4.1 CONCRETE TECHNOLOGY

L T P
3 - 2

RATIONALE

Diploma holders in Civil Engineering are supposed to supervise concreting operations involving proportioning, mixing, transporting, placing, compacting, finishing and curing of concrete. To perform above functions, it is essential to impart knowledge and skills regarding ingredients of concrete and their properties; properties of concrete in plastic and hardened stage, water cement ratio and workability; proportioning for ordinary concrete; concreting operations and joints in concrete.

DETAILED CONTENTS
THEORY

1. Introduction: Definition of concrete, uses of concrete in comparison to other building materials. (02 hrs)

2. Ingredients of Concrete: (06 hrs)

   2.1 Cement: physical properties of cement; different types of cement as per IS Codes

   2.2 Aggregates:

      2.2.1 Classification of aggregates according to size and shape

      2.2.2 Characteristics of aggregates: Particle size and shape, surface texture, specific gravity of aggregate; bulk density, water absorption, surface moisture, bulking of sand, deleterious materials, soundness

      2.2.3 Grading of aggregates: coarse aggregate, fine aggregate; All-in-aggregate; fineness modulus; interpretation of grading charts

   2.3 Water: Quality requirements as per IS:456-2000

3. Water Cement Ratio: (02 hrs)

   3.1 Hydration of cement, principle of water-cement ratio, Duff Abram's Water-cement ratio law: Limitations of water-cement ratio law and its effects on strength of concrete

4. Workability: (04 hrs)

   4.1 Workability factors affecting workability, Measurement of workability: slump test, compacting factor and Vee Bee consistometer; Recommended slumps for placement in various conditions as per IS:456-2000/SP-23

5. Properties of Concrete: (08 hrs)

5.1 Properties in plastic state: Workability, Segregation, Bleeding and Harshness

5.2 Properties in hardened state: Strength, Durability, Impermeability, Dimensional changes;

6. Proportioning for Normal Concrete: (04 hrs)

6.1 Objectives of mix design, introduction to various grades as per IS:456-2000; proportioning for nominal mix design as prescribed by IS 456-2000

6.2 Adjustment on site for: Bulking of fine aggregate, water absorption of aggregate, workability

6.3 Difference between nominal and controlled concrete

6.4. Introduction to IS-10262-2009-Code for controlled mix design

7. Introduction to Admixtures (chemicals and minerals) for improving performance of concrete (03 hrs)

8. Special Concretes (only features) (06 hrs)

8.1 Concreting under special conditions, difficulties and precautions before, during and after concreting
- 8.1.1 Cold weather concreting
- 8.1.2 Under water concreting
- 8.1.3 Hot weather concreting

8.2 Ready mix concrete

8.3 Fibre reinforced concrete

8.4 Polymer Concrete

8.5 Fly ash concrete

8.6 Silica fume concrete

9. Concreting Operations: (12 hrs)

**9.1 Storing of Cement:

- 9.1.1 Storing of cement in a warehouse
- 9.1.2 Storing of cement at site
- 9.1.3 Effect of storage on strength of cement
- 9.1.4 Determination of warehouse capacity for storage of Cement

**9.2 Storing of Aggregate: Storing of aggregate at site

9.3 Batching (to be shown during site visit)

9.3.1 Batching of Cement
9.3.2 Batching of aggregate by:
9.3.2.1 Volume, using gauge box (farma) selection of proper gauge box
9.3.2.2 Weight spring balances and batching machines
9.3.3 Measurement of water

** 9.4 Mixing:

9.4.1 Hand mixing
9.4.2 Machine mixing - types of mixers, capacities of mixers, choosing appropriate size of mixers, operation of mixers
9.4.3 Maintenance and care of machines

**9.5 Transportation of concrete: Transportation of concrete using: wheel barrows, transit mixers, chutes, belt conveyors, pumps, tower crane and hoists etc.

9.6 Placement of concrete:

Checking of form work, shuttering and precautions to be taken during placement

** 9.7 Compaction:

9.7.1 Hand compaction

9.7.2 Machine compaction - types of vibrators, internal screed vibrators and form vibrators

9.7.3 Selection of suitable vibrators for different situations

9.8 Finishing concrete slabs - screeding, floating and trowelling

9.9 Curing:

9.9.1 Objectives of curing, methods of curing like ponding, membrane curing, steam curing, chemical curing

9.9.2 Duration for curing and removal of form work

9.10 Jointing: Location of construction joints, treatment of construction joints, expansion joints in buildings - their importance and location

9.11 Defects in concrete: Identification of and methods of repair

10. Importance and methods of non-destructive tests (introduction only) (01 hr)

NOTE: ** A field visit may be planned to explain and show the relevant things

PRACTICAL EXERCISES:

i) To determine the physical properties of cement as per IS Codes
ii) To determine flakiness and elongation index of coarse aggregates
iii) To determine silt in fine aggregate
iv) Determination of specific gravity and water absorption of aggregates
v) Determination of bulk density and voids of aggregates
vi) To determine surface moisture in fine aggregate by displacement method
vii) Determination of particle size distribution of fine, coarse and all in aggregate by sieve analysis (grading of aggregate)
viii) To determine necessary adjustment for bulking of fine aggregate
ix) To determine workability by slump test:
x) To verify the effect of water, fine aggregate/coarse aggregate ratio and aggregate/Cement ratio on slump
xi) Compaction factor test for workability
xii) Non destructive test on concrete by:
    a) Rebound Hammer Test
    b) Ultrasonic Pulse Velocity Test
xiii) Tests for compressive strength of concrete cubes for different grades of concrete

INSTRUCTIONAL STRATEGY

This subject is of practical nature. While imparting instructions, teachers are expected to organize demonstrations and field visits to show various stages of concreting operations. While working in the laboratory, efforts should be made to provide extensive practical training to students so as to make them confident in the preparation and testing of concrete. Teachers should also organize viva examination so as to develop understanding about concepts and principles involved. The experiments may be demonstrated to students through video programmes developed in the field of 'concrete technology' by NITTTR, Chandigarh.

