

STRENGTH OF MATERIALS

CODE CE 201
CC201/MA/ME/MP 201

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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 stepped 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 $q = \frac{F}{Ib}(\bar{A}y)$ (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 |

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FLUID MECHANICS

CODE CE 202

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RATIONALE

Technicians have to deal with pressure measurement, transportation of fluids and the machines converting hydraulic power into mechanical power and vice versa, in the field/industries for that one has to have a basic knowledge of fluid mechanics. Topics such as pressure measurement, laws governing the flow of liquids, measurement of discharge, production of power are included in this subject.

Although the major emphasis in this subject is on the study of liquids like water an incompressible fluid yet all the principles are applicable to all the fluids such as air, gas, steam etc.

CONTENTS

1. Introduction:

- 1.1 Introduction concepts
 - 1.1.1 Fluids and solids
 - 1.1.2 Liquid, gas and vapour
- 1.2 Fluid mechanics
 - 1.2.1 Kinematics
 - 1.2.2 Dynamics
- 1.3 Fluid properties
 - 1.3.1 Density
 - 1.3.2 Specific volume
 - 1.3.3 Specific gravity
 - 1.3.4 Viscosity
 - 1.3.4.1 Newton's law of viscosity
 - 1.3.4.2 Dynamic and Kinematic viscosity
 - 1.3.5 Compressibility
 - 1.3.6 Surface tension - soap bubble, drop
 - 1.3.7 Capillarity
 - 1.3.8 Vapour pressure and its importance

2. Fluid Pressure and its Measurement:

- 2.1 Definition and its units
- 2.2 Pascal's law
 - 2.2.1 Intensity of pressure at a point in fluid at rest
 - 2.2.2 Pressure head
- 2.3 Pressure
 - 2.3.1 Atmospheric pressure
 - 2.3.2 Gauge pressure
 - 2.3.3 Vacuum pressure
 - 2.3.4 Absolute pressure
 - 2.3.5 Differentials pressure
- 2.4 Law of hydrostatic pressure
- 2.5 Brahma's press
- 2.6 Pressure measurement
 - 2.6.1 Manometers
 - 2.6.1.1 Piezometer - its limitation

- 2.6.1.2 U-tube - simple, differential, inverted
- 2.6.1.3 Micro-manometers
- 2.6.1.4 Inclined tube micro-manometers

2.6.2 Mechanical gauge

- 2.6.2.1 Bourdon gauge
- 2.6.2.2 Bellow gauge
- 2.6.2.3 Diaphragm gauge
- 2.6.2.4 Dead weight gauge

3. Hydrostatics:

- 3.1 Total pressure
- 3.2 Centre of pressure
- 3.3 Total pressure and center of pressure in following cases
 - 3.3.1 Plane surface immersed horizontally
 - 3.3.2 Plane surface immersed vertically
 - 3.3.3 Plane surface immersed at an angle
 - 3.3.4 Curved surface (no proof)
- 3.4 Working of lock gates, sluice gate
- 3.5 Pressure on masonry dams of rectangular and trapezoidal sections and their condition of stability

4. Hydrokinematics :

- 4.1 Description of fluid flow
 - 4.1.1 Euler approach
 - 4.1.2 Lagrangian approach
- 4.2 Definition of path line, stream line
- 4.3 Types of flow
 - 4.3.1 Steady - Non steady
 - 4.3.2 Uniform - Non uniform
 - 4.3.3 Laminar - Turbulent
 - 4.3.4 One, Two, Three dimensional flow
- 4.4 Continuity equation (no proof) :
 - 4.4.1 Assumption
 - 4.4.2 Rate of discharge
 - 4.4.3 one dimensional flow

5. Hydrodynamics and Measurement of Flow:

- 5.1 Energy of fluid - pressure, kinetic and potential
- 5.2 Bernoulli's theorem (no proof)
 - 5.2.1 Assumptions and its limitation
 - 5.2.2 Conversion of pressure into pressure head, velocity into kinetic head
- 5.3 Applications of Bernoulli's theorem
 - 5.3.1 Pitot-tube
 - 5.3.2 Venturimeter
 - 5.3.3 Orificemeter

6. Orifices and Notches:

- 6.1 Definition and classification
- 6.2 Discharge through small orifices
 - 6.2.1 Coefficient of contraction
 - 6.2.2 Coefficient of velocity
 - 6.2.3 Coefficient of discharge
 - 6.2.4 Coefficient of resistance
- 6.3 Time of emptying a vessel of uniform cross section through an orifice at bottom.
- 6.4 Notches - Classification
 - 6.4.1 Crest, Nappe
 - 6.4.2 Difference between notch and weir
- 6.5 Flow over -
 - 6.5.1 Triangular notch
 - 6.5.2 Rectangular notch

[Simple numerical problems without velocity of approach]

7. Flow Through Pipes:

- 7.1 Laws of fluid friction.
- 7.2 Losses of head in pipes
- 7.3 Hydraulic gradient line.
- 7.4 Total energy line.
- 7.5 Flow through pipes in series.
- 7.6 Equivalent length
- 7.7 Flow through parallel pipes (No branched pipes)
- 7.8 Flow through siphon
- 7.9 Definition of water hammer and its effect (No mathematical calculations)

8. Flow through Channels:

- 8.1 Types of flow
 - 8.1.1 Uniform and Non uniform flow, difference in pipe and channel flow.
- 8.2 Classification of an open channel
- 8.3 Formula for uniform flow in open channels
 - 8.3.1. Chezy's formula
 - 8.3.2. Kutter's formula
 - 8.3.3. Bazin's formula
 - 8.3.4. Manning's formula
- 8.4 Factors affecting roughness co-efficient
- 8.5 Values of roughness co-efficient for different channel conditions
- 8.6 Most economical section of channel -
 - 8.6.1 Rectangular section
 - 8.6.2 Triangular section
 - 8.6.3 Trapezoidal section
 - 8.6.4 Circular section
- 8.7 Specific energy of flow in a channel at a cross section

- 8.8 Explanation of the terms -
 - 8.8.1 Critical depth
 - 8.8.2 Critical flow
 - 8.8.3 Sub-critical flow
 - 8.8.4 Super-critical flow
 - 8.8.5 Hydraulic jump
- 8.9 Measurement of flow in open channel by -
 - 8.9.1 Surface slope measurement
 - 8.9.2 Velocity measurement
 - 8.9.3 Flow measurement

9. Turbines :

- 9.1 Introduction
- 9.2 Classification of turbines
- 9.3 Working principles of impulse and reaction turbine
- 9.4 Constructional detail and working of different types of turbines (No mathematical analysis.)
 - 9.4.1 Pelton wheel turbine
 - 9.4.2 Francis turbine
 - 9.4.3 Kaplan turbine

10. Pumps :

- 10.1 Classification of pumps
- 10.2 Constructional detail of reciprocating pump
- 10.3 Constructional detail of centrifugal pump
- 10.4 Comparison of reciprocating and centrifugal pump
- 10.5 Brief description of submersible pump and deep well turbine pump
- 10.6 Installation and maintenance of pumps

