
THEORY OF STRUCTURE

CODE CE 301
CC 301

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RATIONALE

This subject follows the subject of strength of materials taught. The acquired knowledge is applied here to analyse the simple structures. A diploma holder in civil engineering will be required to design and construct simple structures in his professional life.

CONTENTS

1. Frames :

- 1.1 Different types of frames
- 1.2 Calculation of forces in the members of determinate frames
 - 1.2.1 Method of Joints
 - 1.2.2 Method of section

2. Slope and Deflection :

- 2.1 Calculation of slope and deflection in simply supported and cantilever beams, loaded with point and uniformly distributed load by
 - 2.1.1 Double integration method
 - 2.1.2 Macaulay's method
 - 2.1.3 Area moment method

3. Propped Cantilever Beam :

- 3.1 Concept
- 3.2 Drawing of B.M.D. and S.F.D. for propped cantilever beams loaded with point loads and U.D.L.
- 3.3 Slope and deflection for point loads and U.D.L.

4. Fixed Beams :

- 4.1 Concept
- 4.2 Drawing of BMD and SFD using Mohr's theorem

5. Continuous Beams :

- 5.1 Drawing of BMD and SFD for continuous beams loaded with point load and UDL using Claypeyron's theorem of three moments

6. Rolling Loads :

- 6.1 Drawing of maximum B.M.D. and S.F.D. for simply supported beam for rolling loads of
 - 6.1.1 Single concentrated load
 - 6.1.2 Two point loads
 - 6.1.3 Series of point loads
 - 6.1.4 U.D.L. longer than span
 - 6.1.5 U.D.L. shorter than span

7. Influence Line Diagram for the following in Simply Supported Beams :

- 7.1 Reaction
- 7.2 Shear force
- 7.3 Bending moment

8. Three Hinged Arch :

- 8.1 Introduction
- 8.2 Reactions of symmetrical parabolic arch
- 8.3 S.F.D. & B.M.D. of symmetrical parabolic arch

9. Retaining Walls :

- 9.1 Types of retaining walls
- 9.2 Stability of retaining walls

10. Indeterminate Structures :

- 10.1 Types of indeterminacy
- 10.2 External and internal
- 10.3 Degree of indeterminacy in beams and pin jointed frames

REFERENCE BOOKS :

- | | |
|--|----------------|
| 1. Strength of Material & Theory of Structures. Vol – I & II | B.C. Punmia |
| 2. Mechanics of Structure | S.B. Junarkar. |
| 3. Strength of Material | S. Ramamurtham |
| 4. Strength of Material & Theory of Structures. Vol – I & II | R.S. Khurmi |

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DESIGN OF STEEL STRUCTURE

CODE CE 302
CC 302

L T P
2 2 --

RATIONALE

A diploma holder in Civil Engineering will be required to design and construct simple structures in his professional life. This subject covers design of simple steel structure. The student will also learn to use the latest relevant Indian Standard codes in the design practice of steel structures.

NOTE : All designs are to conform to the provisions of IS : 800- 2007.

CONTENTS**1. Introduction :**

- 1.1 Structural Steel
- 1.2 Structural Steel Sections
- 1.3 Steel as a structural material
 - 1.3.1 Advantages
 - 1.3.2 Disadvantages
- 1.4 Limit State Method
 - 1.4.1 Introduction
 - 1.4.2 Limit state design
 - 1.4.3 Limit state of strength
 - 1.4.4 Limit state of serviceability
- 1.5 Partial safety factor for material strength
- 1.6 Partial safety factor for loads.

2. Bolted Connections :

- 2.1 Types of Bolts
- 2.2 Definition and detailing of Bolts
- 2.3 Types of bolted joints
- 2.4 Failure of bolted joints in
- 2.5 Design strength of bolt
 - 2.5.1 Bolts in shear
 - 2.5.2 Bolts in Tension
 - 2.5.3 Bolts in Bearing
 - 2.5.4 Tension capacity of plate
 - 2.5.5 Combined shear and tension
- 2.6 Efficiency of Bolted Joint

3. Welded Connections :

- 3.1 Advantages and Disadvantage of welded joint
- 3.2 Permissible stresses in welds
- 3.3 Types of welded connections
- 3.4 Design of butt and fillet welded connections subjected to axial loads

4. Design of Tension Members:

- 4.1 Net sectional area
- 4.2 Design strength due to yielding of gross section
- 4.3 Design strength due to rupture at net section
- 4.4 Design strength due to block shear
- 4.5 Design of tension members (flats, angles and tee sections only.)

5. Compression Members:

- 5.1 End conditions: Effective length, slenderness ratio, radius of gyration
- 5.2 Permissible stresses in compression as per IS : 800-2007
- 5.3 Strength of columns-single and built up sections.
- 5.4 Design of angle struts.
- 5.5 Design of axially loaded
 - 5.5.1 Single rolled steel section
 - 5.5.2 Built up section
- 5.6 Design of lacing
- 5.7 Design of battens

6. Column Bases:

- 6.1 Design of slab base
- 6.2 Design of gusseted base

7. Design of Beams:

- 7.1 Plastic methods of design
 - 7.1.1 Plastic section modulus
 - 7.1.2 Shape factor
 - 7.1.3 Plastic hinge
- 7.2 Methods of Plastic Analysis
- 7.3 Plastic analysis of structures
- 7.4 Shear behaviour of steel beam
- 7.5 Factors affecting plastic moment capacity.
- 7.6 Design of laterally restrained beams
- 7.7 Web buckling and crippling

8. Roof Trusses:

- 8.1 Basic components of roof truss.
- 8.2 Types of loads on roof truss-
 - 8.2.1 Dead load
 - 8.2.2 Live load
 - 8.2.3 Wind load.
- 8.3 Design of purlins (only angle section for the given load)

9. Plate Girder:

- 9.1 Components of plate girder.
- 9.2 Loads on plate girder.
- 9.3 Sketches of bolted and welded plate girder with various types of stiffeners.

