STRENGTH OF MATERIALS

CODE MP 201 L T P
CC/CE/MA/ME201 2 2/2 2/2

RATIONALE

In Engineering every structure or machine element is designed for a particular application. Then it is tested. A Diploma holder should be capable of designing the various elements for particular requirements. For this he must be able to calculate the stresses in an elements and their nature.

CONTENTS

1. Simple Stress and Strain:

1.1 Various mechanical properties

- 1.1.1 Elasticity
- 1.1.2 Plasticity
- 1.1.3 Ductility
- 1.1.4 Brittleness
- 1.1.5 Toughness
- 1.1.6 Hardness

1.2 Concept of stress and strain

- 1.2.1 Type of force - Direct, shear
- 1.2.2 Stress - Tensile, compressive, shear

1.3 Hook's law

- 1.3.1 Statement of Hook's law
- 1.3.2 Young's modulus of elasticity
- 1.3.3 Tensile test diagram
  - 1.3.3.1 Gauge length
  - 1.3.3.2 Limit of proportionality
  - 1.3.3.3 Elastic limit
  - 1.3.3.4 Yield point, Yield strength
  - 1.3.3.5 Ultimate stress
  - 1.3.3.6 Rupture strength
  - 1.3.3.7 Nominal stress
  - 1.3.3.8 Proof stress

1.4 Working stress and factor of safety
1.5 Stress and strain calculations

- 1.5.1 Principle of superposition
- 1.5.2 Bar of homogeneous section
  - 1.5.2.1 Bar of uniform cross-section
  - 1.5.2.2 Bar of steeped cross-section
- 1.5.3 Bar of composite section

1.6 Temperature stresses

- 1.6.1 Homogeneous section
- 1.6.2 Composite section

1.7 Shear stresses

1.7.1 Modulus of rigidity
1.7.2 Complementary shear stress
1.7.3 Concept of single shear and double shear
1.7.4 Shear strain

1.8 Poisson's ratio and volumetric strain

1.8.1 Lateral strain
1.8.2 Longitudinal strain
1.8.3 Volumetric strain
1.8.4 Bulk modulus

1.9 Relationship between elastic constants (Derivation)

1.9.1 E=3K(1-2/m)
1.9.2 E=2N(1+1/m)
1.9.3 E=9KN/(3K+N)

2. Compound Stress:

2.1 Introduction
2.2 Stress components on an inclined plane

2.2.1 Induced by direct stresses
2.2.2 Induced by simple shear
2.2.3 Induced by direct and simple shear stresses

2.3 Mohr's circle:

2.3.1 For like direct stresses
2.3.2 For unlike direct stresses
2.3.3 For two perpendiculars direct stresses with state of simple shear

2.4 Principal stresses and planes

2.4.1 Major principal stress
2.4.2 Minor principal stress
2.4.3 Mohr's circle method for principal stresses

3. Strain Energy:

3.1 Introduction
3.2 Strain energy from stress - strain diagram
3.3 Proof resilience
3.4 Types of loading - gradual, sudden, impact

3.4.1 Stress in gradual loading
3.4.2 Stress in sudden loading
3.4.3 Stress in impact loading

4. Bending Moments and Shear Force:

4.1 Basic concept

4.1.1 Types of support

4.1.1.1 Movable hinge support (roller)

4.1.1.2 Immovable hinge support
4.1.1.3 Fixed support

4.1.2 Types of beam

4.1.2.1 Cantilever beam
4.1.2.2 Simply supported beam
4.1.2.3 Fixed beam
4.1.2.4 Continuous beam
4.1.2.5 Overhanging beam

4.1.3 Types of load

4.1.3.1 Point load
4.1.3.2 Distributed load - uniformly and non uniformly

4.2 Shear force and bending moment

4.2.1 Concept and calculation of shear force and bending moment
4.2.2 Sign convention for shear force and bending moment

4.3 Bending moment and shear force diagrams (for point loads, U.D.L. and their combinations)

4.3.1 Cantilever beam
4.3.2 Simply supported beam
4.3.3 Simply supported beam with over hang

5. Moment of Inertia:

5.1 Concept of moment of Inertia
5.2 Radius of gyration

5.2.1 Parallel axis theorem
5.2.2 Perpendicular axis theorem

5.3 Moment of Inertia of various section

5.3.1 Rectangle
5.3.2 Triangle
5.3.3 Circle

5.4 Moment of inertia of unsymmetrical section like: T-section, channel section, L-section etc.

6. Bending Stresses in Beams:

6.1 Concept of bending stress
6.2 Theory of simple bending

6.2.1 Assumptions in theory of simple bending
6.2.2 Use of equation $\frac{M}{I} = \frac{f}{y} = \frac{E}{R}$ (with proof)

