
STRENGTH OF MATERIALS

CODE CC 201
CE/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 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 |

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FIELD SURVEY

CODE CC 202

L T P
2 -- 4**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 (construction) Engineering diploma holder include the jobs of (i) Surveying (ii) Plotting of survey data (iii) Preparation of topographic maps and (iv) Setting out works. Stress has, therefore, been given to the development of the skills in types of surveys including, Theodolite Survey, Tacheometry Survey, that the Civil (construction) Engineering 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
 - 4.1.1 Level surface
 - 4.1.2 Level line
 - 4.1.3 Horizontal line
 - 4.1.4 Vertical line
 - 4.1.5 Mean sea level
 - 4.1.6 Reduced level
- 4.2 Names and function of different parts of -
 - 4.2.1 Dumpy level
 - 4.2.2 Tilting 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.

5. Auto Level:

- 5.1 Introduction
- 5.2 Special Features
- 5.3 Important Parts
- 5.4 Operation of Auto Level
 - 5.4.1 Setting up the tripod
 - 5.4.2 Leveling up by the circular level
 - 5.4.3 Centering with the plumb bob
 - 5.4.4 Orientation
 - 5.4.5 Measuring

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. Theodolite :

- 7.1 Types
- 7.2 Different parts of a Vernier Transit Theodolite
- 7.3 Fundamental axes
- 7.4 Temporary adjustment
- 7.5 Transiting
- 7.6 Swinging
- 7.7 Measurement of horizontal angle (Repetition and Reiteration method)
- 7.8 Measurement of vertical angle
- 7.9 Measurement of the bearing
- 7.10 Prolonging a line
- 7.11 Use as level

8. Traverse:

- 8.1 Types - open and closed traverse
- 8.2 Methods of traversing
 - 8.2.1 Traversing by included angles
 - 8.2.2 Traversing by deflection angles
- 8.3 Latitudes and departures
- 8.4 Balancing of a traverse by
 - 8.4.1 Bowditch's rule
 - 8.4.2 Transit rule
- 8.5 Omitted measurements

9. Tachometry:

- 9.1 Concept
- 9.2 Methods
 - 9.2.1 Stadia methods
 - 9.2.2 Tangential methods
- 9.3 Anallatic lens
- 9.4 Determination of horizontal and vertical distances by
 - 9.4.1 Staff vertical
 - 9.4.2 Staff normal to the line of sight
- 9.5 Substance bar

10. Total Station:

- 10.1 Introduction
- 10.2 Special Features
- 10.3 Technical Terms and abbreviations
- 10.4 Setting up the tripod
- 10.5 Centering with laser plummet, coarse level up
- 10.6 Accurate leveling with electronic level
- 10.7 Laser Intensity
- 10.8 Wildcard search
- 10.9 Station Block
- 10.10 Orientation
- 10.11 Manual input of the Station Coordinates

11. Contouring:

- 11.1 Concept
- 11.2 Purpose of contouring
- 11.3 Contour interval
- 11.4 Horizontal equivalent
- 11.5 Factors affecting contour interval
- 11.6 Characteristics of contours
- 11.7 Methods of contouring - direct and indirect
- 11.8 Interpolation of contours

PRACTICALS

- 1. Chain surveying of small areas
- 2. Study of prismatic compass
- 3. Measurements of bearing of lines
- 4. Traverse by compass and adjustment of error
- 5. Study of the component parts and handling of
 - 5.1 Dumpy level
 - 5.2 Tilting level
 - 5.3 Auto level
- 6. Temporary adjustments of a dumpy level and a tilting level
- 7. Use of dumpy level, tilting level and auto level in differential levelling and levelling for cross section and longitudinal section. Recording in level book and plotting.
- 8. 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.
- 9. Methods of plane tabling
 - 9.1 Radiation
 - 9.2 Intersection
 - 9.3 Traversing
 - 9.4 Resection

10. Preparation of a plan on area by plane table survey.
11. Preparations of a contoured plan of an uneven area with the help a level and a plane table.
12. Study of parts of theodolite.
13. Measurement of horizontal angles by repetition and reiteration method.
14. Measurement of vertical angles.
15. Measurement of bearing of line
16. Running a closed traverse using theodolite, computations, balancing and plotting by Gale's traverse table
17. Contouring by Tacheometry of a small area
18. Study and setting of total station.
19. Measurement of horizontal angle, vertical angle, and distance by total station.