REFERENCE BOOKS:

- 1. Limit state Design of Steel Structure Dr.V.L. Shah & Prof. Veena Gore
- 2. Limit state Design of Steel Structure Subramanian

3. IS 800-2007
4. Steel Table

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DESIGN OF R.C.C. STRUCTURE

CODE CE 303
CC 303

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RATIONALE

A diploma holder in Civil Engineering will be required to handle simple R.C.C. structures in his professional life, therefore he should be able to design simple structural elements of R.C.C. The student should also learn to use the latest relevant Indian Standard codes in his design practice.

NOTE : All designs are to conform to the provisions of IS : 456- 2000.

CONTENTS

1. Introduction :

- 1.1 Reinforced Cement Concrete- its meaning, constituents, functions and specifications as per I.S..
- 1.2 Working stress method of design
- 1.3 Limit state method of design
- 1.4 Ultimate method of design
- 1.5 Past practice and present practice for the design of structures.
- 1.6 Grades of concrete and steel
- 1.7 Stress - strain curve for concrete and steel
- 1.8 Load factors
- 1.9 Steel concrete bond, development length, anchorage value
- 1.10 Effective span, specification of reinforcement as per BIS

2. Flexural Members :

- 2.1 Limit state of collapse
- 2.2 Limit state of flexure
- 2.3 Neutral axis, moment of resistance, balanced and unbalanced sections
- 2.4 Limit state of shear, nominal shear stress, shear strength of beam.
- 2.5 Design of shear reinforcement
- 2.6 Limit state of serviceability deflection and cracking criteria.
- 2.7 Curtailment of bars

3. Analysis and Design of Beams :

- 3.1 Single reinforced beam
- 3.2 Doubly reinforced beam
- 3.3 T-beam
- 3.4 Lintel
- 3.5 Cantilever beam

4. Slabs :

- 4.1 Design criteria as per BIS
- 4.2 Design of one-way slab
- 4.3 Design of two-way slab with corners free to lift

5. Compression Members (axially loaded columns) :

- 5.1 Limit state of compression
- 5.2 Load carrying capacity
- 5.3 Design of short column (rectangular, square and circular cross section)

6. Design of Footing :

- 6.1 Critical section for shear and bending moment
- 6.2 Design of an isolated footing of uniform depth for a square column
- 6.3 Layout of reinforcement

7. Retaining Wall :

- 7.1 Types of retaining walls
- 7.2 Design of cantilever type retaining wall
- 7.3 Reinforcement details

8. Prestressed Concrete :

- 8.1 Definition, advantages and methods of prestressing
- 8.2 Losses in prestressing
- 8.3 Stress calculations for point loads and uniformly distributed load for different tendon positions

REFERENCE BOOKS :

- | | |
|--------------------------------|------------------------|
| 1. Design of R.C.C. Structures | B.C. Punmia |
| 2. Design of R.C.C. Structures | H.J. Shah |
| 3. Design of R.C.C. Structures | A.K. Jain |
| 4. Design of R.C.C. Structures | N. Krishna Raju |
| 5. Design of R.C.C. Structures | V.L. Shah & S.R. Karve |

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SURVEYING -II

CODE CE 304

L T P
2 -- 4**RATIONALE**

The important functions of Civil 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, Tachometry survey that the Civil 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. Theodolite :**

- 1.1 Types
- 1.2 Different parts of a Vernier Transit Theodolite
- 1.3 Fundamental axes
- 1.4 Temporary adjustment
- 1.5 Transiting
- 1.6 Swinging
- 1.7 Measurement of horizontal angle (Repetition and Reiteration method)
- 1.8 Measurement of vertical angle
- 1.9 Measurement of the bearing
- 1.10 Prolonging a line
- 1.11 Use as level
- 1.12 Permanent adjustment

2. Traverse :

- 2.1 Types - open and closed traverse
- 2.2 Methods of traversing
 - 2.2.1 Traversing by included angles
 - 2.2.2 Traversing by deflection angles
- 2.3 Latitudes and departures
- 2.4 Balancing of a traverse by
 - 2.4.1 Bowditch's rule
 - 2.4.2 Transit rule
- 2.5 Omitted measurements

3. Tacheometry :

- 3.1 Concept
- 3.2 Methods
 - 3.2.1 Stadia methods
 - 3.2.2 Tangential methods
- 3.3 Anallatic lens
- 3.4 Determination of horizontal and vertical distances by
 - 3.4.1 Staff vertical
 - 3.4.2 Staff normal to the line of sight
- 3.5 Substance bar