6.3 Design criterion and section modulus

6.3.1 Section modulus
6.3.2 Calculation of max bending stress in beams of rectangular, circular, I and T section

7. Shear Stress in Beams:

7.1 Concept

7.2 Use of equation $q = \frac{F}{Ib}(A\bar{y})$ (with proof)

7.3 Shear stress distribution diagram of various sections

- 7.3.1 Rectangle
- 7.3.2 I section
- 7.3.3 T section
- 7.3.4 Channel section
- 7.3.5 H section
- 7.3.6 + section
- 7.3.7 Circular section

8. Deflection:

8.1 Concept of deflection of a beam

8.2 Use of standard formula for calculating deflection (for point loads, U.D.L. and their combination)

- 8.2.1 Cantilever beam
- 8.2.2 Simply supported beam

9. Columns and Struts:

9.1 Concept of column and struts

9.2 Modes of failure

9.3 Types of column; long and short

9.4 Buckling loads

9.5 Slenderness ratio

9.6 Euler's formula (without proof)

- 9.6.1 Both ends hinged
- 9.6.2 One end fixed and other end free
- 9.6.3 Both ends fixed
- 9.6.4 One end fixed and other end hinged
- 9.6.5 Limitations of Euler's Formula
- 9.6.6 Equivalent length

9.7 Rankine's formula

10. Torsion of Shaft:

10.1 Concept of torsion

- 10.1.1 Angle of twist
- 10.1.2 Polar moment of Inertia
- 10.1.3 Assumptions in the theory of pure torsion

10.2 Derivation and use of

$$\frac{q}{r} = \frac{T}{J} = \frac{N\theta}{l}$$

10.3 Relation between power and torque

10.4 Combined stress due to bending and torsion in solid and hollow shaft

11. Springs :

11.1 Introduction and classification of springs
11.2 Flat carriage springs

11.2.1 Application of flat carriage springs
11.2.2 Determination of number of leaves and their sections, deflection and radius of curvature
11.2.3 Quarter elliptical spring

11.3 Closely coiled helical springs :

11.3.1 Application of closely coiled helical springs
11.3.2 Determination of deflection, angle of twist, number of coils and stiffness under axial loading in closely coiled helical springs.

12. Thin Cylindrical Shells :

12.1 Use of cylinders
12.2 Stresses due to internal pressure

12.2.1 Circumferential stress or hoop stress
12.2.2 Longitudinal stress

12.3 Design of thin cylinders - calculation of the various dimensions of a thin cylinder

13. Combined Direct and Bending Stress:

13.1 Effect of eccentricity
13.2 Stress due to eccentric load
13.3 Middle third rule
13.4 Quarter rule

PRACTICALS

1. Study of extensometers
2. Study and operation of UTM
3. Tensile test on mild steel specimen and plotting stress strain curve.
4. Bending test on timber beams.
5. Compression test on common structural materials viz. timber, cast iron etc.
6. Determination of toughness of cast iron and mild steel specimen by Charpy and Izod test.
7. Hardness test by Brinell and Rockwell test.
8. Determination of deflection for various types of loading
9. Torsion test on brass and mild steel
10. Determination of stiffness of close coiled spring

REFERENCE BOOKS :

1. Strength of Materials & Theory of Structures (vol. I) — B.C.Punmia
2. Strength of Materials — Ramamurtham
3. Strength of Materials — Junarkar
4. Strength of Materials — R.S. Khurmi
5. Strength of Materials (Hindi) — Gurcharan singh

* * * * *

PRODUCTION TECHNOLOGY - I

CODE MP 202

L	T	P
2	--	2

RATIONALE

This subject would impart the knowledge of various machinery. The knowledge of metal cutting would help the student in acquiring requisite skills to open up his own work shop or work in a industry

CONTENTS

1. Cutting Tools Material :

1.1 Standards shapes of single point cutting tools
1.2 Materials of cutting tool Properties of material
1.3 H.S. Steel, Cobalt, Tungsten, cemented carbides, diamonds and ceramics

2. Lathe Machines :

2.1 Types of lathes
2.2 Specification of lathes
2.3 Functions of lathes
2.4 Various operations performed on lathes
2.5 Attachments on lathe

3. Drilling Machines :

3.1 Types of drilling machines
3.2 Description, working and Applications
3.3 Work holding, tool holding devices
3.4 Types of drills and reamers
3.5 Selection of a drill
3.6 Various operations on drilling machines

4. Shaper :

4.1 Types of Shapers
4.2 Description, working and Applications
4.3 Construction features of shaper
4.4 Mechanism- Crank and slotted links, Whitworth, quick return and hydraulic
4.5 Work holding devices
4.6 Various operations on Shapers

