



MATS UNIVERSITY

ARANG, RAIPUR (C.G.)



Scheme of Teaching & Examination

III - Semester

S.N.	code	Subject	Periods per week			Scheme of marks		Total Credit
			L	T	P	ESE	IM	
1.	DP310	Mechanical Machine Drawing	3	2	-	70	30	4
2.	DP311	Strength of Material	3	1	-	70	30	4
3.	DP312	Mechanical Engineering Materials	3	0	-	70	30	3
4.	DP313	Manufacturing Technology	4	0	-	70	30	4
5.	DP314	Thermal Engineering	3	1	-	70	30	4
6.	DP315	Machine Drawing Lab	-	-	2	30	20	1
7.	DP316	Strength of Material Lab	-	-	2	30	20	1
8.	DP317	Thermal Engineering Lab	-	-	2	30	20	1
9.	DP318	Manufacturing Technology lab	-	-	2	30	20	1
10.	DP319	Machine Shop – I	-	-	2	30	20	1
Total			16	4	10	540	260	24

L – Lecture, T – Tutorial, ESE – End Semester Examination,
P – Practical, IM – Internal Marks (Include Class Test & Teacher’s Assessments)

FOURTH SEMESTER

**SUBJECT- MECHANICAL MACHINE DRAWING
CODE- DP310**

UNIT – I: Projection and Multi-view Representation

Projection, orthographic projection. First and Third Angle Projection, Superfluous view, choice of views, Auxiliary views-full and partial, Conversion of pictorial views into orthographic views Conventional representation as per IS 696. **Sectional Views** - Full section, half section, partial or broken section, revolved sections, removed section, offset section. Sectioning conventions, section lines. Hatching Procedure for different materials as per IS code 689-1972. Sectional views of assembled parts choosing from IC engine such as steam engine parts, valves, couplings, clutches, brackets, bearings etc. (use 1st and 3rd angle projections both.)

UNIT – II: Dimensioning, Tolerance, Machining and Welding Symbols

Types of dimension (size and location), Dimensioning terms and notation (use of I.S. code 696 and 2709) General rules for dimensioning and practical hints on dimensioning, systems of dimensioning, Dimensioning of cylinder, holes, arcs of circle, narrow space, angles, counter sunk hole, screw thread, taper etc. Application of tolerances (use I.S. code 696), machining marks, finish marks, counter sunk, counter boring, spot facing and figures. Representation of characteristics machining (circularity, angularity etc.) (Refer I.S. 696), Representation of welding joints, welding symbols, tolerance of forms and position. Procedure of drawing fits, limits, size, tolerance, etc.

UNIT – III Production Drawing and Pipe Drafting

Detailed drawing, Assembly drawing, scale, finish, tolerances, procedures, notes etc. Title block, tool list, gauge list, style list, parts list zoning, Preparation of production drawing for pattern shop, forging shop, machine shop, Preparation of assembly drawing from detailed drawing. Exploded views, sectional pictorial views. Assembly drawing of Plummer block, flange coupling, stepped pulleys, foot step bearing, universal coupling, stuffing box, eccentric of steam engine, connecting rod, piston of I.C. engine, stop valves, feed check valves, dead weight safety valve for boiler, cross heads. Preparation of detailed drawing from assembly drawings and assembled pictorial views, interpretation of production drawings, Various symbols used in pipe line work as per IS code of practice, C.I. flanged joint, socket and spigot joint, gland and stuffing box, expansion joint, pipe fittings, typical pipe bends, pipe supports and accessories. Piping diagram for a small pump house

UNIT – IV: Gear Drawing-

Gear terminology such as pitch, pitch circle diameter, module, addendum, root circle diameter, hole depth, blank diameter etc. Construction of cycloidal, involutes teeth-profiles, Pinion and rack meshing, spur gear meshing.

Re-production and Preservation of Drawings, Graphs and Charts - Tracing, Blue printing, Brown print, white print, ammonia printing, xerography, photographic reproduction, micro films. Indexing, folding and codification methods.(Use IS code of practice 696 –1972), Classification of charts, graphs and diagrams, Quantitative and qualitative charts and graphs. Making titles, legends, notes etc. Procedure for making a Graphical Representation in Ink. Logarithmic

Graphs, Semi logarithmic Graphs, Bar charts, Area (percentage) charts, Pie Chart, Polar charts, Trainer chart, Pictorial chart, Alignment charts (Nomo graphs)- Forms and construction, construction of functional scale, parallel scale charts for equations of the Form Three-scale alignment chart, Graphical construction of a z-chart, Four variable Relationship parallel scale Alignment chart.