4. Trigonometrical Levelling :

- 4.1 Determination of heights and distance of a point
 - 4.1.1 Base accessible
 - 4.1.2 Base inaccessible
- 5. Curves :**
 - 5.1 Elements of simple circular curves
 - 5.2 Designation of curve
 - 5.3 Radius and degree of curve
 - 5.4 Relation between radius and degree of curve
 - 5.5 Setting out of simple circular curve by linear and tangential methods
 - 5.6 Vertical curves
 - 5.6.1 Types
 - 5.6.2 Setting out of vertical curves
 - 5.7 Transition Curves
 - 5.7.1 Ideal transition curve
 - 5.7.2 Types of transition curve
- 6. Mine Surveying :**
 - 6.1 Equipment of mine surveys
 - 6.2 The stations and station markers
 - 6.3 Measurement of distance and difference in elevation
 - 6.4 Tunnel alignment and setting out
- 7. Modern Instruments - Brief Description :**
 - 7.1 Electronic distance measuring instruments
 - 7.2 T-2-Theodolite
 - 7.3 Total station
 - 7.4 Global Positioning system

PRACTICALS

1. Study of parts of theodolite.
2. Measurement of horizontal angles by repetition and reiteration method.
3. Measurement of vertical angles.
4. Measurement of bearing of line
5. Prolonging of a line with theodolite.
6. Running a closed traverse using theodolite, computations, balancing and plotting by Gale's traverse table
7. Determination of stadia constants.
8. Contouring by Tacheometry of a small area
9. Setting out of simple circular curves.
10. Determination of height of a distant point by trigonometrical levelling

REFERENCE BOOKS :

- | | |
|--------------------------|---------------|
| 1. Surveying Vol. I & II | B. C. Punmia |
| 2. Surveying Vol. I & II | T.P. Kanetkar |
| 3. Surveying | Devid Clark |

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WATER SUPPLY & SANITARY ENGINEERING

CODE CE 305

L T P
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. Water Demand and Quantity :**

- 1.1 Water demand per capita for domestic and other uses
- 1.2 Population forecast
- 1.3 Fire demand
- 1.4 Design period
- 1.5 Demands as per B.I.S
- 1.6 Sources of Water
- 1.7 Quality of water obtained from different sources

2. Quality of Water :

- 2.1 Examination of water
 - 2.1.1 Physical
 - 2.1.2 Chemical
 - 2.1.3 Bacteriological
- 2.2 Potability of water
- 2.3 Impurities of water
 - 2.3.1 Suspended
 - 2.3.2 Colloidal
 - 2.3.3 Dissolved impurities
- 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
- 3.4 Chemicals used in treatment
- 3.5 Desalination and defluoridation

4. Regulatory Valves :

- 4.1 Sluice valve (gate valve)
- 4.2 Reflux valve
- 4.3 Air release valve
- 4.4 Scour valve
- 4.5 Safety valves
- 4.6 Pressure relief valves
- 4.7 Fire hydrants

5. Distribution of Water :

- 5.1 Systems of supply
 - 5.1.1 Intermittent
 - 5.1.2 Continuous
- 5.2 Service reservoirs
- 5.3 Advantages and disadvantages of metered water supply
- 5.4 Types of layouts
 - 5.4.1 Dead end system and its design as per PHED practice
 - 5.4.2 Grid system
 - 5.4.3 Radial system

6. Rural Water Supply :

- 6.1 Important aspects
- 6.2 Sources
- 6.3 Treatment

7. System of Sanitation :

- 7.1 Necessity of systematic collection and disposal of waste
- 7.2 Dry waste
- 7.3 Semi-liquid waste
- 7.4 Liquid waste
- 7.5 Terminology related to sanitary engineering

8. Quantity of Sewage :

- 8.1 Domestic sewage
- 8.2 Industrial waste
- 8.3 Storm water
- 8.4 Volume of domestic sewage dry weather flow (D.W.F.) and equivalent DWF
- 8.5 Variation of flow
- 8.6 Limiting velocities
 - 8.6.1 Non-silting velocity
 - 8.6.2 Non-scouring velocity
 - 8.6.3 Self cleansing velocity
 - 8.6.4 Transporting velocity
- 8.7 Depth of flow

9. Characteristics and Composition of Sewage :

- 9.1 Decomposition of sewage
- 9.2 Sewage sampling
- 9.3 Physical and chemical analysis

- 9.4 Testing of sewage
 - 9.4.1 Physical test
 - 9.4.2 Biological test
 - 9.4.3 Chemical test

10. Building Drainage :

- 10.1 Aims and requirements
- 10.2 Fittings and arrangements in single and multi storied buildings
- 10.3 Different sanitary fitting and their installation
- 10.4 Traps, seal in traps
- 10.5 Gulley trap
- 10.6 Intercepting trap
- 10.7 Grease trap
- 10.8 Causes of breaking seal in the traps and precautions
- 10.9 Testing of house drainage system
- 10.10 Septic tank
- 10.11 Soak pit

11. Sewerage Systems :

- 11.1 Types
 - 11.1.1 Separate system
 - 11.1.2 Combined system
 - 11.1.3 Partially separate system
- 11.2 Stone ware sewers
- 11.3 Cast iron sewers
- 11.4 Concrete sewers
- 11.5 Sewer Joints
- 11.6 Different shapes of sewers

12. Appurtenances :

- 12.1 Manholes
 - 12.1.1 Location
 - 12.1.2 Location
 - 12.1.3 Construction
- 12.2 Drop manhole
- 12.3 Inlets
- 12.4 Catch basin
- 12.5 Inverted syphon
- 12.6 Flushing tanks
- 12.7 Ventilating shaft
- 12.8 Lamp holes

13. Laying of Sewers :

- 13.1 Setting out alignment
- 13.2 Excavation
- 13.3 Checking the gradient using boning rod
- 13.4 Preparation of bed
- 13.5 Lowering, laying and jointing
- 13.6 Testing
- 13.7 Back filling
- 13.8 Construction of masonry sewers
- 13.9 Construction of surface drains