REFERENCE BOOKS :

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

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BUILDING TECHNOLOGY

CODE CC 203
CE 203

L T P
2 2/2 --

RATIONALE

Building construction is an important job of Civil (construction) 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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CONSTRUCTION MANAGEMENT-I

CODE CC 204

L T P
2 2/2 --**RATIONALE**

A junior engineer is responsible for the management of a construction job at site. He is required to instruct the workmen, arrange the materials, tools and plants before carrying out any construction activity. So this subject provides all the necessary know how for the systematic work and guidance to the diploma holders. Safety relating to civil works is also included in the contents.

Complex research and development projects can be managed effectively if the project managers have the means to plan and control the schedules and costs of the work required to achieve their technical performance objectives.

Network techniques provide a rational approach to the planning and controlling of construction works. The application of such techniques is inevitable when there is a constraint on resources and a need for higher productivity.

CONTENTS**1. Introduction :**

- 1.1 Construction as an industry
- 1.2 Basic concepts of Management
- 1.3 Different Schools of Management
- 1.4 Different types of construction
- 1.5 Stages in construction from conception to realization
- 1.6 Construction team - owners, engineer and contractor
- 1.7 Construction management
 - 1.7.1 Necessity
 - 1.7.2 Resources - men power, machines, materials, money and management
 - 1.7.3 Function of construction management-planning, organising, staffing, directing, controlling and co-ordinating
 - 1.7.4 Joint venturing and BOT (Build Operate and Transfer) projects

2. Human Resources Development :

- 2.1 Introduction, object and functions of human resource development department
- 2.2 Recruitment, sources and methods of selection, need for effective training, method of training, duties of supervisor / Foremen, role of HRD in industries.

3. Wages and Incentives :

- 3.1 Definitions and Requirement of a good wage system
- 3.2 Methods of Wage Payment
- 3.3 Wage incentives :
 - 3.3.1 Types of Incentive
 - 3.3.2 Incentive to Supervisor
 - 3.3.3 Difference in Wage Incentive and Bonus

4. Organisation :

- 4.1 Types of organisation
 - 4.1.1 Line, functional and line & staff and their description chart
 - 4.1.2 Advantages, disadvantages and applications of various organisation
 - 4.1.3 Principles of organisation
 - 4.1.4 Site organisation
 - 4.1.5 Principles of storing and stacking materials at site
 - 4.1.6 Location of equipments
 - 4.1.7 Introduction of job layout and factors influencing it
 - 4.1.8 Drawing of Different types of job layout

5. Construction Contracts :

- 5.1 Introduction
- 5.2 Proposal and agreements
- 5.3 Types of construction contracts : lumpsum contract, rate contract, cost plus contracts, turnkey contracts
- 5.4 General conditions of contracts
- 5.5 Contract labour act.

6. Construction Labour :

- 6.1 Condition of construction workers in India
- 6.2 Wages paid to workers
- 6.3 Trade unions
- 6.4 Trade union act
- 6.5 Important provisions of Minimum Wages Act
- 6.6 Productivity in construction
- 6.7 Workman's Compensations Act

7. Construction Safety :

- 7.1 Meaning and scope
- 7.2 Legal requirements
- 7.3 Causes and effects of accidents
- 7.4 First Aid
- 7.5 First prevention
- 7.6 Safety programme
- 7.7 Safety training

8. Project Management :

- 8.1 Introduction
- 8.2 Project planning
- 8.3 Project Scheduling
- 8.4 Project Controlling
- 8.5 Role of decision in project management
- 8.6 Techniques of analysing alternatives :
operation research
- 8.7 Methods of planning and programming

9. Bar Chapter and Milestone Charts :

- 9.1 Introduction
- 9.2 Development of bar charts
- 9.3 Shortcomings of bar charts and remedial measures
- 9.4 Milestone charts
- 9.5 Development of PERT network

10. Elements of Network :

- 10.1 Introduction
- 10.2 Event
- 10.3 Activity
- 10.4 Dummy
- 10.5 Network rules
- 10.6 Graphical guidelines for network
- 10.7 Common partial situations in network
- 10.8 Numbering of events

11. Development of Network :

- 11.1 Introduction
- 11.2 Planning for network construction
- 11.3 Modes of network construction
- 11.4 Steps in development of network
- 11.5 Work breakdown structure
- 11.6 Hierarchies