PRACTICALS

1. Determination of coefficient of friction in pipe
2. Determination of losses of head in flow through pipes
3. Determination of roughness coefficient for different types of channel surfaces.
4. Determination of surface velocity and mean velocity in an open channel
5. Study of constructional features of working of Pelton wheel turbine and Francis turbine.
6. Study of constructional features and working of centrifugal and reciprocating pump
7. Study of different types of manometers and pressure gauges
8. Verification of Bernoulli's theorem
9. Determination of C_d for Venturimeter
10. Determination of C_d for Orificemeter
11. Determination of C_c, C_v and C_d of small orifice
12. Visit of a nearby dam

REFERENCE BOOKS:

- | | |
|-------------------------------|--------------------|
| 1. Hydraulics | Modi & Seth |
| 2. Hydraulics | K. R. Arora |
| 3. Hydraulics | Anand & Kulsrestha |
| 4. Hydraulics | B. L. Gupta |
| 5. Fluid Mechanics & Machines | Dr. Jagdish Lal |
| 6. Fluid Mechanics & Machines | Dr. R.K.Bansal |
| 7. Fluid Mechanics & Machines | R.S.Khurmi. |
| 8. Hydraulics & Pneumatics | H.L. Stewart. |

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BUILDING TECHNOLOGYCODE CE 203
CC 203L T P
2 2/2 --**RATIONALE**

Building construction is an important job of Civil Engineering diploma holder. So he must acquire the knowledge of various parts of the building, their functions, importance and procedure of construction and maintenance. Building technology includes all the aspects of construction and importance of building work.

CONTENTS**1. Introduction :**

- 1.1 Definition of a building
- 1.2 Classification of building based on occupancy
- 1.3 Explanation of different parts of a building

2. Foundation :

- 2.1 Concept of foundation
- 2.2 Factors affecting selection of foundations
- 2.3 Definition and importance of bearing capacity, Average bearing capacity of common soils.
- 2.4 Types of foundations- shallow and deep foundations
- 2.5 Shallow foundation- spread footings, raft and inverted arch foundation. Rankine's formula for depth of foundations
- 2.6 Deep Foundation - Pile foundation, their suitability, Classification of piles according to function, material and installation
- 2.7 Causes of failure of foundation and remedial measures.

3. Walls :

- 3.1 Purpose of walls
- 3.2 Types of walls- Load bearing, non-load bearing
- 3.3 Partition walls - construction details, suitability and use of brick and wooden partition walls.
- 3.4 Cavity walls - Brief description and constructional detail of cavity walls

4. Brick Masonry :

- 4.1 Definition related to brick masonry
- 4.2 Bond, necessity of bond
- 4.3 Types of bonds- English, Flemish, header and stretcher, T-junction, corner junction.
- 4.4 Sketches for 1, 1½ and 2-brick thick wall and square pillars
- 4.5 Construction of brick walls-method of laying brick in walls and precautions to be taken for it.

5. Stone Masonry :

- 5.1 Definition related to stone masonry
- 5.2 Dressing of stones - Hammer dressing, chisel dressing
- 5.3 General principles for construction of stone masonry
- 5.4 Brief description and sketches of different types of stone masonry- Ashlar, random rubble and coursed rubble. Ashlar facing to coursed, rubble and brick masonry.
- 5.5 Brief description, sketches and uses of joggles, dowells and cramps in stone masonry.

6. Scaffolding, Shoring and Underpinning :

- 6.1 Brief description and application of different types of scaffolding and shores.
- 6.2 Meaning and need for underpinning.

7. Dampness and its Prevention:

- 7.1 Causes of dampness in buildings and principles of its prevention.
- 7.2 Materials commonly used for damp proofing.
- 7.3 Damp proof course
- 7.4 Anti termite treatment of buildings before and after construction

8. Arches and Lintels :

- 8.1 Meaning and uses of arches and lintels
- 8.2 Glossary of terms related to arch and lintels
- 8.3 Thickness of lintels, Effective span
- 8.4 Type of arches e.g. semi circular, segmental arches, elliptical, pointed, relieving arch, flat arch.
- 8.5 Thickness of semi-circular and segmental arches by empirical rules

9. Doors :

- 9.1 Types of door frames - stone, timber, steel, concrete
- 9.2 Description and sketches of different types of doors ledged, battened and braced door, framed and panelled door, glazed and panelled doors, louvered doors, flush doors.
- 9.3 Use of collapsible door, rolling steel doors, side sliding doors, wire mesh doors.

10. Windows :

- 10.1 Names, uses and sketches of - fully panelled window, fully glazed windows
- 10.2 Casement and pivoted window, dormer window, clearstory window, skylight, fanlight and ventilators
- 10.3 Window frames of different materials- wood, steel, aluminium.

11. Stairs and Stair Cases :

- 11.1 Glossary of terms related to stairs
- 11.2 Brief description and sketches of common types of staircase : Straight flight, Quarter turn, Half turn dog legged and open newel, Bifurcated, Circular, Spiral
- 11.3 Classification of staircases according to materials used.
- 11.4 Rise, Tread & Going of the different type of stair.

12. Roofs :

- 12.1 Functions of roofs and ceilings. Brief description, constructional details and suitability of common types of roofs.
- 12.2 Definition of terms for pitched roofs, principal rafter, common rafter, jack rafter, hip rafter, valley rafter, ridge piece, caves, purlins, cleats, wall plates, valley gutter, side gutter, gable, fascia board.
- 12.3 Roof coverings for pitched roofs - Asbestos cement and C.G.I. method of arranging and fixing to battens, rafters, purlins both steel and wooden.
- 12.4 Drainage arrangement for pitched and flat roofs.

13. Floors :

- 13.1 Ground floors
- 13.2 Brief description, uses and construction of ground floors - Brick on edge; tiles, stone slab, marble and glazed tiles, lime concrete, cement concrete, terrazzo and mosaic.

14. Finishing of buildings :

- 14.1 Different types of plastering, rendering and painting
- 14.2 Methods of plastering, and curing
- 14.3 Defects in plasters and repairs of the defects.
- 14.4 Different types of painting uses and methods of painting

- 14.5 White washing, colour washing and distempers- water and oil bound distempers. Application of cement plastic paints
- 14.6 Provision of expansion joints in building floors, walls and roofs.

15. Building Bye Laws :

- 15.1 Study of building bye laws as per IS 1256-1967
- 15.2 Terminology related to residential building, building permit occupancy certificate, unsafe buildings, enforcement code, offences and penalties.
- 15.3 Health sanitation and other requirements, means of access, open space requirements, plinth area, projections, covered area in residential plots.
- 15.4 Distance from electric lines, plinth regulation, height regulation, size of rooms, lighting and ventilation, construction of water closets, kitchen, mezzanine floor, stair cases, drainage and sanitation.