14. Maintenance :

- 14.1 Inspection of mains
- 14.2 Cleaning of sewers
- 14.3 Precautions during cleaning operations
- 14.4 Maintenance of traps
- 14.5 Cleaning of house drainage line
- 14.6 Ventilation of sewers
- 14.7 Tools and equipment needed for maintenance

15. Sewage Disposal :

- 15.1 General composition of sewage
- 15.2 Strength of sewage
- 15.3 Land disposal
- 15.4 Dilution method of disposal
- 15.5 Nuisance due to disposal
- 15.6 Self purification of streams

16. Treatment and Disposal :

- 16.1 Primary treatment
- 16.2 Secondary treatment
- 16.3 Function and construction of
 - 16.3.1 Screening chambers
 - 16.3.2 Grit chambers
 - 16.3.3 Clarifier chambers
 - 16.3.4 Trickling filters
 - 16.3.5 Aeration tank
 - 16.3.6 Activated sludge process
- 16.4 Sludge treatment
- 16.5 Sludge digestion
- 16.6 Sludge disposal

17. Rural Sanitation :

- 17.1 Introduction
- 17.2 Dry and wet latrines : selection, location, design life
- 17.3 Latrine for waterlogged high flood areas.
- 17.4 Aqua privies
- 17.5 Storm water and sludge problem

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 Jackson Turbidimeter or nephelometer.
- 7. To determine the alkalinity by titration method.
- 8. Sampling procedure for water and sewage.
- 9. Determination of chlorides of sewage sample.
- 10. Determination of sulphates of sewage sample.
- 11. Determination of BOD of sewage sample.
- 12. Determination of COD of sewage sample.

REFERENCE BOOKS :

- 1. Water Supply Engg.

S. K. Garg

2. Water Supply & Sanitary Engg.	Rangwala
3. Water Supply Engineering	B.C. Punmia
4. Sanitary Engineering	S.K. Garg
5. Sanitary Engineering	Rangwala
6. Sanitary Engineering	B.C. Punmia
7. Water Supply & Sanitary Engg.	G.S. Birde & J.S. Birde

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IRRIGATION ENGINEERING

CODE CE 306

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RATIONALE

In the field of irrigation engineering a diploma engineer is responsible for maintenance and smooth running of IRRIGATION channels. So he should have sufficient knowledge of water management for the growth of crops in the country.

In the field of irrigation engineering, a diploma engineer is responsible for maintenance and smooth running of irrigation channels. So he should have sufficient knowledge of water management for the growth of crops in the country. Irrigation engineering is taught in the diploma course to impart the knowledge of :

- I. System of channels providing irrigation at agricultural areas.
- II. Crops and irrigation structures.

CONTENTS**1. Introduction:**

- 1.1 History of irrigation development in India.
- 1.2 Classification and different methods of irrigation.

2. Water Requirements of Crops :

- 2.1 Classes and availability of soil water
- 2.2 Depth and frequency of irrigation
- 2.3 Relationship between duty, delta and base period.
- 2.4 Gross command area (G.C.A.) culturable commanded area (C.C.A.), culturable cultivated and uncultivated area. Intensity of irrigation
- 2.5 Factors affecting duty of water, methods of improving duty
- 2.6 Principal crops of rajasthan and India. Sowing and harvesting time
- 2.7 Water requirements and rotation of different crops
- 2.8 Calculation of water requirement for a given irrigated area.

3. Hydrology:

- 3.1 Hydrologic cycle
- 3.2 Rainfall its characteristics and methods of measurement.
- 3.3 Run off, factors affecting run off, determination of average annual run off.
- 3.4 Importance and different methods of gauging stream flow. Hydrograph, unit hydrograph and flood hydrograph

4. Dams :

- 4.1 Types of Dams
- 4.2 Selection of site for a dam
- 4.3 Forces acting on a gravity dam
- 4.4 Failure of gravity dams

5. Earthen and Rock fill Dams :

- 5.1 Homogeneous dams and composite dams

- 5.2 Causes of failure of earthen dams
 - 5.3 Drainage of earthen dam
 - 5.4 Rock-fill dams : basic features and its need
- 6. Spillways :**
- 6.1 Brief description and functions of different types of spillways
- 7. River Training Works :**
- 7.1 River behaviour in plane and mountainous regions
 - 7.2 Different methods of river training works sketches and brief description
- 8. Canals :**
- 8.1 Explanation of terms-canal
 - 8.2 Classification of canals, channel, major distributory, minor distributory, water course, navigation canal, hydro-canal, irrigation canal, perennial canal, inundation canal
 - 8.3 Water shed
 - 8.4 Drainage
 - 8.5 Alignment of irrigation canal
 - 8.6 Explanation of terms-critical velocity, rugosity coefficient, velocity ratio, silt factor
 - 8.7 Regime, regime slope, regime dimensions
 - 8.8 Relation between Kennedy's critical velocity ratio and Lacey's silt factor.
 - 8.9 Problems of sediment transport in channels.
 - 8.10 Salient features of Kennedy's and Lacey's silt theories
 - 8.11 Computing the losses in irrigation channels
- 9. Water Logging :**
- 9.1 Definition
 - 9.2 Causes, effects and preventive measures
 - 9.3 Types of canal lining brief description and advantages
- 10. Diversion Head Works :**
- 10.1 Typical layout of head works
 - 10.2 Brief description, sketches and function of component parts of weir or barrage
 - 10.3 Scouring sluices, silt excluder
 - 10.4 Divide-wall
 - 10.5 Fish ladder
 - 10.6 Guide bank
 - 10.7 Marginal bunds
 - 10.8 Head regulator
 - 10.9 Classes of weirs
 - 10.9.1 Rockfill weir
 - 10.9.2 Bligh type weir
 - 10.9.3 Khosla type weir
 - 10.9.4 Pickup weir
 - 10.10 Causes of failure of weirs.
- 11. Cross Drainage Works :**
- 11.1 Brief description of different methods of disposal of drainage intercepted by canals
 - 11.2 Inlet and outlet
 - 11.3 Aqueduct and syphon aqueduct
 - 11.4 Super passage and syphon
 - 11.5 Level crossing