5. Slotting Machines :

5.1 Difference between shaper and slotter
5.2 Types of slotters
5.3 Description, working and applications
5.4 Various operations on slotters

6. Planer :

6.1 Types of planers
6.2 Description, working and applications
6.3 Various operations on planers
6.4 Various mechanism of planer
6.5 Work holding devices
6.6 Difference between planer, shaper and slotter

7. Metal Cutting Saws

7.1 Types of metal cutting saws
7.2 Working and uses of sawing machines
7.3 Specifications
7.4 Suitability of sawing to machining operations
7.5 Description and construction of cutters/blade for sawing machines

PRACTICALS

1. Simple exercises on Lathe Machine involving -

1.1 Turning
1.2 Step Turning
1.3 Parting
1.4 Knurling
1.5 Chamfering
1.6 Grooving
1.7 Taper turning
1.8 Thread cutting

2. Simple exercises on Drilling -

2.1 Drilling
2.2 Boring
2.3 Counter sinking
2.4 Reaming
2.5 Tapping

3. Simple exercises on Shaper involving -

3.1 Preparing a MS Block with all face finished
3.2 Cutting a key along the length on the block

4. Internal Keyway cutting on a slotting machine.
5. Planning practice on a rectangular cast iron piece.

REFERENCE BOOKS :

1. Workshop Technology (Vol.-II) Hazra Chaudhary
2. Workshop Technology (Vol.-II) B. S. Raghuvanshi
3. Workshop Technology (Hindi) S. K. Bhatnagar

*****

MANUFACTURING PROCESS

CODE MP 203

L	T	P
2	--	2

RATIONALE

This subject provides an opportunity to the student to learn about various welding processes and foundry work. Welding is very useful for fabrication work and Foundry for production of castings used for manufacturing of machines. This also gives knowledge of metal cutting mechanism to the student. Theory is to be supported by visits to industries and case studies. This will help in developing proper attitude and skill to the technicians. Hence the technicians will be in a position to help and solve the problems of industry.

CONTENTS

7.3 Properties of molding - sand, permeability, refractoriness, adhesiveness, cohesiveness, strength, flowability, collapsibility
7.4 Tempering, sand conditioning and sand muller.

8. Core and Core Making :

8.1 Core, core print and core boxes
8.2 Types of cores, functions, advantage of core, shrinkage of cores
8.3 Core sand and binders, core loams, oil and CO_2 cores, synthetic resin
8.4 Core Making procedure, core oven and core baking.

9. Testing of Moulding Sands :

9.1 Need for testing chemical analysis, moisture content test, clay content test, Grain fineness test
9.2 Permeability test and strength test.

10. Mould Making :

10.1 Moulding boxes, hand tools used for mould making
10.2 Steps involved in making a mould, gating system: definition and brief idea of basin, sprue, runner and gates
10.3 Moulding machines - Squeeze machine, jolt squeeze machine and sand slinger.
10.4 Moulding processes - Green sand, dry sand, loam, Co_2 moulding, skin dried, plaster, metal moulding

11. Special Casting Techniques :

11.1 Die casting - Hot chamber, cold chamber process
11.2 Investment or lost wax process
11.3 Centrifugal casting - True, Semi centrifugal, centrifugal
11.4 Shell moudling
Advantages, Disadvantages and application of above processes

12. Melting Furnaces :

12.1 Cupola furnace - Construction, operation, preparation, charging
12.2 Crucible furnace of tilting types - construction, operation

13. Castings :

13.1 Different types of defects
13.2 Testing of defects - Radiography, magnetic particle inspection, Ultrasonic inspection

PRACTICALS

1. Making following types of joints by gas welding :
1.1 Preliminary joining practice on gas welding
1.2 Vertical welding

2. Exercises of gas welding on the following

2.1 Aluminium welding
2.2 Brass welding
2.3 Copper welding
2.4 C.I. welding

3. Gas cutting of the following types
3.1 Preliminary gas cutting practice
3.2 Stock cutting by oxy acetylene
3.3 C.I. cutting

4. Making following types of joints by arc welding

4.1 Preliminary joining practice by arc welding
4.2 Butt and lap joint (in vertical position travel up and down)
4.3 Welding of outside corner joint

5. Exercise on spot welding
6. Exercise on brazing
7. Exercise on TIG/MIG/CO_2 welding
8. Pattern making :

8.1 Preparation of solid pattern (single piece)
8.2 Preparation of split pattern
8.3 Preparation of self cored pattern

9. Preparation of the following types of moulds .

9.1 Floor moulding
9.2 Turn over moulding.

10. Testing of moulding sand- moisture content
11. Moulding and casting of

11.1 A solid pattern
11.2 A split pattern

12. Testing and inspection of casting defects visually
Foundry exercise can be shown in a nearby industry/ foundry.

REFERENCE BOOKS :