16. Basic Principles of Building Planning:

- 16.1 Aspect, prospect its internal circulation, privacy grouping (i) living areas (ii) sleeping areas and (iii) working areas
- 16.2 Roominess, flexibility, furniture setting, sanitation elegance and economy
- 16.3 Arrangement of doors, windows, cupboards etc for a residential building

17. Orientation :

- 17.1 Orientation of buildings as per I.S. 7662 in relation to sun and wind directions, rain, internal circulation and placement of room, commensurate with available areas and requirements.
- 17.2 Preparation and study of sun chart on polar graphs. Sun shading devices-types sketches suitability, for different orientations.

18. Site Selection :

- 18.1 Selection of site for a building and building complex
- 18.2 Comparative study of sites with respect to local topography, flooding, soil access, location
- 18.3 Communication links, with surroundings availability of water and electricity, prevailing wind, made up ground, water table, trees etc.

19. Design of Buildings :

- 19.1 Common standards for floor space and cubical contents for residential building and public building (Schools, Hostels, Dispensaries, Panchayatghars).
- 19.2 Economical design of single room tenements, double room tenement and residential flats
- 19.3 Design of a residential building and public buildings (School, Hostel, Dispensary, Panchayatghar) including location of water supply line, drainage line and placing of electrical fittings.
- 19.4 Details of a toilet, kitchen and staircase for modern residential buildings.

REFERENCE BOOKS :

- | | |
|--------------------------|-----------------|
| 1. Building Construction | Bindra & Arora. |
| 2. Building Construction | Sushil Kumar. |
| 3. Building Construction | B.C. Punamia. |

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SURVEYING - I

CODE CE 204

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RATIONALE

A diploma holder is expected to be well aware of the surveying. He must know measuring instruments and application of them in practical work. He should be able to measure a irregular field and calculate its area. The important functions of Civil Engineering diploma include the jobs of (i) Surveying (ii) Plotting of survey data (iii) Preparation of survey maps and (iv) Setting out works.

Stress has, therefore, been given to the development of the skills in types of surveys including levelling, contouring, Plane table alongwith Minor Instruments that the Civil Engg. diploma holder will normally be called upon to perform. Ability of plotting and preparing survey maps and sections is equally important like fieldwork and so the students are required to be given practice in both.

CONTENTS**1. Introduction :**

- 1.1 Plane surveying and geodetic surveying
- 1.2 Uses of surveying in engineering.
- 1.3 Principles of surveying

2. Chain Surveying :

- 2.1 Different types of chains
 - 2.1.1 Metric chain
 - 2.1.2 Engineer's chain
 - 2.1.3 Gunter's chain
 - 2.1.4 Revenue chain
- 2.2 Types of Tapes
 - 2.2.1 Linen tapes
 - 2.2.2 Metallic tapes
 - 2.2.3 Invar tapes
 - 2.2.4 Steel band
- 2.3 Ranging rods
- 2.4 Offset rods
- 2.5 Line ranger
- 2.6 Cross staff
- 2.7 Optical square
- 2.8 Arrows
- 2.9 Folding, unfolding, of chains
- 2.10 Testing and adjusting of chains
- 2.11 Ranging
 - 2.11.1 Direct ranging
 - 2.11.2 Indirect ranging
- 2.12 Chaining on plane ground,
- 2.13 Conventional signs in surveying
- 2.14 Recording in field book
- 2.15 Chaining on sloping ground
 - 2.15.1 Direct method
 - 2.15.2 Indirect method

- 2.16 Common errors and precautions
- 2.17 Traversing
- 2.18 Fixing and marking stations
- 2.19 Base line, Check lines and Tie lines
- 2.20 Common obstacles in chaining
- 2.21 Plotting of traverse

3. Compass Surveying :

- 3.1 Prismatic compass
- 3.2 Surveyor's compass
- 3.3 Difference in the above two compasses
- 3.4 Definitions
 - 3.4.1 Meridian - magnetic, true, arbitrary
 - 3.4.2 Magnetic dip
 - 3.4.3 Magnetic declination
 - 3.4.4 Fore bearing
 - 3.4.5 Back bearing
- 3.5 Whole circle bearing system
- 3.6 Quadrilateral bearing system
- 3.7 Conversion from whole circle bearing to quadrilateral bearing and vice versa.
- 3.8 Reading the bearing of lines
- 3.9 Computation of internal angles
- 3.10 Distribution of instrumental error
- 3.11 Local attraction
- 3.12 Correction of bearings due to local attractions
- 3.13 Traversing with chain and compass
 - 3.13.1 Open traverse
 - 3.13.2 Closed traverse
- 3.14 Booking in field book
- 3.15 Adjustment of error in a closed traverse

4. Levelling :

- 4.1 Definitions
 - 4.1 Level surface
 - 4.2 Level line
 - 4.3 Horizontal line
 - 4.4 Vertical line
 - 4.5 Mean sea level
 - 4.6 Reduced level
- 4.2 Names and function of different parts of -
 - 4.2.1 Dumpy level
 - 4.2.2 Tilting level
 - 4.2.3 Auto level
- 4.3 Difference in dumpy and tilting level.
- 4.4 Internal and external focusing telescope
- 4.5 Temporary adjustments of dumpy and tilting level
- 4.6 Levelling staff
 - 4.6.1 Self reading
 - 4.6.2 Telescope staff
 - 4.6.3 Target staff

- 4.7 Reading a levelling staff
- 4.8 Levelling with dumpy and tilting levels
 - 4.8.1 Taking observations
 - 4.8.2 Recording in a level book.
- 4.9 Calculation of R.L.
 - 4.9.1 Height of instrument method
 - 4.9.2 Rise and fall method
 - 4.9.3 Arithmetical checks
- 4.10 Types of levelling
 - 4.10.1 Fly levelling
 - 4.10.2 Differential levelling
 - 4.10.3 Profile levelling
 - 4.10.4 Reciprocal levelling
 - 4.10.5 Precise levelling
- 4.11 Effect of curvature and refraction in levelling and their corrections.
- 4.12 Permanent adjustment
 - 4.12.1 Dumpy level
 - 4.12.2 Tilting level
 - 4.12.3 Automatic level
- 5. Contouring :**
 - 5.1 Concept
 - 5.2 Purpose of contouring
 - 5.3 Contour interval
 - 5.4 Horizontal equivalent
 - 5.5 Factors affecting contour interval
 - 5.6 Characteristics of contours
 - 5.7 Methods of contouring - direct and indirect
 - 5.8 Interpolation of contours
 - 5.9 Uses of contour maps
 - 5.10 Drawing cross sections from contour maps.
- 6. Plane Table Surveying :**
 - 6.1 Description and uses of plane table and its accessories
 - 6.2 Advantages of plane table surveying
 - 6.3 Centering, levelling and orientation of plane table
 - 6.4 Radiation
 - 6.5 Intersections
 - 6.6 Traversing
 - 6.7 Resection
 - 6.8 Two point problems
 - 6.9 Three point problems
 - 6.10 Errors in plane tabling
- 7. Minor Instrument :**
 - 7.1 Study and uses of
 - 7.1.1 Hand level
 - 7.1.2 Abney level