12. Distributory Works :

- 12.1 Brief description and sketches of
 - 12.1.1 Distributory head
 - 12.1.2 Silt selective device
 - 12.1.3 Discharge regulator
 - 12.1.4 Tail escape
 - 12.1.5 Bed bar tail escape

13. Well Irrigation :

- 13.1 Explanation of terms - well, open well tube well, shallow and deep well, ground water reservoir, mota layer, depression head, cone of depression, radius of influence critical velocity.
- 13.2 Classification of tube well
 - 13.2.1 Slotted wells
 - 13.2.2 Strainer wells
 - 13.2.3 Cavity wells
- 13.3 Brief description and sketches of common types of strainer
- 13.4 Construction of strainer well - selection of site boring and lowering of casing tube, preparation of strata chart, lowering strainers, shrouding, development
- 13.5 Construction of slotted and cavity wells
- 13.6 Duty of open wells and tube wells
- 13.7 Relative advantages and disadvantages of open wells and tube wells.

REFERENCE BOOKS :

- | | |
|---|-----------------|
| 1. Irrigation & Water Power Engg. | Dr. B.C. Punmia |
| 2. Irrigation & Water Power Engg. | Dr. P.N. Modi |
| 3. Irrigation & Water Power Engg. | S.K. Garg |
| 4. Elem. Irrigation Engg. (Hindi) | Gurcharan Singh |
| 5. Elem. Irrigation Engg. (Hindi) | B.L. Gupta |
| 6. Fundamental Principles of Irrigation Engg. | V.B. Priyani |

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CIVIL ENGINEERING ESTIMATING AND COSTING

CODE CE 307
CC 307

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1 -- 4

RATIONALE

A diploma holder should have the knowledge about to forecast the quantity of materials required for each item of work from the available drawings. The student should also know about specifications of each work, knowledge of earthwork calculation and preparing of abstract of cost.

A diploma holder in civil engineering has a major job of valuation and rent fixation. Once he is working as junior engineer or contractor he must be familiar with the departmental procedures. The student will get the knowledge of making tender notices, inviting tenders, executing contracts and recording M.B.

CONTENTS**1. Introduction :**

- 1.1 Purpose
- 1.2 Importance of estimating
- 1.3 Common items of works in civil engineering construction works
- 1.4 Units of measurement for common items of works
- 1.5 Methods of measurement
- 1.6 Explanation of common terms used for estimating
- 1.7 Different types of estimates and their significance
- 1.8 Merits and demerits.
- 1.9 Methods of taking out quantities
- 1.10 Study of Basic Schedule of Rates (B.S.R.)

2. Rate-Analysis :

- 2.1 Factors affecting cost of work
- 2.2 Explanation of terms
- 2.3 Prime cost
- 2.4 Original cost
- 2.5 Provisional items
- 2.6 Provisional sum
- 2.7 Day work, item wise
- 2.8 Analysis of cost of material
- 2.9 Labour
- 2.10 Transport
- 2.11 Establishment charges and incidentals
- 2.12 Preparation of analysis of rates for items of work involved in building construction mentioned in practical syllabus.

3. Specifications :

- 3.1 Importance of specifications. Principles for writing out specifications, types of specification
- 3.2 Writing general and detailed specifications for items of work in building construction mentioned in practical syllabus.

4. Detailed Estimates for Buildings :

- 4.1 Calculation of quantities
- 4.2 Preparing abstract of cost for a residential building.

5. Earth Work Calculations for Road & Rail Formation :

- 5.1 Earthwork calculations and estimates for roads and rail formation
For earth work following methods may be used :
 - 5.1.1 Mean depth method.
 - 5.1.2 Mean area method.
 - 5.1.3 Prismoidal formula method
 - 5.1.4 Graphical method
Using longitudinal and typical cross sections
- 5.2 Cross section for different stations.
- 5.3 Finding earth work by these sections
- 5.4 Calculation of permanent and temporary lands for roads
- 5.5 Economical depth of digging for canals
- 5.6 Mass haul diagram

6. Preparing Detailed Estimates for the Various Items of Work from the given Drawing for

- 6.1 Detailed estimates for earthwork of irrigation canals
- 6.2 Septic tank and soak pit
- 6.3 Bitumen road

7. Valuation of Property and Rent Fixation :

- 7.1 Objects of valuation
- 7.2 Free-hold property
- 7.3 Lease-hold property
- 7.4 Property income
- 7.5 Obsolescence
- 7.6 Market-value
- 7.7 Book value