UNIT – V: Computer Graphics

Introduction to computer graphics, geometric modeling, Types of commands, Methods of Representing objects in geometric modeling, Automatic Drafting-Generating hard copy engineering drawing direct form CAD base, Graphic features of CAD helpful in automatic drafting. Graphic terminal and other hardware for computer graphics their function and use.

TEXT BOOKS

1. Elements of Machine Drawing - N.D.Bhatt. AnandCharotkar
2. Machine Drawing- R.K.Dhawan, S. Chand

REFERENCE BOOKS:

1. Fundamentals of Engineering Drawing - Warren J Luzadder (Prentice-Hall)
Mechanical Drawing - Giesecke, MichellSpecer, Hill (Collier Macmillan Internal Edition)

THIRD SEMESTER
SUBJECT- STRENGTH OF MATERIALS
CODE- DP311

UNIT – I Simple Stresses and Strains

Introduction, Types of loads and deformation, Types of stresses and strains, Hooke's law, stress-strain diagram for ferrous and non-ferrous materials, Modulus of elasticity (E), Modulus of rigidity (G) and Bulk modulus (K) of materials, Stresses in Bars of varying cross sections, composite sections, Thermal stresses and strains, thermal stresses in composite sections, Poisson's ratio, volumetric strain, Relation between E, G and K, Strain energy, Resilience, Proof resilience, Modulus of resilience, Suddenly applied loads and Impact loads..

UNIT – II Shear Force & Bending Moment Diagrams:

Definitions, types of loading, types of beams, Shear force and bending moment, sign conventions, S.F. and B.M. diagrams for Cantilever, Simply supported and subjected to Point loads, Uniformly distributed loads and Combination of these loads Point of contraflexure, numerical problems on above. **Shear Stresses in Beams:** Introduction, Shear stress equation, assumptions made, Distribution of shear stresses over various sections, such as rectangular, circular, I, L & T sections, Simple numerical problems.

UNIT- III Deflection of Beams:

Introduction, Strength and Stiffness of a beam, Curvature of a bent beam, Derivation of equation for slope and deflections of beam in case of cantilever & simply supported beam loaded with point loads, UDL Simple numerical problems, Importance of deflection and practical applications. **Torsion of Shaft:** Definition of torsion, Relation between stress, strain and angle of twist, Assumptions made, Strength of solid and hollow circular shafts, polar moment of inertia, Calculation of shaft diameter on the basis of strength and stiffness for given power transmitted, Tensional Rigidity, Maximum torque comparison of solid and hollow shaft, Size of shaft for a given torque.

UNIT- IV Springs

Definition, types and use of springs, Spring classification based on size, shape and load- leaf spring, helical and spiral spring, Stiffness of a spring and maximum Shear stress, Deflection of spring. **Columns and Struts:** Definition, Crippling load, different end conditions, Slenderness ratio, equivalent length, radius of gyration, Euler's theory, Limitation of Euler's formula, Rankine's formula, Rankine constant, for different materials, Simple problems & D.T.S. code for columns.

UNIT- V Stresses in Frames, Thin Pressure Vessels:

Definition of frame, perfect, deficient and redundant frames, Assumptions made in finding stresses in members, Bows notation, solution of problems using these methods, Cylindrical and spherical vessels subjected to internal pressure, Hoop stress, longitudinal, Stress, Volumetric strain, change in volume.

Text Books

1. Strength of Material – Dr. Sadhu Singh – Khanna Publishers
2. Elements of Strength of Material – Timo Shenko & Young – EWP Press
3. Strength of Material – R.K. Rajput – Dhanpat Rai & Sons

References Books

1. Strength of Material – Rider – ELBS
2. Mechanics of Material – F.P. Bear & E.E. Johnston – McGraw Hill
3. Mechanics of Material – J.M. Gera & Time Shenko – CBS Publishers
4. Introduction to Solid Mechanics – I. H. Shames – PHI

THIRD SEMESTER
SUBJECT- MECHANICAL ENGINEERING MATERIALS
CODE- DP312

UNIT-I : Engineering Materials & Testing:

Introduction to engineering materials, Classification of engineering materials and their properties, Mechanical properties of materials, Destructive and non-destructive testing. Structure of Solid Materials: Classification, Amorphous and crystalline states, Unit cells and crystal structure (BCC , FCC, and HCP) Allotropy, Solidification of metals, Ingot solidification, dendritic growth and its effect on properties, methods of preventing dendritic growth, Growth of single crystals- column crystal, Equiaxed grains, segregation of impurities, grain and grain Boundaries, Structural imperfection -types of imperfections, Impurity atoms, Point defects, Line defects, screw and mixed dislocations, surface defects.