- 7.1.3 Clinometer
- 7.1.4 Planimeter
- 7.1.5 Pantagraph
- 7.1.6 Sextant
- 7.1.7 Cylon ghat tracer

PRACTICALS

1. Study of
 - 1.1 Different types of chains and tapes
 - 1.2 Cross staff
 - 1.3 Optical square
 - 1.4 Line ranger
2. Use of Chains :
 - 2.1 Folding and unfolding
 - 2.2 Ranging and chaining on plane and sloping surface
 - 2.3 Setting right angles.
 - 2.4 Setting parallel lines.
 - 2.5 Taking offsets.
3. Chain surveying of small areas
4. Study of prismatic compass
5. Study of surveyor compass
6. Measurements of bearing of lines
7. Transverse by compass and adjustment of error
8. Study of the component parts and handling of
 - 8.1 Dumpy level
 - 8.2 Tilting level
 - 8.3 Staves
9. Temporary adjustments of a dumpy level and a tilting level
10. Use of dumpy level and tilting level in differential levelling and levelling for cross section and longitudinal section. Recording in level book and plotting.
11. Study of Automatic level.
12. Study and use of plane table and its accessories e.g. stand, table, clamping arrangement, sight vane, through compass, plumbing fork, plumb bob, spirit level etc.
13. Methods of plane tabling
 - 13.1 Radiation
 - 13.2 Intersection
 - 13.3 Traversing
 - 13.4 Resection
14. Two and three point problems
15. Preparation of a plan on area by plane table survey.
16. Plotting spot levels of a given area by the grid method and interpolation of contours.
17. Preparations of a contoured plan of an uneven area with the help a level and a plane table.
18. Study of
 - 18.1 Hand and abney level
 - 18.2 Clinometer
 - 18.3 Planimeter
 - 18.4 Pantagraph
 - 18.5 Sextant
 - 18.6 Cylon ghat tracer

REFERENCE BOOKS :

- | | |
|---------------------|-----------------------|
| 1. Surveying | B. C. Punmia |
| 2. Surveying | G. C. Singh |
| 3. सर्वेक्षण भाग-I | डा० बालचन्द्र पुनमिया |
| 4. Surveying Vol. I | S.B. Kanetkar |
| 5. Surveying | K. R. Arora |

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TRANSPORTATION ENGINEERING

CODE CE 205
CC 205

L T P
2 2/2 2/2

RATIONALE

For economic social and cultural development of a country, Highway plays a very important role. With the invention of heavy and high-speed automobiles, it has become necessary to construct path for them for their speedy, safe and undelay movement from one place to another place. Due to lack of awareness in this field, road accident rate may increase, there may be delay in reaching raw materials to industries and finished products to consumer's etc. The basic purpose of this subject is to make the students of diploma to acquaint with construction and maintenance of highway for safe, undelayed movement of traffic with minimum accidental hazards.

This subject is to cater to the needs of the diploma holder engaged in the investigation, planning and construction of railways. The study of technology behind the layout, construction and maintenance of reasonably good all weather railway systems, is extremely important. Moreover, the maintenance part is very difficult and highly sophisticated affairs requiring the service of large team of technicians having sound knowledge of appropriate technology. Under railways, topics related to jobs, which fall under the purview of Civil Engineering technicians, have been included.

CONTENTS**1. Introduction :**

- 1.1 Importance of highway transportation
- 1.2 Different modes of transportation
- 1.3 Scope of highway engineering

2. Highway Development and Planning :

- 2.1 Historical development of road construction
- 2.2 Necessity of highway planning
- 2.3 Classification of roads
- 2.4 Road pattern
- 2.5 Highway planning in India

3. Highway Geometric Design :

- 3.1 Highway alignment and basic consideration governing alignment for a road
- 3.2 Glossaries of terms used in road geometric and their importance
- 3.3 Highway cross section elements
- 3.4 Sight distances
- 3.5 Design of horizontal alignments
- 3.6 Design of vertical alignments

4. Traffic Engineering :

- 4.1 Scope of traffic engineering
- 4.2 Passenger car unit (PCU)
- 4.3 Traffic control devices - signs, signals, marking, traffic islands
- 4.4 Causes and precaution of road accidents

- 4.5 On street and off street parking
- 4.6 Highway lighting
- 5. Highway Materials :**
 - 5.1 Subgrade soil
 - 5.1.1 Desirable properties
 - 5.1.2 Highway research board classification of soils
 - 5.1.3 CBR test
 - 5.2 Stone aggregates
 - 5.2.1 Desirable properties
 - 5.2.2 Attrition and abrasion tests
 - 5.2.3 Crushing test
 - 5.2.4 Impact test
 - 5.2.5 Shape test
 - 5.3 Bituminous materials
 - 5.3.1 Penetration test
 - 5.3.2 Softening point test
 - 5.3.3 Ductility, flash and fire point
 - 5.3.4 Specific gravity test
- 6. Construction of Roads :**
 - 6.1 Introduction
 - 6.2 Water Bound Macadam roads
 - 6.3 Bituminous roads
 - 6.4 Cement concrete road
- 7. Highway Maintenance :**
 - 7.1 Common types of road failures
 - 7.2 Routine maintenance
- 8. Road Drainage and Road Arboriculture :**
 - 8.1 Necessity of road drainage
 - 8.2 Surface and sub surface drainage
 - 8.3 Object of road arboriculture
 - 8.4 Common roadside trees
 - 8.5 Plantation and protection of trees
- 9. Bridges :**
 - 9.1 Introduction : Classification of bridges
 - 9.1.1 Temporary bridges
 - 9.1.2 Permanent bridges
 - 9.2 Selection of site of the bridges
 - 9.3 Economical span of the bridges, calculation of discharge, velocity, afflux by various methods
 - 9.4 Cause ways, culverts - brief description with sketches
 - 9.5 Brief introduction to piers, abutments, wing walls and bearing.

10. Railways :

- 10.1 Railways, its importance
- 10.2 Railway systems in India
- 10.3 Gauge, different gauges in India
- 10.4 Advantages and disadvantages of more than one gauge
- 10.5 Definition of a permanent way

11. Rails :

- 11.1 Function of rails
- 11.2 Requirement of rails
- 11.3 Types of rail sections - Double headed rails, bull headed, flat footed rail
- 11.4 Standard length and weight of flat-footed rails for different gauges
- 11.5 Wear of rails- its causes and effects
- 11.6 Failures of rails
- 11.7 Creep-its definition, causes, effect and prevention
- 11.8 Corrugated or roaring rails.
- 11.9 Conning of wheels

12. Sleepers :

- 12.1 Functions of sleepers
- 12.2 Characteristics of good sleeper
- 12.3 Different types of rail sleepers- wooden, steel, cast iron, concrete and prestressed concrete
- 12.4 Size and shapes of all type of sleepers
- 12.5 Sleeper density

