Code: 15IM/IP 45

Total Hrs.: 50

IA Marks: 20

Hrs/ Week: 04

Exam Hours: 03

Exam Marks: 80

MODULE- I

Crystal Structure-Unit Cells, Crystal systems, BCC, FCC, and HCP structures, Coordination number and atomic packing factors **Crystal Imperfection**-Point, line and surface imperfections **Atomic Diffusion**-Fick's laws of diffusion, Factors affecting Diffusion, Steady and non-steady state diffusions. (10 Hrs)

MODULE-II

Dislocation Characteristics of dislocations slip systems, slip in single crystals, Plastic deformation of polycrystalline materials, Deformation by twinning

Fracture

Types of fracture, ductile and brittle fracture, Ductile to brittle transition temperature

Fatigue and creep Cyclic stresses, SN curves, crack initiation and propagation, Factors affecting fatigue life, Creep behaviour Stress and temperature effects, Data extrapolation methods. (10 Hrs)

MODULE-III

Phase DiagramsSolid solutions, Hume Rothary rules-substitutional, and interstitial solid solutions, Intermediate

phases, Gibbs phase rule, Construction of equilibrium diagrams, lever rule

Iron carbonequilibrium diagram Description of phases, Solidification of steels and cast irons, Invariantreactions, TTT curves, Continuous cooling curves. (10 Hrs)

MODULE- IV

Heat Treatment of Metals Annealing and its types, normalizing, Hardening, tempering, Martempering,Austempering, Hardenability, surface hardening methods like carburizing, cyaniding,Nitriding, Flame hardening and induction hardening. Age hardening of Aluminium – Copperalloys **Recovery, Recrystallization and Grain Growth** Recrystallization temperature, annealing temperature v/s cold-worked and recovered grains, Direction of grain boundary motion, time v/s grain diameter. (10 Hrs)

MODULE- V

Steels and cast irons Ferrous alloys, steels – low medium and high carbon, AISI designation steels, Cast irons – types and properties **Composites and ceramics** Composite materials: definition, classification, Types of matrix materials & reinforcements, Application of composites, Ceramics: Glasses, Glass – ceramics, clay products, Refractories, abrasives and cements. (10 Hrs)

NOTE:

Internal Assessment: 20 Marks (15 marks for test: 5 marks for additional activity)

Scheme of Examination:

- Two full question (with a maximum of four sub question) of twenty marks each to be set from each module. Each question should cover all content of the respective module.
- Student has to answer five full question choosing one full question from each module

TEXT BOOKS:

1. William D Callister, “An Introduction -Material’s Science and Engineering”, John Wiley and Sons India Pvt Ltd., 6th Edition, 2006 New Delhi.
2. Smith -Foundation of Material Science and Engineering, 3rd Edition, McGraw Hill, 1997.
3. Donald R Asklund, Pradeep.p.phule -Essentials of Materials for Science and Engineering, Thomson Engineering, 4th edition 2003.

REFERENCE BOOKS:

1. V Raghavan -Physical Metallurgy, Principles and Practices, PHI, 2nd Edition 2006, New Delhi.
2. H. Van Black and Addison -Elements of Material Science and Engineering, Wesley Edition, 1998.
3. James F Shackelford -Introduction to Material Science for Engineering, 6th edition Pearson Prentice hall, New Jersey, 2006.

Course outcomes:

At the end of this course, students will be able to;

1. Estimate the impact of imperfection on the property of the material
2. Analyze steady and non-steady types of diffusion and solve related problems
3. Construct the iron carbon diagram and TTT curves
4. Estimate the hardness and other properties of metals obtained from different heat treatment processes
5. processes
6. Select the right iron-carbon alloy for any given application

FOUNDRY AND FORGING LABORATORY

Sub Code: 15IML/IPL 47A / 47B

Hrs/week: 03

Total Lecture Hrs: 48

IA Marks: 20

Exam Hours: 03

Exam Marks: 80

PART – A

1. Testing of Moulding sand and Core sand Preparation of sand specimens and conduction of the following tests:

- Compression, Shear and Tensile tests on Universal Sand Testing Machine.
- Permeability test
- Core hardness & Mould hardness tests.
- Sieve Analysis to find Grain Fineness number of Base Sand
- Clay content determination in Base Sand

PART – B

2. Foundry Practice Use of foundry tools and other Equipments.

Preparation of moulds using two moulding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes).

3. Preparation of one casting (Aluminum or cast iron-Demonstration only)

PART – C

1. Forging Operations: Calculation of length of the raw material required to do the model.
2. Preparing minimum three forged models involving upsetting, drawing and bending operations.

Out of these three models, at least one model is to be prepared by using Power Hammer.

Scheme of Examination:

One question is to be set from Part-A: 20 marks

One question is to be set from either Part-B or Part-C: 40 marks

Calculation part in case of forging is made compulsory

Viva: 20 marks

METALLOGRAPHY AND MATERIAL TESTING LABORATORY

Sub Code: 15IML/IPL 48A/ 48B
Hrs/week: 03
Total Lecture Hrs: 48

IA Marks: 20
Exam Hours: 03
Exam Marks: 80

PART – A

3. Preparation of specimen for Metallographic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
4. Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat-treated samples.
5. To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters.
4. Non-destructive test experiments like,
 - (a). Ultrasonic flaw detection
 - (b). Magnetic crack detection
 - (c). Dye penetration testing. To study the defects of Cast and Welded specimens

PART – B

1. Tensile, shear and compression tests of metallic and non-metallic specimens using Universal Testing Machine
2. Torsion Test
3. Bending Test on metallic and nonmetallic specimens.
4. Izod and Charpy Tests on M.S & C.I Specimen.
5. Brinell, Rockwell and Vickers's Hardness test
6. Fatigue Test.

Scheme of Examination:

ONE question from part -A: 20 Marks

ONE question from part -B: 40 Marks

Viva -Voice: 20 Marks