1.	A Text Book of Welding Technology	O.P. Khanna
2.	Welding Technology	Tahil Maghnani
3.	A Text Book on Foundry Technology	M.Lal & O.P.Khanna.
4.	Foundry Engineering	Tahil Meghnani
5.	Manufacturing Process - I	R.K. Yadav

******

THERMAL ENGINEERING

CODE MP 204 L T P
MR 204 2 -- 2

RATIONALE

For a technician in Refrigeration and Air Conditioning field the subject of heat engineering is very important for understanding the basic principles and concepts of thermodynamics and its application. Boilers have been added to the contents so as to provide knowledge about the generation of steam for heating purpose. Knowledge of air compressors is also essential for them.

CONTENTS

1. Introduction :

1.1 Basic concept
1.2 Types of system
1.2.1 Open
1.2.2 Closed

1.3 Isolated boundary and surroundings
1.4 Intensive properties
1.4.1 Pressure
1.4.2 Temperature

1.5 Extensive properties
- 1.5.1 Mass
- 1.5.2 Volume
- 1.5.3 Specific heat
- 1.5.4 Internal energy
- 1.5.5 Potential energy
- 1.5.6 Kinetic energy
- 1.5.7 Flow energy
- 1.5.8 Heat, work
- 1.5.9 Enthalpy

2. Gas Laws :

2.1 Boyle's law
2.2 Charles's law
2.3 Joule's law
2.4 Characterised gas equation
2.5 Gas constant
2.6 Mole
2.7 Universal gas constant
2.8 Molar specific heat
2.9 Simple numerical problems

3. Laws of Thermodynamics :

3.1 Zeroth law
3.2 First law
3.3 Law of conservation of energy and its mathematical equation
3.4 Second law
3.5 Concept of entropy

4. Thermodynamic Processes :

4.1 Study and p-v diagrams

- 4.1.1 Constant pressure
- 4.1.2 Constant temperature
- 4.1.3 Hyperbolic
- 4.1.4 Reversible adiabatic
- 4.1.5 Polytropic
- 4.1.6 Free expansion and throttling

4.2 Work done
4.3 Change of internal energy
4.4 Change of entropy
4.5 Simple numerical problems

5. Cycles and Air Standard Efficiency :

5.1 Concept of reversibility
5.2 Thermal efficiency of cycle
5.3 Air standard efficiency and its assumption
5.4 Carnot cycle

- 5.4.1 P-v diagram
- 5.4.2 Thermal efficiency
- 5.4.3 Application
- 5.4.4 Limitation

5.5 Concept of heat engine, refrigerator and heat pump

5.6 Explanation of entropy
5.7 Simple problems on work done and efficiency of Carnot cycle

6. Properties of Pure Substances (Steam) :

6.1 Change of phase of water during a constant pressure process
6.2 Generation of steam at constant pressure
6.3 Enthalpy of wet and dry saturated steam
6.4 Dryness fraction
6.5 Superheated steam
6.6 Enthalpy of steam
6.7 Specific volume
6.8 External work of evaporation
6.9 Internal latent enthalpy
6.10 Internal energy of steam
6.11 Entropy of steam
6.12 Use of steam tables, T-S, H-S charts
6.13 Heating and expansion of steam during thermodynamic processes
6.14 Change of internal energy, enthalpy and entropy of steam
6.15 Simple problems

7. Steam Boilers :

7.1 Classification
7.2 Description and working
7.3 Boiler mountings and accessories

8 I. C. Engines :

8.1 Classification of I.C. Engines
8.2 Two stroke and four stroke cycles
8.3 Brief description and working of Petrol Engine and Diesel Engine.
8.4 Cooling of I.C. Engines
8.5 Lubrication systems of I.C. Engines
8.6 Governing of I.C. Engines
8.7 Description of Zenith and MPFI carburetor
8.8 Diesel fuel pump and injector
8.9 Carnot cycle
8.10 Otto cycle
8.11 Diesel cycle and
8.12 Dual combustion cycle
8.13 Their air standard efficiency
8.14 Simple problems
8.15 I.P., B.P., and methods of finding I.P. and B.P.
8.16 Mechanical energy balance sheet of I.C. engines.