13. Ballast :

- 13.1 Functions of ballast
- 13.2 Characteristics of good ballast
- 13.3 Materials used as ballast - broken stone, gravel, cinder, kanker, moorum, brickbats etc.
- 13.4 Size and section of ballast
- 13.5 Quantity of ballast
- 13.6 Renewal of ballast

14. Fixture and Fastenings :

- 14.1 Connection of rail to fish plate and welded rails
- 14.2 Connection of rail to sleepers
- 14.3 Details of fixtures used

15. Railway Geometries :

- 15.1 Alignment of railway line
- 15.2 Typical cross sectioning singles and doubles tracks in cutting and embankment
- 15.3 Gradients, curve, transition length as per railway code
- 15.4 Superelevation, cant deficiency
- 15.5 Widening of gauge on curves

16. Points and Crossing :

- 16.1 Necessity and details of arrangement
- 16.2 Sketch of a turnout
- 16.3 Functions of different parts and components
- 16.4 Different types of point and crossing
- 16.5 Turnout, crossover, scissors, diamond crossing with slips, double junctions, gathering lines
- 16.6 Turn tables and triangles.

17. Tracks Laying :

- 17.1 Plate laying
- 17.2 Methods of plate laying
- 17.3 Duties of a permanent way inspector

18. Maintenance :

- 18.1 Routine maintenance of formation and side slope
- 18.2 Routine maintenance of ballast, fixtures and drainage
- 18.3 Special maintenance - replacement of defective sleeper and rails
- 18.4 Tools used for the maintenance of track.

19. Stations and Yards :

- 19.1 Classification
- 19.2 Requirement and layout of station and yards
- 19.3 Flag station, wayside station, junction, terminal station
- 19.4 Passenger yards, goods yards
- 19.5 Marshalling yards, locomotive yards
- 19.6 Station equipments

20. Signallings :

- 20.1 Classification and functions of signal
- 20.2 Types of signal - Semaphore, warner, shunt disc, colour light signal, outer, home, routing signal, starter, advanced starter, calling on and co-acting signals
- 20.3 3-aspect signals
- 20.4 Absolute block system
- 20.5 Automatic block system
- 20.6 Pilot guard system

21. Tunnelling :

- 21.1 Introduction
- 21.2 Advantages and disadvantages
- 21.3 Methods of construction of tunnels full-face method and needle beam method
- 21.4 Factors effecting the alignment of tunnels
- 21.5 Description and sketches of different types of tunnels
- 21.6 Necessity of ventilation
- 21.7 Method of ventilation
- 21.8 Drainage of tunnels
- 21.9 Safety precautions to be taken at the time of construction of tunnels.

PRACTICALS

1. Determination of abrasion value of aggregates by Los Angel's test
2. Determination of impact value of aggregate
3. Determination of crushing value of given aggregates
4. Determination of C.B.R. value of sub grade soil.
5. Determination of penetration value of bitumen
6. Determination of softening point of bitumen.
7. Determination of ductility of bitumen
8. Determination of flash and fire point of bitumen

REFERENCE BOOKS :

- | | |
|--------------------------------|---------------------------------|
| 1. Highway Engg. | Khanna & Justo. |
| 2. Highway Engg. | Priyani |
| 3. Bridge Engg. | S.P. Bindra |
| 4. Railway Bridges and Tunnels | Vazirani and Chandola |
| 5. Railway Bridges and Tunnels | B.L. Gupta |
| 6. Railway Bridges and Tunnels | G.C. Singh |
| 7. Railway Engineering | Saxena and Arora |
| 8. Railway and Tunnels | S.C. Rangwala |
| 9. Highway Lab Manual | A. K. Duggal, NITTTR Chandigarh |

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SOIL AND FOUNDATION ENGINEERING

CODE CE 206
CC 206

L T P
2 -- 2

RATIONALE

Supervision of earth work in construction at dams, roads, embankments and other structures is an important function of a Civil Engg. diploma holder. For this the basic knowledge of Soil Engg. is essential. This subject covers such topics as will enable the diploma holder to identify and classify the different types of soils, their selection and proper use in the field of engineering construction. To develop related skills suitable laboratory work is also recommended.

CONTENTS**1. Introduction :**

- 1.1 Introduction and scope of soil engineering
- 1.2 Origin and formation of soils
- 1.3 Major soil deposits of India

2. Fundamental Definitions and Relationships :

- 2.1 Representation of soil as a three phase system
- 2.2 Definition of moisture content, unit weights, density, and specific gravity, void ratio, porosity, degree of saturation and the relationship among them.

3. Classification of Soils :

- 3.1 Classification of soils as per particle size and plasticity chart according to IS specifications
- 3.2 Particle size distribution - Sieve analysis
- 3.3 Consistency of soils – Liquid limit, Plastic limit and Shrinkage limit
- 3.4 Field identification of soil

4. Permeability of Soils:

- 4.1 Definition of permeability and related terms
- 4.2 Darcy's law of flow through soils
- 4.3 Factors affecting permeability
- 4.4 Measurement of permeability in laboratory
- 4.5 Measurement of permeability in field

5. Compaction :

- 5.1 Process of compaction
- 5.2 Proctor's compaction test
- 5.3 Moisture content and density relationships

- 5.4 Factors affecting compaction
 - 5.5 Different methods of compaction
 - 5.6 Brief description of field compaction methods, equipments and suitability for different type of soils.
- 6. Consolidation :**
- 6.1 Meaning and explanation of phenomena
 - 6.2 Total stress, neutral stress and effective stress
 - 6.3 Measurement of compressibility characteristics
 - 6.4 Consolidation test
 - 6.5 Pressure void ratio relationship in consolidation
 - 6.6 Practical methods of accelerating consolidation
 - 6.7 Normally consolidated and over consolidated soil
- 7. Shear strength :**
- 7.1 Concept of shear strength
 - 7.2 Factors contributing to shear strength of soils.
 - 7.3 Drainage conditions of testing.
 - 7.4 Determination of shearing strength by direct shear test, unconfined compression test, vane shear test.
- 8. Bearing Capacity :**
- 8.1 Concept of bearing capacity
 - 8.2 Terzaghi's bearing capacity factors and bearing capacity as per IS code
 - 8.3 Factors affecting bearing capacity.
 - 8.4 Determining bearing capacity of soil by plate load test and Standard Penetration Test.
 - 8.5 Methods of improving bearing capacity
- 9. Earth Pressures :**
- 9.1 Active and passive earth pressure
 - 9.2 Earth pressure at rest
 - 9.3 Determination of earth pressure by Rankine's theory for cohesionless soil (No derivation)
- 10. Soil Exploration :**
- 10.1 Functions and scope of soil exploration
 - 10.2 Excavation and boring methods of sub-surface exploration
 - 10.3 Types of samplers
 - 10.4 Disturbed and undisturbed samples
 - 10.5 Labelling, sealing and preservation of samples
- 11. Foundation :**
- 11.1 Introduction to different types of foundation
 - 11.1.1 Shallow foundation
 - 11.1.2 Deep foundation
 - 11.1.3 Raft foundation
 - 11.1.4 Well foundation
- 12. Pile Foundation :**
- 12.1 Definition of pile foundation
 - 12.2 Places of application
 - 12.3 Classification of piles based on functions and materials.
 - 12.4 Formula related to pile foundations –
 - 12.4.1 Static formula
 - 12.4.2 Dynamic engineering news formula
 - 12.4.3 Hiley's formula