12. Time Estimates :

- 12.1 Introduction
- 12.2 Uncertainties : Use of PERT
- 12.3 Time estimates
- 12.4 Frequency distribution
- 12.5 Mean, variance and standard deviation
- 12.6 Probability distribution
- 12.7 Beta distribution
- 12.8 Expected time

13. Time Computations :

- 13.1 Introduction
- 13.2 Earliest expected time
- 13.3 Formulation for T_E
- 13.4 Latest allowable occurrence time
- 13.5 Formulation for T_L
- 13.6 Combined tabular computations for T_E and T_L

14. Network Analysis :

- 14.1 Slack
- 14.2 Critical path
- 14.3 Probability of meeting scheduled date

15. Network Analysis :

- 15.1 Introduction
- 15.2 CPM : process
- 15.3 CPM: networks
- 15.4 Activity time estimate
- 15.5 Earliest event time
- 15.6 Latest allowable occurrence time
- 15.7 Combined tabular computations for T_E and T_L
- 15.8 Start and finish times of activity
- 15.9 Float
- 15.10 Super Critical and Sub Critical activities and critical path

16. CPM : Cost Model :

- 16.1 Introduction
- 16.2 Project cost
- 16.3 Indirect project cost
- 16.4 Direct project cost
- 16.5 Slope of direct cost curve
- 16.6 Total project cost and optimum duration
- 16.7 Contracting the network for cost optimization
- 16.8 Steps in time-cost optimization

17. Updating :

- 17.1 Introduction
- 17.2 Updating : Process
- 17.3 Data required for updating
- 17.4 Steps in process of updating
- 17.5 When to update

18. Resources Allocation and Multi Project Scheduling :

- 18.1 Introduction
- 18.2 Project Resources
- 18.3 Objectives of Resource Allocation
- 18.4 Assessment of Resource Requirement
- 18.5 Resources usage profiles : histograms
- 18.6 Resources smoothing
- 18.7 Resources leveling
- 18.8 Multi Project Multi Resource Allocation

REFERENCE BOOKS :

- | | |
|---|-----------------------------------|
| 1. Construction Management & Accounts | Vazrani & Chandola |
| 2. Construction Management & Accounts | H. Singh- (TMH). |
| 3. Construction Management & Equipment | B.L. Gupta. |
| 4. Construction Planning & Equipment | Satya Narayannn & Sushma Saxena |
| 5. Construction Management & Equipment | Subhash Sharma & Khanna. |
| 6. Construction Management, Equipments & Accounts (Hindi) | M.R.Choudhary |
| 7. Construction Planning & Management | P.S. Gehlot & D.M. Dhir |
| 8. PERT and CPM | Dr. B.C. Punmia & K.K. Khandelwal |
| 9. PERT and CPM | Dr. P.N. Modi |
| 10. Construction Planning & Management | P.S. Gehlot & B.M. Dhir |

*** **

TRANSPORTATION ENGINEERING

CODE CC 205
CE 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 also caters 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 (construction) 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
- 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 CC 206
CE 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 (construction) 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 repellent 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 |

CONCRETE TECHNOLOGY

CODE CC 207
CE 207

L T P
2 -- 2

RATIONALE

A diploma holder in Civil (construction) 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 how 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 Gunite or shot concrete
- 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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PUBLIC HEALTH ENGINEERING

CODE CC 208

L	T	P
2	--	2/2

RATIONALE

One of the basic necessities of life on this earth is water. Life would be impossible without it and yet it is unfortunately not available to many people in the required quantity and quality. The greater tragedy is the lack of awareness of people about water and sanitary requirements. One of the basic responsibilities of a diploma holder is to educate people in about public health standards followed by planning, design and construction of public health works. First, providing potable water and second, appropriate collection and disposal of waste solids and liquids. The purpose of this essential subject is to make the diploma holder to acquire the knowledge of all public health works and to enable him to construct them efficiently.