- 7.8 Distress value
- 7.9 Monopoly value
- 7.10 Salvage value
- 7.11 Scrap value
- 7.12 Accommodation value
- 7.13 Replacement value
- 7.14 Sentimental value
- 7.15 Speculative value
- 7.16 Factors affecting the value of the property
- 7.17 Annuity
- 7.18 Capital cost
- 7.19 Capitalized value
- 7.20 Year's purchase
- 7.21 Methods of determining depreciation
- 7.22 Valuation of property
- 7.23 Method of determining valuation of property
- 7.24 Typical valuation report
- 7.25 Types of rents
- 7.26 Rules of capital cost fixation for govt. buildings
- 7.27 Rules for calculation of standard rent

8. Procedure of Works :

- 8.1 Main staff structure of engineering department
- 8.2 Duties of junior engineer
- 8.3 Administrative approval
- 8.4 Expenditure sanction or approval
- 8.5 Technical sanction or a approval
- 8.6 Tender System
- 8.7 E-tendering
- 8.8 Technical bid and financial bid
- 8.9 Appropriation and re-appropriation of funds
- 8.10 Procedure for original minor and major works
- 8.11 Repair works
- 8.12 Types of estimates
- 8.13 Preliminary estimate
- 8.14 Cubical content estimate
- 8.15 Plinth area estimate
- 8.16 Revised estimate
- 8.17 Supplementary estimate
- 8.18 Daily labour on muster roll system
- 8.19 Completion report

9. Stores, Tools and Plants :

- 9.1 Purchase of stores
- 9.2 Reserve of stock
- 9.3 Dead stock
- 9.4 Surplus and unserviceable stores
- 9.5 Verification of stores
- 9.6 Issue of materials from stock
- 9.7 Tools and plants
- 9.8 M.A.S. account

PRACTICALS

1. Writing units for various items of work involved in construction
2. Recording measurement in M.B.
3. Finding out the quantities of work for a residential building.

4. Calculation of arch masonry.
5. Preparation of detailed estimate for a residential building.
 - 5.1 Single storey
 - 5.2 Double storey
6. Writing detailed specifications and rate analysis schedules for
 - 6.1 Earth work in excavation.
 - 6.2 Concrete in foundation.
 - 6.3 Brick work in sub and super structure.
 - 6.4 Random rubble and Ashler masonry.
 - 6.5 RCC in beams and slabs.
 - 6.6 Plastering
 - 6.7 Pointing
 - 6.8 White washing, colour washing and distempering
7. Calculation of earthwork by average depth, average area, prismatic formula and graphical method.
8. Find out earthwork for roads using longitudinal section and typical cross section.
9. Calculation of permanent and temporary land for roads.
10. Finding earth work for irrigation canals using L-section and cross section.
11. Calculation of permanent and temporary land for canals
12. Detailed estimate for septic tank and soak pit
13. Valuation by different methods.
14. Typical valuation reports
15. Calculation of rent of residential building
16. Calculation of rent of commercial building

REFERENCE BOOKS :

- | | |
|--|---------------------|
| 1. Estimating & Costing | Chakerborty |
| 2. Estimating & Costing | B.N. Dutta |
| 3. Estimating & Costing | Rangwala |
| 4. Estimating & Costing | Bhasin |
| 5. Estimating & Costing | Vazirani & Chandola |
| 6. Civil Engg. Estimating & Costing | Mahajan |
| 7. Civil Engg. Estimating & Costing | G.S. Birdie |
| 8. P.W.D. Basic Schedule of Rates of Rajasthan State | |

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ENVIRONMENTAL ENGINEERING

CODE CE 308

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RATIONALE

A civil engineering diploma holders must have the knowledge of different types of pollution caused due to industrialisation and construction activities so as he may help in balancing the ecosystem and control pollution by providing controlling measures. He should also be aware of the environment laws for effectively controlling the pollution of environment.

CONTENTS**1. Environment and Ecology :**

- 1.1 Definition and understanding of their concept
- 1.2 Ecosystem
- 1.3 Energy flow in an ecosystem
- 1.4 Important bio chemical cycles (water, carbon, oxygen)
- 1.5 Communities relationship in an eco system

2. Factors Affecting Environmental Pollution :

- 2.1 Population
 - 2.2 Urbanisation
 - 2.3 Industrialisation
 - 2.4 Transportation
 - 2.5 Insecticide
 - 2.6 Animals
 - 2.7 Wars
 - 2.8 Deforestation
- 3. Water Pollution :**
- 3.1 Fresh water
 - 3.1.1 Causes of water pollution in surface and ground water
 - 3.1.2 Water quality standards
 - 3.1.3 Remedial measures to control fresh water pollution
 - 3.2 Waste water
 - 3.2.1 Adverse effects of domestic and industrial effluents
 - 3.2.2 Standards for industrial effluents
 - 3.2.3 Remedial measures to control industrial pollution
- 4. Air Pollution :**
- 4.1 Definition
 - 4.2 Sources
 - 4.3 Harmful effects on living and non living beings
 - 4.4 Permissible limits as per Indian standard
 - 4.5 Remedial measures
- 5. Noise Pollution :**
- 5.1 Introduction
 - 5.2 Sources of noise
 - 5.3 Decibel scale
 - 5.4 Adverse effect on human beings and environment
 - 5.5 Control measures
- 6. Land Pollution :**
- 6.1 Introduction
 - 6.2 Sources of land pollution
 - 6.3 Effects of land pollution
 - 6.4 Control measures
 - 6.5 Soil conservation
- 7. Environmental Impact Assessment (EIA) :**
- 7.1 Introduction
 - 7.2 E.I.A. of thermal power plants, mining and nuclear radiation
- 8. Global Environmental Issues :**
- 8.1 Deforestation
 - 8.2 Land sliding
 - 8.3 Recharging and drying of water resources
 - 8.4 Green house effects
 - 8.5 Ozone depletion
 - 8.6 Acid rain
 - 8.7 Global warming