13. Soil Stabilisation :

- 13.1 General principles of soil stabilisation
- 13.2 Different types of soil stabilisation –
 - 13.2.1 Mechanical Stabilisation
 - 13.2.2 Water reluctant chemicals
 - 13.2.3 Cement stabilisation
 - 13.2.4 Lime stabilisation
 - 13.2.5 Bitumen stabilisation
 - 13.2.6 Stabilisation by grouting

PRACTICALS

1. Determination of moisture content
2. Determination of specific gravity of soils
3. Grain size analysis (by sieve analysis)
4. Determination of liquid and plastic limits of soils
5. Determination of field density by core cutter method
6. Determination of field density by sand replacement method
7. Proctor's compaction test
8. Constant head and falling head permeability test.
9. Determination of shear strength from direct shear test
10. Determination of unconfined compression strength test.
11. Conduct of SPT
12. Soil sampling by auger and tube sampler.

REFERENCE BOOKS :

- | | |
|--|----------------|
| 1. Soil Engg | B.C. Punmmia |
| 2. Basic Soil Engg. | Dr. Alam Singh |
| 3. Modern Geo- Technical Engg. | Alam Singh |
| 4. Soil and Foundation Engineering (Hindi) | B.C. Punmia |
| 5. Soil and Foundation Engineering (Hindi) | B.L.Gupta. |
| 6. Soil Mechanics(Hindi) | Janardan Jha |

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CONCRETE TECHNOLOGY

CODE CE 207
CC 207

L T P
2 -- 2

RATIONALE

A diploma holder in Civil Engineering will be required to handle various constructions made of cement concrete in his professional life. He should know the properties and uses of various types of cement and other ingredients used in cement concrete. He should know to prepare concrete mix and various operations required. He should also know to test the cement and other ingredients used in cement concrete as per Indian Standard Codes.

CONTENTS**1. Cement :**

- 1.1 Manufacture of Portland cement
- 1.2 Chemical composition
- 1.3 Hydration of cement

- 1.4 Types of cement
 - 1.4.1 Ordinary Portland cement
 - 1.4.2 Rapid hardening cement
 - 1.4.3 Extra rapid hardening cement
 - 1.4.4 Sulphate resisting cement
 - 1.4.5 Blast furnace cement
 - 1.4.6 Quick setting cement
 - 1.4.7 Super sulphate cement
 - 1.4.8 Low heat cement
 - 1.4.9 Portland pozzolana cement
 - 1.4.10 White cement
 - 1.4.11 Hydrophobic cement
 - 1.4.12 Oil-well cement
 - 1.4.13 High alumina cement
- 1.5 Testing of cement
 - 1.5.1 Field testing
 - 1.5.2 Fineness test
 - 1.5.3 Specific gravity of cement
 - 1.5.4 Standard consistency test
 - 1.5.5 Setting time test
 - 1.5.6 Strength test
 - 1.5.7 Soundness test

2. Aggregates :

- 2.1 Classification of aggregates according to sources
- 2.2 Shape, size and texture
- 2.3 Bulk density
- 2.4 Specific gravity
- 2.5 Water absorption and moisture content
- 2.6 Bulking of aggregate
- 2.7 Alkali - aggregate reaction
- 2.8 Grading of aggregates
- 2.9 Sieve analysis
- 2.10 Standard grading curve
- 2.11 Specified grading
- 2.12 Gap grading
- 2.13 Flakiness index
- 2.14 Elongation index
- 2.15 Fineness modulus
- 2.16 Crushing value
- 2.17 Ten percent Fines value

3. Water :

- 3.1 Indian Standards for quality of water for use in cement concrete.
- 3.2 Effect of impurities in water on concrete.

4. Admixtures and Construction Chemical :

- 4.1 General
- 4.2 Admixtures
 - 4.2.1 Plasticizers
 - 4.2.2 Super plasticizers
 - 4.2.3 Retarders
 - 4.2.4 Accelerators

- 4.2.5 Air entraining admixtures
- 4.2.6 Pozzolanic or mineral admixtures
- 4.2.7 Air detraining admixtures
- 4.2.8 Alkali aggregate expansion inhibitors
- 4.2.9 Workability admixtures
- 4.2.10 Grouting admixtures
- 4.2.11 Bonding admixtures
- 4.3 Construction chemicals
 - 4.3.1 Concrete curing compounds
 - 4.3.2 Polymer bonding agents
 - 4.3.3 Floor hardener and dust proofers
 - 4.3.4 Surface retarders
 - 4.3.5 Bond aid for plastering
 - 4.3.6 Ready to use plaster
 - 4.3.7 Guiniting agents
 - 4.3.8 Water proofing

5. Fresh Concrete :

- 5.1 Workability
- 5.2 Factors affecting workability
- 5.3 Measurement of workability
 - 5.3.1 Slump test
 - 5.3.2 Compacting factor test
 - 5.3.3 Vee-Bee consistometer test
- 5.4 Segregation
- 5.5 Bleeding
- 5.6 Process of manufacture of concrete

6. Concrete Operation :

- 6.1 Batching
 - 6.1.1 Volume batching
 - 6.1.2 Weight batching
- 6.2 Mixing
 - 6.2.1 Hand mixing
 - 6.2.2 Machine mixing
- 6.3 Transporting of concrete
 - 6.3.1 Mortar pan
 - 6.3.2 Wheel barrow
 - 6.3.3 Bucket and rope way
 - 6.3.4 Truck mixer and dumpers
 - 6.3.5 Belt conveyors
 - 6.3.6 Chute
 - 6.3.7 Skip and hoist
 - 6.3.8 Pumps and pipeline
- 6.4 Placing concrete
- 6.5 Compaction of concrete
 - 6.5.1 Hand compaction
 - 6.5.2 Compaction by vibrators