CONTENTS

1. Quantity of Water:

- 1.1 Water demand per capita for domestic and other uses
- 1.2 Fire demand
- 1.3 Design period
- 1.4 Demands as per B.I.S

2. Quality of Water:

- 2.1 Examination of water
 - 2.1.1 Physical
 - 2.1.2 Chemical
 - 2.1.3 Bacteriological
- 2.2 Potable water
- 2.3 Impurities in water
 - 2.3.1 Suspended
 - 2.3.2 Colloidal
 - 2.3.3 Dissolved
- 2.4 Permissible standard for potable water
- 2.5 Effects of impurities if they are more than permissible limits

3. Treatment of Water:

- 3.1 Flow diagrams of treatment plants
- 3.2 Function, constructional details, working of
 - 3.2.1 Aeration unit
 - 3.2.2 Feeding and mixing devices of chemicals
 - 3.2.3 Sedimentation
 - 3.2.4 Coagulation and flocculation unit
 - 3.2.5 Filtration unit
 - 3.2.5.1 Slow sand filter
 - 3.2.5.2 Rapid sand filter
 - 3.2.5.3 Pressure filter
- 3.3 Chlorination

4. Conveyance of Water:

- 4.1 Use, joints, merits and demerits of
 - 4.1.1 Steel pipes
 - 4.1.2 Cast iron pipes
 - 4.1.3 P.V.C.
 - 4.1.4 Asbestos cement pipes
 - 4.1.5 G.I. pipes

5. Construction of Water Distribution System:

- 5.1 Service reservoirs
- 5.2 Types of layouts
 - 5.2.1 Dead end system and its design as per PHED practice
 - 5.2.2 Grid system
 - 5.2.3 Radial system

6. Building Water Supply:

- 6.1 Water supply arrangement for a building & drawing (single and double story) as per B.I.S.
- 6.2 Water supply fixtures and their installation
- 6.3 Tapping of a water main.
- 6.4 Leakage detection and prevention
- 6.5 Maintenance of fixtures

7. Building Drainage:

- 7.1 Aims and requirements
- 7.2 Fittings and arrangements in single and multi storied buildings
- 7.3 Different sanitary fitting and their installation
- 7.4 Traps, seal in traps
- 7.5 Gulley trap
- 7.6 Intercepting trap
- 7.7 Grease trap
- 7.8 Causes of breaking seal in the traps and precautions
- 7.9 Testing of house drainage system

8. Sewerage Systems:

- 8.1 Types
 - 8.1.1 Separate system

- 8.1.2 Combined system
- 8.1.3 Partially separate system
- 8.2 Stone ware sewers
- 8.3 Cast iron sewers
- 8.4 Concrete sewers
- 8.5 Sewer Joints
- 8.6 Different shapes of sewers

9. Appurtenances :

- 9.1 Manholes
 - 9.1.1 Location
 - 9.1.2 Construction
- 9.2 Drop manhole
- 9.3 Inlets
- 9.4 Catch basin
- 9.5 Inverted syphon
- 9.6 Flushing tanks
- 9.7 Ventilating shaft
- 9.8 Lamp holes

10. Laying of Sewers :

- 10.1 Setting out alignment
- 10.2 Excavation
- 10.3 Checking the gradient using boning rod
- 10.4 Preparation of bed
- 10.5 Lowering, laying and jointing
- 10.6 Testing
- 10.7 Back filling
- 10.8 Construction of masonry sewers
- 10.9 Construction of surface drains

PRACTICALS

1. To determine residual chlorine by Orthotolidine-Sodium test.
2. To determine optimum dose of coagulant by jar test.
3. To determine hardness of water by E.D.T.A. test.
4. To determine pH value of water by universal indicator method.
5. To determine total, dissolved and suspended solids in a water.
6. To determine turbidity of water by nephelometer..
7. Layout of water treatment plant and detailed drawing of rapid sand filter.
8. Sketch of sluice, reflux, air release, scour, safety valve.
9. Flow diagram of sewage treatment plant (with sketch)
10. Study of various types of traps (with sketches)
11. Study of flushing cistern (with sketches)
12. Study of urinals and WC's. (with sketches)
13. Sketches of manhole, septic tank, clarifier and trickling filter.

REFERENCE BOOKS :

- | | |
|----------------------------------|-------------|
| 1. Water Supply Engg. | S. K. Garg |
| 2. Water Supply & Sanitary Engg. | Rangwala |
| 3. Water Supply Engineering – I | B.C. Punmia |
| 1. Sanitary Engineering | S.K. Garg |
| 2. Sanitary Engineering | Rangwala |
| 3. Water Supply – II | B.C. Punmia |

CONSTRUCTION MATERIALS AND EQUIPMENTS

CODE CC 209
CE 209

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RATIONALE

Construction materials are an important part of Civil (construction) 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, feldspar, 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 DRAWINGCODE CC 210
CE 210L T P
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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 (construction) 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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