9. Air Compressors :

9.1 Industrial use of compressed air
9.2 Classification of compressors

9.2.1 Single stage compressor
9.2.2 Multistage compressor

9.3 Intercooling and aftercooling
9.4 P-v diagrams and power required
9.5 Rotary and centrifugal compressor

PRACTICALS

1. Study by models/charts/actual units of Common type of fire tube and water tube boiler
2. Study by models/charts/actual units of the followings -
   - 2.1 Boiler mountings
   - 2.2 Boiler accessories
3. Study by models, charts and actual units of Petrol Engine
4. Study by models, charts and actual units of Diesel Engine
5. Study by models, charts and actual units of Carburetor
6. Study by models, charts and actual units of Diesel fuel pump and fuel injector
7. Determination of dryness fraction of steam by separating and throttling calorimeter
8. Study of reciprocating air compressor.
9. Study of rotary air compressor.
10. Study of centrifugal air compressor.

REFERENCE BOOKS :

1. Thermal Engineering — Mathur & Mehta
2. Thermal Engineering — Rai & Saro
3. Thermal Engineering — Balani
4. Thermal Engineering — Verma & Gulecha
5. Thermal Engineering — Nag

******

MACHINE DRAWING - I

CODE MP 205

L	T	P
--	--	3

RATIONALE

Machine drawing is essential for expressing and understanding the constructional features of different machines their component and assemblies. For this the knowledge of universal conventions and practices is necessary.

CONTENTS

1. Machine Symbols :

- 1.1 Introduction to machining symbols

2. Fasteners :

- 2.1 Nuts
- 2.2 Bolts

3. Joints and Couplings :

- 3.1 Cotter and Knuckle joints
- 3.2 Flexible bushed pin type coupling
- 3.3 Universal coupling

4. Pulleys :

- 4.1 Stepped pulleys
- 4.2 Fast and loose pulleys

5. Bearings :

- 5.1 Taper Roller Bearings

5.2 Plumber Block
5.3 Wall bracket

6. Engine Parts :

6.1 Stuffing box
6.2 Eccentric
6.3 IC engine Connecting rod
6.4 Piston

7. Assembled Drawings :

7.1 Tail stock
7.2 Shaper tool head
7.3 Drilling jig
7.4 Machine vice

REFERENCE BOOKS :

1. Machine Drawing — P.S.Gill
2. Machine Drawing — R.B.Gupta
3. Machine Drawing — Laxmi Narayanan & Mathur
4. Machine Drawing — K.R.Gopalkrishnan
5. Machine Drawing — Siddeshwar
6. Intermediate Machine Drawing — A.C. Parkinson

*****

HEAT TREATMENT AND MATERIAL SCIENCES

CODE MP 206

L	T	P
1	2/2	--

RATIONALE

Material and its treatment have been an important filed of study and analysis for any production engineer. This subject is designed to give the student basic knowledge about material, structure, heat treatment processes etc. for ferrous as well as non-ferrous metals.

CONTENTS

1. Introduction and Properties of Materials :

1.1 Engineering materials and their classification
1.2 Purpose of heat treatment
1.3 Different phases of steel

1.3.1 Iron carbon diagram

2. Structure of Metals and their Deformation :

2.1 Metal structure
2.2 Arrangement of atoms in metals
2.3 Crystalline structure of metals
2.4 Deformation of metal

3. Commonly used Operation of Heat Treatment :

- 3.1 Annealing
  - 3.1.1 Objects of annealing
  - 3.1.2 Process annealing
- 3.2 Normalizing
- 3.3 Hardening
  - 3.3.1 Quenching
  - 3.3.2 Hardening defects
- 3.4 Tempering
  - 3.4.1 Low temperature tempering
  - 3.4.2 Medium temperature tempering
  - 3.4.3 High temperature tempering
- 3.5 Austempering
  - 3.5.1 T.T.I. curve or S curve or Isothermal curve
- 3.6 Martempering
- 3.7 Case hardening
  - 3.7.1 Carburising
  - 3.7.2 Nitriding
  - 3.7.3 Cyaniding
  - 3.7.4 Induction hardening
  - 3.7.5 Flame hardening

4. Heat treatment of hammer, dies and die moulds

5. Heat treatment of high speed steel

6. Ferrous Materials :

- 6.1 Classification of iron and steels
- 6.2 Manufacturing of pig iron, wrought iron, cast-iron and steel
- 6.3 Types of cast iron : white, malleable and grey.
- 6.4 Classification of steels
- 6.5 Effect of various alloying elements on steel and alloy steel

7. Non Ferrous Materials :

- 7.1 Important ores and properties of Al, Co, Zn, Tin and Lead

8. Plastic Materials

- 8.1 Definitions
- 8.2 Classifications
- 8.3 General characteristics of following plastic materials
  - 8.3.1 Thermosetting plastic
  - 8.3.2 Thermo-plastic plastic
- 8.4 Common engineering applications of following plastic materials
  - 8.4.1 Thermosetting plastic
  - 8.4.2 Thermo-plastic plastic

REFERENCE BOOKS :

1. Workshop Technology — Chapman
2. Material Science — R.K. Rajput

* * * * *

METROLOGY

CODE MP 207

L	T	P
2	--	2

RATIONALE

This subject is related to the measurement of product dimensions, which is an important part of production. Every product has some dimensions and qualities to measure upon which quality of product depends. The content of syllabus broadly includes linear and angular surface, thread and gear measurements etc. and inspection procedures. It helps in developing skill of measurement.