- 6.6 Types of vibrators and its uses
- 6.7 Curing of concrete
 - 6.7.1 Water curing
 - 6.7.2 Membrane curing
 - 6.7.3 Steam curing
- 6.8 Finishing
 - 6.8.1 Formwork finishes
 - 6.8.2 Requirements of good finish
- 6.9 Joints in concrete
 - 6.9.1 Construction joints
 - 6.9.2 Expansion joints
 - 6.9.3 Contraction joints
 - 6.9.4 Isolation joints
- 7. Strength of Concrete :**
 - 7.1 Water cement ratio
 - 7.2 Gain of strength with age
 - 7.3 Relation between compressive and tensile strength
 - 7.4 Bond strength
 - 7.5 Aggregate cement bond strength
- 8. Special Concrete :**
 - 8.1 Light weight concrete
 - 8.2 No fines concrete
 - 8.3 Aerated concrete
 - 8.4 High density concrete
 - 8.5 Fiber reinforced concrete
 - 8.6 Polymer concrete
 - 8.7 Guniting or shotcrete
 - 8.8 RMC (ready mixed concrete)
 - 8.9 Ferro cement
 - 8.10 High Performance concrete
- 9. Formwork :**
 - 9.1 Requirements of formwork
 - 9.2 Types of formwork
 - 9.3 Time for stripping formwork
- 10. Quality Control at Site :**
 - 10.1 Factors causing variations in the quality of concrete
 - 10.2 Field control
 - 10.3 Statistical quality control
 - 10.4 Frequency of test
- 11. Concrete Mix Design :**
 - 11.1 Concept
 - 11.2 Variables in proportioning
 - 11.3 Indian Standard recommended method for concrete mix design IS10262-1982

12. Deterioration and Restoration of Concrete :

- 12.1 Introduction
- 12.2 Internal and external causes of deterioration of concrete
- 12.3 Prevention of deterioration of concrete.
- 12.4 Corrosion of reinforcing steel – causes & prevention.
- 12.5 Maintenance & repair –
 - 12.5.1 Repair materials – mortar, grouts, shotcrete, gunite, bonding agent, protective coating on concrete surface and protective coating on reinforcement
 - 12.5.2 Repair measures – assessment of damage, possible repair measures, structural strengthening
 - 12.5.3 Repair of cracks and honey combs.

PRACTICALS

1. Determination of specific gravity of cement.
2. Determination of consistency of cement
3. Determination of Initial and Final setting time of cement.
4. Determination of fineness of cement
5. Determination of soundness of cement
6. Determination of compressive strength of cement
7. Determination of specific gravity and water absorption of aggregates
8. Determination of flakiness index and elongation index of aggregates
9. Determination of Bulk density of aggregates
10. Determination of fineness modules and grain size distribution
11. Determination of bulking of fine aggregate
12. Test for workability
 - 12.1 Slump test
 - 12.2 Compaction factor test
 - 12.3 Vee-Bee test
13. Determination of strength of cement concrete.
14. Mix Design of M-20 by IS code method (IS10262- 1982)

REFERENCE BOOKS :

- | | |
|--------------------------------|--------------------|
| 1. Concrete Technology | P.D. Kulkarni |
| 2. Concrete Technology | M.S Shetty |
| 2. Concrete Technology | Varshney. |
| 4. Concrete Technology (Hindi) | G. Das & B.L.Gupta |
| 5. Concrete Manual | M.L. Gambhir |
| 6. Code IS-456-2000 | |

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BUILDING DRAWING

CODE CE 208

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RATIONALE

A Civil Engineering diploma student should be able to communicate through drawings and sketches. He should also read drawing given to him. Through this subject, the student should develop skills of preparing drawing, drawing sketches to explain construction details and reading building sketches to explain construction details and reading building drawings. Considerations, which go with planning of building, should also be covered in the subject.

CONTENTS

1. **Detailed working plan, elevation and section of the following.**
 - 1.1 Two bed room residential single story building with given direction (North, South etc)
 - 1.2 Three bed room duplex bungalow with the given plot size
 - 1.3 Detailed plan of above showing house drainage, water supply and electrical fittings as per BIS.
 - 1.4 Hostel building
 - 1.5 Primary health centre
 - 1.6 School building
 - 1.7 Panchayat bhawan
 - 1.8 Community hall
 - 1.9 Polytechnic college building
 - 1.10 Office building
 - 1.11 Fifty bed hospital at district headquarter
2. **Drawing of a small residential building from measurements.**
3. **Detailed working plan, elevation and section through stair-case drawing of a two storied building.**

REFERENCE BOOKS :

- | | |
|------------------------|----------------------|
| 1. Civil Engg. Drawing | Gurcharn Singh. |
| 2. Building Drawing | Shah, Kala & Pataki. |
| 3. Building Drawing | V. B. Sikka |

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CONSTRUCTION MATERIALS AND EQUIPMENTS

CODE CE 209
CC 209

L T P
2 -- 2/2

RATIONALE

Construction materials are an important part of Civil Engineering. A Civil Engg. diploma holder should have the thorough knowledge about different materials, useful for constructions. Diploma holder should know the properties of different materials used in Civil Engineering works.

CONTENTS

1. **Stones :**
 - 1.1 Classification of rocks
 - 1.2 Geological classification - igneous rocks, sedimentary rocks and metamorphic rocks
 - 1.3 Chemical classification - argillaceous, siliceous and calcareous rocks
 - 1.4 Physical classification - unstratified, stratified, foliated rocks.
 - 1.5 Common rock forming minerals and their properties - silica, felspar, mica, hornblende and dolomite.
 - 1.6 Qualities of good building stone
 - 1.7 General characteristics, identification and uses of common building stones - granite, basalt, trap, sand stone, lime stone, dolomite, marble, slate, quartzite.
 - 1.8 Natural bed of stones
 - 1.9 Seasoning of stones.
2. **Bricks :**
 - 2.1 Meaning and composition of brick
 - 2.2 Preparation of brick clay - weathering, kneading and tempering of clay
 - 2.3 Brief description and use of pug mill
 - 2.4 Standard size and shape of wooden and steel moulds

- 2.5 Moulding - ground moulding, table moulding, sand moulding and slop moulding, machine moulding, utility of frog.
 - 2.6 Brief description and working of different types of kilns
 - 2.7 Classification and testing of bricks as per B.I.S.
- 3. Tiles :**
- 3.1 Use of tiles
 - 3.2 Classification of tiles
 - 3.2.1 According to use
 - 3.2.2 According to shape
 - 3.2.3 Special tiles - Allahabad tiles, Mangalore tiles
 - 3.3 Preparation of clay
 - 3.4 Moulding, shaping, drying and burning
 - 3.5 Properties and uses of fire clay tiles.
- 4. Lime :**
- 4.1 Introduction - lime, calcination, quick lime, slaking, setting, hardening, hydraulicity
 - 4.2 Classification of lime as per B.I.S.
 - 4.3 Manufacture of lime - process of charging, burning, collection and slaking.
 - 4.4 Properties and uses of lime
 - 4.5 Storage of lime
 - 4.6 Testing of lime as per B.I.S.
 - 4.7 Field test of lime as per B.I.S.
 - 4.8 Pozzolanic materials as surkhi, cinder and fly ash.
- 5. Lime Mortar :**
- 5.1 Constituents of lime mortar
 - 5.2 Functions of sand and surkhi in lime mortar.
 - 5.3 Preparation of lime mortar - mixing and grinding
 - 5.4 Properties and common uses of lime mortar.
 - 5.5 Constituents, function and properties of lime concrete
- 6. Cement and Cement Mortar :**
- 6.1 Introduction
 - 6.2 Raw material
 - 6.3 Manufacturing process of ordinary Portland cement
 - 6.4 Flow diagram for wet and dry process
 - 6.5 Properties and use of ordinary Portland cement
 - 6.6 Constituents, function and use of cement mortar
- 7. Timber :**
- 7.1 Standing timber, rough timber, converted timber, exogenous trees, endogenous trees, softwood and hard wood.
 - 7.2 Growth and general structure of exogenous trees
 - 7.3 Seasoning of timber - natural and artificial
 - 7.4 Conversion of timber by sawing
 - 7.5 Common defects of timber and decay of timber
 - 7.6 Preservation of timber
 - 7.7 Qualities and uses of good timber
 - 7.8 Manufacturing and uses of ply woods and different ply boards and laminated boards.