UNIT-II : Permanent Deformation:

Types & mechanism of plastic flow, Slip phenomenon in single crystals, Dislocation theory, Twinning, & Annealing, Recovery, Recrystallization and grain growth, Practical Metallography, preparation of specimen, selecting the specimen, grinding and polishing, Etching and etching reagents, The metallurgical microscope, use and care of microscope. Micro-examination, Sulphur printing. Phase Diagrams & Iron-Carbon System: Basic definition of phases, solid solutions- types, formation, examples, characteristics, Factors affecting the formation of solid solutions, Equilibrium or phase diagrams plotting of equilibrium diagrams, Interpretation, phase rule, lever rule and its applications,

UNIT-III : Heat Treatment of Steels:

Objective of heat treatment, Description of processes, Annealing, hardening , normalizing and tempering, Hardening processes- surface hardening, Flame hardening case hardening, methods, their scope, limitation and advantages, Quenching mediums and its effect on hardness- Hardening defects due to improper quenching, Harden ability, Jommy test and interpretation of its results, TTT curves- interpretation and use, Types of cast Irons- their micro- structure, formation, properties and uses, Alloy cast irons-various alloying elements used, their effects on properties and uses,

Unit-IV: Non-Ferrous Metals and Alloys:

Copper- its properties and uses, copper base alloys- brasses and bronzes, their classification, composition, properties and uses, Aluminum- its, properties and uses, Aluminum alloys- their composition, classification properties and uses (Only commonly used important alloys).

Unit-V: Preservation, Selection & Modern Trends in Materials Engineering:

Corrosion- meaning, various mechanism effect of corrosion, methods of minimizing corrosion, Selection of Materials- selection requirements Modern trends in materials engineering- new materials like FRP, Composites, Synthetic Rubbers, Synthetic wood & Super conductivity.

Text & Reference Books:

1. A Textbook of material Science & metallurgy by O.P. Khanna
2. Material Science of Processes by S.K.Choudhary
3. Material Science of Processes by Laitin- Lakhtin Pub.MIR publisher, Moscow
4. Material of Engineers by MH. A. Kempstyl.
5. Introduction to Material Science and Engineering
6. Physical metallurgy Principles, Read Hill Pub. Affiliated East – West press pvt. Ltd. New Delhi.
7. Engineering metallurgy by R. Higgins.

THIRD SEMESTER
SUBJECT- MANUFACTURING TECHNOLOGY
CODE- DP313

UNIT – I

Introduction to Manufacturing Processes:

Importance of manufacturing processes, classification, economic and technological definitions of manufacturing processes. **Foundry Pattern making** - Types, material, allowances, colour codes, core – types, materials and its properties. **Mould Making** - Types of sand moulding, design considerations, moulding machines & moulding procedure, moulding sand – types, properties, composition and applications. **Casting** - Procedure, Melting furnaces, casting defects. **Special Casting Processes** - Investment casting, centrifugal casting, shell moulding, CO₂ moulding, slush casting, die casting.

UNIT – II

Welding

Principles of Welding, survey and allied processes. **Arc Welding** Power Source and Consumable, MMAW, TIG and MIG processes and their parameter selection, atomic hydrogen welding, welding of cast iron, welding electrode – types, composition, specification.

Resistance Welding Principle, equipment and processes. Thermit Welding, brazing & soldering, Internal and external welding defects, Inspection & testing of weld.

UNIT – III

Forging - Principle, types, tools and fixture of forging, forging dies, forging machines, forging design, drop forging die design, upset forging die design, forging practice and process capability, forging defects, Inspection and testing of forged parts.

Extrusion

Principle, extrusion processes, process parameters, extrusion equipment, extrusion defects.

Rolling - Principle, classification of rolled products, types of rolling, rolling mill train components, roll pass design for continuous mill.

UNIT – IV

Machine Tools

Lathe

Introduction, type, specification, construction, work holding devices & tools, mechanism and attachments for various operations, taper turning, thread cutting operations on Lathe, capstan and turret lathe.

Shaper

Introduction, type, specification, Quick return Mechanisms, Table feed mechanism, work holding devices, shaper operations

Milling

Introduction, specification, types, mechanisms and attachments for milling, milling operations, Indexing-simple, compound and differential.