CONTENTS

1. Linear and Angular Measurement :

1.1 Bevel protractor
1.2 Sine bar
1.3 Angle gauges
1.4 Clinometer
1.5 Auto collimator
1.6 Angle dekkar
1.7 Taper measurements using slip gauges, rollers vernier calliper, depth gauge and height gauges etc.

1.7.1 Checking the angle of a piece tapered on one side
1.7.2 To check the angle of a tapered hole
1.7.3 To determine the included angle of an internal dovetail
1.7.4 To measure the angle of a V groove
1.7.5 To determine the width of a V groove
1.7.6 To find out the radius of circle of any job having a portion of a circle.

2. Measurement of Surface Finish :

2.1 Meaning of surface texture, primary and secondary texture
2.2 Lay, sampling length, mean line of profile, centre line of profile
2.3 CLA and RMS value
2.4 Factors affecting surface finish
2.5 Representation of important surface roughness parameters

2.6 Measurement of surface finish

2.6.1 Comparison methods
2.6.2 Direct instrument measurements by Stylus probe instrument

3. Measurement of Surface Finish :

3.1 Principle of interference
3.2 Interferometry applied to flatness testing
3.3 N.P.L. flatness interferometer

4. Measurements by Comparison :

4.1 Classification of dial gauges
4.2 Advantages of dial gauges
4.3 Working mechanism of dial indicator
4.4 Passmeters
4.5 Comparators

4.5.1 Advantages and disadvantages of Mechanical, Electrical, Optical and pneumatic comparators
4.5.2 Read type mechanical comparator (Construction and working)
4.5.3 Principle of electrical comparator
4.5.4 Theory of pneumatic gauging

5. Screw Thread Measurement :

5.1 Screw thread terminology
5.2 Errors in threads
5.3 Effective diameter measurement by two wire and three wire methods and three wire method
5.4 Measurement of major and minor diameter

6. Gear Measurement :

6.1 Terminology of gear
6.2 Measurement of tooth thickness by gear tooth vernier calliper
6.3 Calculation of blank diameter

7. Machine Tool Metrology

7.1 Introduction
7.2 Machine tool measurement
7.3 Alignment test
7.4 Performance test
7.5 Alignment test on lathe machine
7.6 Alignment test on drilling machine

8. Fits and Tolerance:

8.1 Interchangeability
8.2 Types of fits
8.3 Definitions and terminology limits, fits and tolerances

PRACTICALS

1. Measurement with the vernier calliper, external and internal
2. Measurement with micrometer external and internal
3. Measurement with height and depth gauges.
4. Measurement with dial indicator using surface plate and accessories for

4.1 Flatness
4.2 Concentricity of round jobs

5. Measurement with combination set and measurement of angle with bevel protractor.
6. Study and use of slip gauges
7. Measurement of thread characteristics
8. Marking and measuring exercise (with all measuring devices)
9. Study of limit gauges such as- plug, snap, thread gauges
10. Measurement of tapers - external and internal
11. Measurement of gear characteristics
12. Measurements of bore with cylinder dial gauge for size, ovality and taper
13. Measurement of angle with the help of Sine bar -

13.1 Height gauge
13.2 Slip gauge

14. Measurement of worn-out I.C. engine piston, clearance between cylinder and piston and between bearing and journal.
15. Study and use of comparators
16. Study and use of tool room microscopes.

REFERENCE BOOKS :

1. Engineering Metrology R.K.Jain
2. Engineering Precision Metrology R.C.Gupta
3. Engineering Metrology (Hindi) Mittal
4. Engineering Metrology (Hindi) Bhatnagar.

*****

INDUSTRIAL ELECTRICAL AND ELECTRONICS

CODE MP 208

L	T	P
2	--	2

RATIONALE

This subject is designed to give basic knowledge of electrical machines such as transformers, AC DC Machines and electronics utilization. After going through the course the students will develop capabilities to handle electrical machines, which they may come across.