8. Ferrous Material :

- 8.1 Pig iron
- 8.2 Cast iron
- 8.3 Wrought iron
- 8.4 Steel
 - 8.4.1 Classification
 - 8.4.2 Heat Treatment
- 8.5 Structural steel

9. Non Ferrous Metals :

- 9.1 Aluminum
- 9.2 Copper
- 9.3 Zinc
- 9.4 Galvanized
- 9.5 Corrosion of Metals
 - 9.5.1 Mechanism and prevention

10. Glass :

- 10.1 Properties
- 10.2 Types of Glass
- 10.3 Industrial forms of glasses

11. Paints and Varnishes :

- 11.1 Classification of paints - oil paints, plastic paints, enamel paints, water paints and cement paints.
- 11.2 Constituent materials of paints
- 11.3 Preparation and uses of different paints
- 11.4 Constituents, properties and uses of varnish and polish - spirit polish and wax polish.
- 11.5 Different types and use of exterior paints

12. Equipment for Earth Work and Compaction :

- 12.1 Bull Dozers
- 12.2 Scraper
- 12.3 Loaders
- 12.4 Excavator
- 12.5 Shovels
- 12.6 Cranes
- 12.7 Static Compaction Equipment
- 12.8 Vibratory compaction equipment
- 12.9 Rubber tyred compaction equipment
- 12.10 Road Rollers

13. Bitumen or Asphalt Mixing Plant :

- 13.1 Hot mix plant
- 13.2 Cold Mix plant
- 13.3 Paver finisher
- 13.4 Bitumen distributors
- 13.5 Road Marking machine

14. Hauling Equipment

- 14.1 Different Types of dumpers
- 14.2 Trailors

15. Equipment for Concreting :

- 15.1 Concrete batching and mixing plant
- 15.2 Concrete mixer
- 15.3 Truck – mixers – transit truck mixers, truck agitators
- 15.4 Concrete pumps and dumpers
- 15.5 Concrete paver finishers

PRACTICALS

- 1. Identification of common rocks and minerals
- 2. Dimension, water absorption and efflorescence tests of bricks
- 3. Dimension, water absorption test of tiles
- 4. Field test of lime
- 5. Laboratory test of lime as per B.I.S.
- 6. Identification of common Indian timbers, plywood and laminated boards

REFERENCE BOOKS :

- 1. Construction Materials Sushil Kumar
- 2. Construction Materials Rangwala

COMPUTER AIDED DRAWING

CODE CE 210
CC 210

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RATIONALE

In the present scenario computer is becoming more and more important in every field. Computer software for drafting are widely used for drawing work. In this subject student will be given exercises to draw detailed drawings used in civil engineering.

CONTENTS

- 1. Getting Started – I**
Starting AutoCAD – AutoCAD screen components – Starting a drawing: Open drawings, Create drawings (Start from scratch, Use a template & Use a wizard) – Invoking commands in AutoCAD – Drawing lines in AutoCAD – Co-ordinate systems: Absolute co-ordinate system, Relative co-ordinate system – Direct distance method – Saving a drawing: Save & Save As – Closing a drawing – Quitting AutoCAD
- 2. Getting Started – II**
Opening an existing file – Concept of Object – Object selection methods: Pick by box, Window selection, Crossing Selection, All, Fence, Last, Previous, Add, Remove – Erasing objects: OOPS command, UNDO / REDO commands – ZOOM command – PAN command, Panning in real time – Setting units – Object snap, running object snap mode – Drawing circles
- 3. Draw Commands**
ARC command – RECTANG command – ELLIPSE command, elliptical arc – POLYGON command (regular polygon) – PLINE command – DONUT command – POINT command – Construction Line: XLINE command, RAY command – MULTILINE command
- 4. Editing Commands**
MOVE command – COPY command – OFFSET command – ROTATE command – SCALE command – STRETCH command – LENGTHEN command – TRIM command – EXTEND command – BREAK command – CHAMFER command – FILLET command – ARRAY command – MIRROR command – MEASURE command – DIVIDE command – EXPLODE command – MATCHPROP command – Editing with grips: PEDIT

5. **Drawing Aids**
Layers – Layer Properties Manager dialog box – Object Properties: Object property toolbar, Properties Window – LTSCALE Factor – Auto Tracking – REDRAW command, REGEN command
6. **Creating Text**
Creating single line text – Drawing special characters – Creating multiline text – Editing text – Text style
7. **Basic Dimensioning**
Fundamental dimensioning terms: Dimension lines, dimension text, arrowheads, extension lines, leaders, centre marks and centrelines, alternate units – Associative dimensions – Dimensioning methods – Drawing leader
8. **Inquiry Commands**
AREA – DIST – ID – LIST – DBLIST – STATUS – DWGPROPS
9. Editing Dimensions
Editing dimensions by stretching – Editing dimensions by trimming & extending – Editing dimensions: DIMEDIT command – Editing dimension text: DIMTEDIT command – Updating dimensions – Editing dimensions using the properties window – Creating and restoring Dimension styles: DIMSTYLE
10. **Hatching**
BHATCH, HATCH commands – Boundary Hatch Options: Quick tab, Advance tab – Hatching around Text, Traces, Attributes, Shapes and Solids – Editing Hatch Boundary – BOUNDARY command
11. **Blocks**
The concept of Blocks – Converting objects into a Block: BLOCK, _BLOCK commands – Nesting of Blocks – Inserting Blocks: INSERT, MINSERT commands – Creating drawing files: WBLOCK command – Defining Block Attributes – Inserting Blocks with Attributes – Editing Attributes
12. **Plotting Drawings in AutoCAD**
PLOT command – Plot Configuration – Pen Assignments – Paper Size & Orientation Area – Plot Rotation & Origin – Plotting Area – Scale
13. **Draw working plan, elevation of the following.**
 - 13.1 Three bed room duplex bungalow with the given plot size
 - 13.2 Detailed plan of above showing house drainage, water supply and electrical fittings as per BIS.
 - 13.3 Hostel building
 - 13.4 School building

REFERENCE BOOK :

1. AutoCAD for Windows Bible (with Applications) / Sham Tickoo / Galgotia Publications Pvt. Ltd.
2. Advanced AutoCAD Robert M. Thomas / Sybex BPD
3. AutoCAD Part – 1 & 2 Banglay Prokashito Tutorial / CD Media / Sonolite, 55, Elliot Road, Kolkata

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