UNIT-V

Drilling

Introduction, drill nomenclature, types of drilling machines, other operations like counter boring, counter sinking, spot facing etc.

Reaming

Introduction, description of reamers, type of reaming operations.

Boring

Introduction, types of boring machines, boring operations, boring tools

TEXT BOOKS

1. Manufacturing Technology (Vol. – I & II) – P.N. Rao – Tata McGraw Hill Pub. Company, New Delhi
2. A Text Book of Production Technology(Manufacturing Processes) – P.C. Sharma – S. Chand and Company Ltd., New Delhi
3. Manufacturing Science – A. Ghosh & A.K. Mallik – East West Press Pvt. Ltd., New Delhi
4. Production Technology – R.K. Jain – Khanna Publishers, New Delhi

THIRD SEMESTER
SUBJECT- Thermal Engineering
CODE- DP314

UNIT I Dimensions and Basic Concepts of Thermodynamics

Definition and importance of Thermodynamics, Thermodynamic system open, close and isolated system, Boundary and surroundings, Forms of energy. Point and path functions Properties of system, intensive and extensive properties, definition of work, Heat and work as energies in transitions, thermodynamic equilibrium Zeroth law of Thermodynamic. Quasi-static process, work done during Quasi-static process.

UNIT II: First Law of Thermodynamics

Concept of heat reservoir, Heat source and heat sink, Statement of first law-mathematical representation ,Application of first law to open and closed system. Concept of internal energy and its calculation, relationship between heat transfer, work transfer and change in internal Energy Steady flow energy equation and its application to various units such as Boiler, Nozzle, Turbine, Compressor ,Enthalpy. Ideal gas processes-isobaric, isochoric, isothermal, adiabatic, polytropic, and throttling process as applied to open and close system, representation of these processes on P-V diagram and T-S diagram Computation of net heat transfer and work done and enthalpy.

UNIT III : Second Law of Thermodynamics

Limitations of First law. Statement of second law-Kelvin planck's and clausius Statements, Concept of heat pump, refrigerator and heat engine , Thermal Efficiency, Parameters affecting Thermal efficiency, Means of increasing efficiency ,Equivalence of Kelvin Planck and clausius statements. Thermodynamics reversible and irreversible processes. Factors that makes a process irreversible. Reversible cycle, Carnot cycle, its efficiency and limitations, carnot theorem, clausius inequality, concept of Entropy, Principle of increase of entropy, determination of increase of entropy. T-S and H-S diagrams computation of change in entropy. Otto, Diesel and Dual cycles.

UNIT – IV: Two Phase System - Pure substance, phase, phase changes, steam as a two phase system, steam formation and its representation on the enthalpy plane, properties changes, Representation of wet, dry and saturated and superheated steam on PV,T-S and h-s planes. Dryness fraction of steam, methods of determination of dryness fraction-separating and throttling calorimeter. Use of steam tables and Mollier's diagram.

UNIT – V: Steam Generators

Definition, classification, Working of Babcock and Wilcox boiler and Lancashire boiler, Boiler mountings and accessories, boiler draught.

Text Books

Thermal Engineering By P.L. Ballany - Khanna Publisher's

Thermal Engineering – Vol-I & II By R.K.Kapoor, Tata McGraw Hill

Thermodynamics and heat Engines - Vol-I, By R Yadav, Central Book Depot, Allahabad

References :

Engineering Thermodynamics- by P.K.Nag, TMH

A Course in Thermodynamics and Heat Engines- by Kothanandran, Khajuria and arrora.

THIRD SEMESTER
SUBJECT- MACHINE DRAWING LAB
CODE- DP315

EXPERIMENTS TO BE PERFORMED

Following shall be list of sheets to be prepared as machine drawing lab. Work

1. One Sheet on multi view representation
2. Two sheets on sectional views of assembled parts on like I.C.engine parts and steam engine parts. One sheet on welding symbols.
3. One sheet on dimensioning, limits and tolerancing.
4. Two sheets on detailed drawing like drill jigs, fixtures, screw jack etc.
5. Two sheets on assembly drawing like flange coupling, stepped pulleys, foot step bearing, universal coupling, etc.
6. One sheet on Pipe joints and pipe fittings.
7. Two sheet on production drawing from any of the following using CAD-
 - o Hexagonal nut
 - o Spur gear
 - o Stepped pulley
 - o Connecting rod
 - o Stop valve
 - o Stop valve
 - o flange coupling
 - o safety valve
 - o Fly wheel
 - i. (Show the following parameters in the above drawing – tolerance, surface finish, part number, machining sequences)