CONTENTS

1. Transformers:

1.1 Introduction to AC circuits
1.2 Construction and working principle
1.2 emf. equation
1.3 mmf balance
1.4 leakage, flux and reactance voltage
1.5 Phasor diagram
1.6 Equivalent circuit
1.7 No load and short circuit test
1.8 Hysteresis and eddy current losses
1.9 Efficiency
1.10 Cooling, auto transformer
1.11 3-phase and transformer connections (simple description)

2. D.C. Motors:

2.1 Construction
2.2 Types of field excitation
2.3 Generator principle
2.4 e.m.f. equation
2.5 Working of motor
2.6 Functions of commutator
2.7 Back emf, torque and speed relation
2.8 Speed torque armature current characteristics of series, shunt and compound motors
2.9 Starting
2.10 Starter speed control
2.11 Applications of D.C. drive

3. Induction Motors:

3.1 Construction and working principle
3.2 Relation between speed, poles and frequency

3.3 Slip, torque - slip characteristics
3.4 Starting
3.5 Various starters
3.6 Speed control
3.7 Comparison with DC drive
3.8 Single phase motor working
3.9 Starting methods
3.10 Types of construction

4. Power Electronics:

4.1 Thyrister, construction working characteristic (tow transistor theory)
4.2 Firing gate control
4.3 Controlled rectification
4.4 Basic inverter
4.5 Application of power control devices in drives (simple block diagram concept only)

5. Measuring Instruments:

5.1 Control and damping
5.2 PMMC and MI instruments
5.3 Multi Meter, dynamometer, wattmeter
5.4 Induction type energy meter and megger

6. Instrumentation:

6.1 Transducers
6.2 Measurement of mechanical quantities

6.2.1 Temperature
6.2.2 Displacement and strain etc

6.3 Typical instrumentation system

7. Industrial Drive:

7.1 Comparison of A.C. and D.C. drive systems
7.2 Selection of motors for industrial drive

7.2.1 Rolling miles
7.2.2 Paper mills
7.2.3 Crane
7.2.4 Mines
7.2.5 Textile mills
7.2.6 Lathe
7.2.7 Pump

8. Electrical panels and control equipments

8.1 Introduction of electrical panels
8.2 Simple constructional detail and circuit diagram
8.3 Power factor
8.3 Control Equipment
8.3.1 HRC Fuses
8.3.2 MCB, MCCB, ELCB,ACB
8.3.3 Relay

PRACTICALS

1. Study of transformers and Determination of turn ratio of transformer
2. Open circuit and short circuit test on a single phase transformer
3 Determination of efficiency and regulation of a 1-phase transformer by direct loading.
4. Study of the construction and field connection of the D.C. machines connection starting, speed control and reversal of rotation of D.C. shunt motor.
5. Study of construction of three phase and single-phase induction motors connection starting and reversal of rotation of induction motors.
6. Connection and function of D.O.I. starter.
7. Connection and function of star delta starter.
8. Study of the construction of PMMC, MI instruments and their use.
9. Study of energy meter and wattmeter. Direct load test of an energy meter and its calibration.
10. Connection of ELCB and fuse on a switch board

REFERENCE BOOKS :

1.	Basic Electrical Engg.	V.N. Mittal
2.	Electrons of Electrical Engg.	K.D. Sharma
3.	Electrical & Electronics	B.L. Thereja
4.	Electrical Science	B.R. Gupta
5.	Electronics and Instruction	H.M. Rai

* * * * *

INDUSTRIAL HYDRAULICS

CODE MP 209

L	T	P
1	--	2

RATIONALE

For technicians educating in the field of production engineering the subject of Industrial Hydraulics is important for understanding the basic principles, concepts and application of hydraulic drives in the modern day industry. The knowledge of hydraulics and the practical applications involved in it is essential in order to understand the recent advances in the field of machine tool industry and precision machining techniques.

CONTENTS

1. Introduction to Hydraulics :

1.1 Properties of fluids

- 1.1.1 Viscosity
- 1.1.2 Temperature
- 1.1.3 Pressure
- 1.1.4 Relationship between them (Bernoulli's theorem, Pascal's Law)

1.2 Specification of fluids

- 1.2.1 Flash And Fire point
- 1.2.2 Colour
- 1.2.3 Lubricity
- 1.2.4 Film Strength