9. Non Conventional Sources of Energy in Environmental Protection.**10. Pollution Control Acts :**

- 10.1 Water Pollution Control Act 1974 and 1981
- 10.2 Air Pollution Control Act 1981
- 10.3 Forest (Animal) Conservation Act 1972
- 10.4 Environmental Protection Act 1986
- 10.5 Pollution Control provisions in Motor Vehicle Act

11. Environment Laws :

- 11.1 Water Pollution Prevention and Control Act
- 11.2 Air Pollution Prevention and Control Act

REFERENCE BOOKS :

- | | | |
|----|----------------------------------|--------------------|
| 1. | An Overview of Environment Engg. | Kapoor |
| 2. | Water Supply & Sanitary Engg. | Birdie & Birdie |
| 3. | पर्यावरण इंजीनियरी | सी.बी. शर्मा |
| 4. | पर्यावरण अवबोध | डॉ. ओझा |
| 5. | पर्यावरण अभियांत्रिकी | अजय कुमार उपाध्याय |

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CONSTRUCTION MANAGEMENT AND ACCOUNTS

CODE CE 309

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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. He is also supposed to make payments to workmen and handle some govt. money. 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.

CONTENTS**1. Introduction :**

- 1.1 Different types of construction
- 1.2 Stages in construction from conception to realization
- 1.3 Construction team - owners, engineer and contractor
- 1.4 Construction management
 - 1.4.1 Necessity
 - 1.4.2 Resources - men power, machines, materials, money and management
 - 1.4.3 Function of construction management-planning, organising, staffing, directing, controlling and co-ordinating
 - 1.4.4 Joint venturing and BOT (Build Operate and Transfer) projects

2. Construction Planning :

- 2.1 Construction project planning
- 2.2 Stages in planning
- 2.3 Bar charts
- 2.4 Introduction to Network
- 2.5 Planning and scheduling by bar charts
- 2.6 Limitations of bar chart
- 2.7 PERT and CPM
- 2.8 Network construction
- 2.9 Determination of project schedule and critical path of a network for different cases
- 2.10 Resource allocation and cost time balancing.

3. Organisation :

- 3.1 Types of organisation
 - 3.1.1 Line, functional and line & staff and their description chart
 - 3.1.2 Advantages, disadvantages and applications of various organisation
 - 3.1.3 Principles of organisation
 - 3.1.4 Site organisation
 - 3.1.5 Principles of storing and stacking materials at site
 - 3.1.6 Location of equipments
 - 3.1.7 Introduction of job layout and factors influencing it

4. Construction Contracts :

- 4.1 Introduction
- 4.2 Proposal and agreements
- 4.3 Types of construction contracts : lumpsum contract, rate contract, cost plus contracts, turnkey contracts
- 4.4 General conditions of contracts
- 4.5 Contract labour act.

5. Construction Labour :

- 5.1 Condition of construction workers in India
- 5.2 Wages paid to workers
- 5.3 Trade unions
- 5.4 Trade union act
- 5.5 Important provisions of Minimum Wages Act
- 5.6 Productivity in construction
- 5.7 Workman's Compensations Act

6. Inspection and Quality Control :

- 6.1 Technical services required for inspection
- 6.2 Quality construction
- 6.3 Quality control operation
- 6.4 Quality control in concreting, earthwork and other constructions.
- 6.5 Methods of recording progress of a project

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. Public Works Accounts :

- 8.1 Payment to labourers
- 8.2 Payment to contractors and suppliers
- 8.3 Standard measurement book
- 8.4 First and final bill
- 8.5 Running account bill
- 8.6 Advance payments
- 8.7 Hand receipt form no. 28
- 8.8 General instructions for preparation of bills
- 8.9 Payment to work-charged establishment

- 8.10 Imprest account
- 8.11 Temporary advance account
- 8.12 Treasury challan
- 8.13 Cash book

REFERENCE BOOKS :

- | | |
|--|---------------------------------|
| 1. Construction Management & Accounts | Vazrani & Chandola |
| 2. Construction Management & Accounts | H. Singh- (TMH). |
| 3. Estimating Costing & Specification in Civil Engg. | M.Chakraborti |
| 4. Estimating Costing & Specification in Civil Engg. | S.Dutta. |
| 5. Construction Management & Equipment | B.L. Gupta. |
| 6. Construction Equipment | Dr. Mahesh Verma. |
| 7. Construction Planning & Equipment | Peurtoy Mc. Graw Hill |
| 8. Construction Planning & Equipment | Satya Narayannn & Sushma Saxena |
| 9. Construction Management & Equipment | Subhash Sharma & Khanna. |
| 10. PERT & CPM | Dr. P.N. Modi. |
| 11. Construction Management, Equipments & Accounts (Hindi) | M.R.Choudhary |

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EARTHQUAKE RESISTANT STRUCTURE

CODE CE 310
CC 310

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RATIONAL

Earthquake Engineering deals with innovative ideas and knowledge in design and construction, which are put in practice to safeguard structures from seismic forces and prevent earthquake hazard from becoming a disaster.