THIRD SEMESTER
SUBJECT- THERMAL ENGINEERING LAB
CODE- DP317

EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)

1. To study Mountings & Accessories of a Boiler.
2. To study the Cochran Boiler and it's Accessories and Mountings.
3. To study the Lancashire and it's Accessories and Mountings.
4. To study the Babcock Wilcox and it's Accessories and Mountings.
5. To study a Simple Steam Engine.
6. To study a Simple Steam Engine with D-Slide Valve.
7. To study a Compound Steam Engine.
8. To study Meyer's Expansion Valve of Steam Engine.
9. To study Drop Valve of Steam Engine.
10. To study Two Stroke Petrol Engine.
11. To study Four Stroke Petrol Engine.
12. Determination of vacuum efficiency and condenser efficiency of a surface steam condenser.
13. Performance and testing of steam jet condenser.
14. Study of Steam Turbines
15. Study of Reciprocating Compressor

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Cornish Boiler or its model with mountings and accessories.
2. Cochran Boiler or its model with mountings and accessories.
3. Lancashire Boiler or its model with mountings and accessories.
4. Babcock Wilcox Boiler or its model with mountings and accessories.
5. Reducing Valve
6. Expansion Steam Trap
7. Steam Injector
8. Green Economizer
9. Super Heater
10. Steam Engine with D-Slide Valve
11. Spring Loaded Safety Valve
12. Throttle Valve
13. Stop Valve Hopkins's Type
14. Blow off Cock
15. Feed Check Valve
16. Lever Safety Valve
17. Dead Weight Safety Valve
18. Pressure Gauge
19. Fusible Plug
20. High Steam Low Water Safety Valve
21. Antipriming Pipe
22. Model of Two Stroke Petrol Engine
23. Model of Four Stroke Petrol Engine
24. Surface Steam Condenser experimental setup, Steam Turbine
25. Jet Condenser experimental setup, Reciprocating Compressor

THIRD SEMESTER
SUBJECT- MANUFACTURING TECHNOLOGY LAB
CODE- DP318

CARPENTRY: Timber, Definition, Engineering Application, Types of Wood, Seasoning and Preservation, PlyWood, PlyBoards. Practical Work: T Lap Joint End Lap Joint

FOUNDRY: Moulding Sands, Constituents and Characteristics, Pattern, Definition Material, Types, Core Prints, Role of Gate runner, riser, core, casting defects like blow holes & cavities. Practical Work: Mould of any pattern Casting of simple pattern

WELDING: Welding , Brazing and soldering process and their applications. Oxy-acetylene gas welding process, Type of flame & their application. Manual & Metal arc welding technique and equipment, AC & DC welding, Constituents and functions of electrode coating, welding positions, type of weld joints, Common welding defects. Practical Work: 1. Lap Joint by Gas Welding 2. Square butt joint Arc welding 3. Lap joint by Arc welding 4. Demonstration of brazing

METAL CUTTING: Introduction to machining and common machining operations. Cutting tool material, Definition of machine tools, specification and block diagram of lathe, Shaper Drilling machine and grinder. Common lathe operations such as turning, parting, chamfering and facing. Quick return mechanism of shaper, Difference between drilling and boring, Files-Material classification.

THIRD SEMESTER
SUBJECT- MACHINE SHOP – I
CODE- DP319

Min 10 experiments out of the following
(or such experiment alongwith study of the machines/processes)

1. Shear-angle determination (using formula) with tube cutting (for orthogonal) on lathe machine.
2. Bolt (thread) making on Lathe machine
3. Tool grinding (to provide tool angles) on tool-grinder machine.
4. Gear cutting on Milling machine.
5. Machining a block on shaper machine.
6. Finishing of a surface on surface-grinding machine.
7. Drilling holes on drilling machine and study of twist-drill.
8. Study of different types of tools and its angles & materials.
9. Experiment on tool wear and tool life.
10. Experiment on jigs/Fixtures and its uses
11. Resistance welding experiment.
12. Experiment on TIG/MIG Welding.
13. Macro and Microstructure of welding joints, HAZ.

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Center Lathe
2. Grinding Machine
3. Shaper Machines
4. Milling Machines
5. TIG and MIG Welding Machines
6. Resistance welding machines.
7. Drilling machines.
8. Various types of cutting tools.
9. jigs and fixtures.
10. Measurement Tools
11. Equipments for costing of nonferrous material.
12. EDM, ECM, USM, AJM, EBM and LBM.
13. gear shaping and gear hobbing machines, gear cutting on milling machines.