1.3 Dynamic Force and power

1.4 Types of Flows

- 1.4.1 Streamline
- 1.4.2 Turbulent

2. Principles of Hydraulic Machinery:

2.1 Components

2.1.1 Hydraulic Actuator
2.1.2 Control Devices (Valves)
2.1.3 Generator
2.1.4 Accessories

2.2 Electrical Controls
2.3 Principle of Hydraulic Circuit design

3. Hydraulic Actuators:

3.1 Linear Devices

3.1.1 Single acting
3.1.2 Double acting
3.1.3 Telescopic
3.1.4 Tandem Devices

3.2 Rotary Devices

3.2.1 Types of Hydraulic Motors – Vane Type, Screw type, Gear type

4. Control Devices:

4.1 Direction Control valves

4.1.1 Two Way DCV
4.1.2 Three Way DCV
4.1.3 Four Way DCV
4.1.4 Unidirectional (Check Valve)

4.2 Flow Control valves
4.3 Pressure Control valves

4.3.1 Direct Pressure operated
4.3.2 Relief Valve

5. Generating Devices (Hydraulic Pumps):

5.1 Rotary Pumps

5.1.1 Vane Pump
5.1.2 Gear pump
5.1.3 Screw Pump

5.2 Reciprocating pumps

5.2.1 Piston pumps

6. Accessories :

6.1 Reservoirs
6.2 Filtration units
6.3 Accumulators
6.4 Pressure switches
6.5 Pressure Gauges
6.6 Oil level Gauges

7. Hydraulic Circuits for Various Industrial Applications:

7.1 Hydraulic drives

7.1.1 Lathe
7.1.2 Surface Grinder
7.1.3 Shaper

7.2 Clamping And Locating devices
7.3 Application to special circuits- intensifiers etc.

7.3.1 Hydraulic Press
7.3.2 Hydraulic Crane
7.3.3 Hydraulic Jack

7.4 Mobile applications-, etc.

7.4.1 Earth movers
7.4.2 Loaders

8. Piping and Piping layout

8.1 Introduction
8.2 Pipe fittings and Drawing symbols
8.3 Standardization and specifications of pipe
8.3 Piping design and layout

PRACTICALS

1. Study of Various Hydraulic components
2. Preparation of suitable Hydraulic circuit for given industrial applications
3. Study of various mobile hydraulic devices
4. Study of various types of fluid couplings
5. Study of hydraulic brakes
6. Study of copying attachment for lathe machine
7. Study of flow characteristics of various pumps at different pressure ranges
8. Study of various piping layouts

REFERENCE BOOKS :

1 Fluidics & Tribology A. Aggrawal
2 Industrial Hydraulics John Pippenger

*****

'C' PROGRAMMING

CODE MP 210 L T P
Same in all branches except AR/CC/CE/CS/EE/IT 2 -- 2

RATIONALE

RATIONALE

'C' is computer programming language and also structured programming language. In 'C' programming language we consider various syntax used in programming. By having good knowledge of 'C', students can write modular application and system programs. 'C' can be used in the engineering applications. By acquiring a sound knowledge of 'C' students will be able to understand the concept of all the application areas. This course is specially designed for engineering students of all diploma streams.

CONTENTS

1. Introduction:

1.1 Scope of 'C' Language
1.2 Distinction and similarities with other HLLs
1.3 Special features and Application areas

2. Elements of 'C' :

2.1 Character set
2.2 Key words
2.3 Data types
2.4 Constants and Variables
2.5 Operators: unary, binary, ternary
2.6 Operator precedence

3. Console Input-Output:

3.1 Types of I-O
3.2 Console I-O
3.3 Unformatted console I-O: getchar(),putchar(), gets(), puts(), getch(),getche()
3.4 Formatted I-O: scanf(), printf()

4. Control Flow :

4.1 Statements and blocks
4.2 if
4.3 switch
4.4 Loops: for, while, do-while
4.5 goto and labels
4.6 break, continue, exit
4.7 Nesting control statements

5. Arrays :

5.1 Basic concepts
5.2 Memory representation
5.3 One dimensional array
5.4 Two dimensional array

6. Functions :

6.1 Basic concepts

6.2 Declaration and prototypes
6.3 Calling
6.4 Arguments
6.5 Scope rules
6.6 Recursion
6.7 Storage classes types
6.8 Library of functions: math, string, system

7. Pointers :

7.1 Basic concepts
7.2 &, * operator
7.3 Pointer expression: assignment, arithmetic, comparison
7.4 Dynamic memory allocation
7.5 Pointer v/s Arrays

8. Structure and Enumerated Data Types :

8.1 Basic concepts
8.2 Declaration and memory map
8.3 Elements of structures
8.4 Enumerated data types : typedef, enum
8.5 Union

PRACTICALS

1. Problems based on arithmetic expression, fixed mode arithmetic.
2. Problems based on conditional statements and control structures.
3. Problems based on arrays (1-D, 2-D), functions and pointers.
4. Problems based on engineering applications.

REFERENCE BOOKS :

1. 'C' Programming — Stephen Kochan
2. Programming with 'C' — Schaum's Series
3. 'C' Programming — V.Balguru Swami
4. 'C' Programming — Kernighan & Ritchie
5. Let us 'C' — Yashwant Kanetkar

* * * * *