CONTENTS

- 1. Engineering Seismology :**
 - 1.1 Introduction
 - 1.2 Causes of Earthquakes
 - 1.3 Seismology
 - 1.3.1 Seismic Waves
 - 1.3.2 Seismograph
 - 1.3.3 Seismogram
 - 1.4 Earthquake size
 - 1.4.1 Magnitude
 - 1.4.2 Intensity
 - 1.4.3 Magnitude versus intensity
 - 1.4.4 Magnitude and intensity in seismic design
 - 1.5 Classification of Earthquakes
 - 1.6 Seismic zoning
 - 1.6.1 Use of zoning map
 - 1.6.2 Tectonic Features of India
 - 1.7 Seismic zones of India
- 2. Structural Dynamics :**
 - 2.1 Loads
 - 2.2 Effect of Earthquake motion on structures
 - 2.3 Fundamental natural period
- 3. Behaviour of Buildings During Earthquakes :**
 - 3.1 Failure Mechanism of a Masonry Building
 - 3.1.1 Out of plane failure
 - 3.1.2 In plane failure
 - 3.1.3 Connection failure
 - 3.1.4 Diaphragm failure

- 3.1.5 Failure due to opening in walls
 - 3.1.6 Pounding
 - 3.1.7 Non structural components failure
 - 3.2 Earthquake damage categories
 - 3.3 Types of damages observed in traditionally built constructions during past Earthquakes
 - 3.3.1 Stone masonry
 - 3.3.2 Wooden building
 - 3.3.3 Earthen building
 - 3.3.4 Non-engineering reinforced concrete buildings
 - 3.4 Common causes of damage.
- 4. Provisions for Seismic Strengthening of Masonry Constructions :**
- 4.1 Introduction
 - 4.2 Earthquake resistant construction
 - 4.3 Traditionally built masonry constructions
 - 4.4 Types of construction
 - 4.5 Seismic design codes
 - 4.6 Introduction of IS 4326, 1993
 - 4.7 Special construction features (clause 5)
 - 4.8 Categories of Buildings
 - 4.9 Codal Provisions of IS 4326 : 1993
 - 4.10 Seismic Strengthening Arrangements (Clause 8.4)
 - 4.10.1 Horizontal reinforcement
 - 4.10.2 Vertical reinforcement
 - 4.11 Timber construction
 - 4.11.1 Types of timber construction
 - 4.12 Introduction of IS : 13828 : 1993
 - 4.12.1 Earthquake resistance features of stone masonry
 - 4.12.2 Earthquakes resistance features of burnt clay brick in weak mortar
 - 4.13 Introduction to IS : 13827 : 1993
 - 4.13.1 General recommendation for improving Earthquakes resistance of earthen constructions
 - 4.13.2 Seismic strengthening features of earthen building
- 5. Seismic Performance of Reinforced Concrete Buildings :**
- 5.1 Introduction
 - 5.2 Flow of Inertia Forces
 - 5.2.1 Strong column-weak beam analogy
 - 5.3 Effect of irregularities on performance of RC Buildings
 - 5.3.1 Definitions of irregular building
 - 5.4 Identification of seismic damages in Reinforced concrete buildings
- 6. Ductile Detailing of Reinforced Concrete Buildings :**
- 6.1 Introduction
 - 6.2 Codal Provision of IS 13920 : 1993 (General Specification (Clauses 5.0))
 - 6.3 Flexural members (clause 6.0)
 - 6.3.1 Longitudinal Reinforcement
 - 6.3.2 Transverse reinforcement
 - 6.4 Columns and frame members subjected to axial load and bending (clause 7.0)
 - 6.4.1 Longitudinal reinforcement of columns
 - 6.4.2 Transverse reinforcement of columns
 - 6.5 Special confining reinforcement
 - 6.6 Beam column joint
 - 6.7 Shear walls
- 7. Disaster Management :**
- 7.1 Introduction
 - 7.2 Disaster management

- 7.3 Disaster rescue
- 7.4 Psychology of rescue
- 7.5 Rescue workers
 - 7.5.1 Qualities of the Rescuer
- 7.6 Rescue equipment
- 7.7 Safety in Rescue operations
 - 7.7.1 Basic precautions
 - 7.7.2 Rescue worker safety
 - 7.7.3 Casualty safety
 - 7.7.4 Equipment safety
 - 7.7.5 Hazards arise due to breakdown of public utilities

REFERENCE BOOKS:

- | | |
|--|--|
| 1. Earthquake Resistant Design of Structures | P. Agarwal & M. Shirkhande, Printice-Hall , Pub. |
| 2. I.S. Criteria for Earthquake Resistant Design of Structures | IS : 1893 |
| 3. Earthquake Resistant Design & Construction of Building | IS : 4326 |
| 4. Ductile Detailing of Reinforced Concrete Structures | IS : 13920 |
| 5. Elements of Earthquake Engineering | Jai Krishna & A.R. Chandrashekharan South Asian Pub. |
| 6. Earthquake Resistant Building Construction | Neelam Sharma |

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MODEL PAPERCODE CE 210 (PR)
CC 210**COMPUTER AIDED DRAWING**

Times : 3 Hour

MM Marks : 50

- | | |
|--|-------|
| 1. Draw the following sketch (Figure1) using Computer Aided Drawing and take
Is print of A-4 size sheet | 20 |
| 2. Draw following sketch (any one) using Computer Aided Drawing take their
Print on A-4 sheets. | 15x1 |
| (i) (Figure 2) | |
| (ii) (Figure 3) | |
| Viva voce | 10 |
| Sessional work done during the whole year | 05 |
| | ----- |
| TOTAL | 50 |
| | ----- |