RECOMMENDED BOOKS

i) Kulkarni, PD; Ghosh, RK and Phull, YR; "Text Book of Concrete Technology"; Oxford and IBH Publishing Co. New Delhi

ii) Krishnamurthy, KT; Rao, A Kasundra and Khandekar, AA; "Concrete Technology"; Dhanpat Rai and Sons, Delhi,

iii) Gupta BL and Gupta Amit; "Text Book of Concrete Technology"; Standard Publishers Distributors, Delhi.

iv) Varshney, RS;"Concrete Technology";, Oxford and IBH Publishing, New Delhi

v) Neville, AM; "Properties of Concrete", Pitman (ELBS Edition available), London

vi) Orchard; "Concrete Technology"; Vol I, II, and III

vii) Handoo, BL; Puri, LD and Mahajan Sanjay "Concrete Technology"; Satya Prakashan, New Delhi,

viii) Sood, Hemant, Mittal LN and Kulkarni PD; "Laboratory Manual on Concrete Technology", CBS Publishers, New Delhi, 2002

ix) Vazirani, VN; and Chandola, SP; "Concrete Technology"; Khanna Publishers, Delhi,

x) Gambhir, ML; "Concrete Technology";, MacMillan India Ltd., New Delhi

xi) Siddique, R., "Special Structural Concretes", , Galgotia Publishers Pvt. Ltd. Delhi

xii) Birinder Singh, "Concrete Technology", Kaption Publications, Ludhiana,

(xiii) Module on 'Special Concretes by Dr Hemant Sood , NITTTR Chandigarh

(xiv) Concrete Technology by P Dayaratman

(xv) Video programme on different experiments in 'Concrete Technology' developed by NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	04
2	06	12
3	02	04
4	04	08
5	08	18
6	04	08
7	03	07
8	06	12
9	12	25
10	01	02
Total	**48**	**100**

4.2 WATER SUPPLY AND WASTE WATER ENGINEERING

L	T	P
5	-	2

RATIONALE

One of the basic necessities of life is water which is not easily available to a lot of people. Providing potable water at the first place then collection and disposal of waste solids and liquids are important activities of civil engineering field. This subject provides basic knowledge and skills in the field of water supply system and waste disposal system. Classroom instructions should be suplimented by field visits to show functional details of water supply and waste disposal systems. It will also be advantageous to invite professionals from field to deliver extension lectures on specialised operations.

DETAILED CONTENTS

A. WATER SUPPLY

1. Introduction (02 hrs)
   - 1.1 Necessity and brief description of water supply system.

2. Quantity of Water (06 hrs)
   - 2.1 Water requirement
   - 2.2 Rate of demand and variation in rate of demand
   - 2.3 Per capita consumption for domestic, industrial, public and fire fighting uses as per BIS standards (no numerical problems)
   - 2.4 Population Forecasting

3. Quality of Water (04 hrs)
   - 3.1 Meaning of pure water and methods of analysis of water
   - 3.2 Physical, Chemical and bacteriological tests and their significance
   - 3.3 Standard of potable water as per Indian Standard
   - 3.4 Maintenance of purity of water (small scale and large scale quantity)

4. Water Treatment (brief introduction) (09 hrs)
   - **4.1 Sedimentation - purpose, types of sedimentation tanks
   - **4.2 Coagulation floculation - usual coagulation and their feeding
   - **4.3 Filtration - significance, types of filters, their suitability
   - 4.4 Necessity of disinfection of water, forms of chlorination, break point chlorine, residual chlorine, application of chlorine.
   - 4.5 Flow diagram of different treatment units, functions of (i) Areation fountain (ii) mixer (iii) floculator, (iv) classifier, (v) slow and rapid sand filters (vi) chlorination chamber.

5. Conveyance of Water (09 hrs)

**5.1 Different types of pipes - cast iron, PVC, steel, asbestos cement, concrete and lead pipes. Their suitability and uses, types of joints in different types of pipes.

5.2 Appurtenances: Sluice, air, reflux valves, relief valves, scour valves, bib cocks, stop cocks, fire hydrants, water meters their working and uses

5.3 Distribution site: Requirement of distribution, minimum head and rate, methods of layout of distribution pipes

5.3.1 Systems of water supply - Intermittent and continuous service reservoirs - types, necessity and accessories.

5.3.2 Wastage of water - preventive measures

5.3.3 Maintenance of distribution system

5.3.4 Leakage detection

6. Laying out Pipes (06 hrs)

6.1 Setting out alignment of pipes

6.2 Excavation for laying of pipes and precautions to be taken in laying pipes in black cotton soil.

6.3 Handling, lowering beginning and jointing of pipes

6.4 Testing of pipe lines

6.5 Back filling

6.6 Use of boring rods

7. Building Water Supply (02 hrs)

7.1 Connections to water main (practical aspect only)

**7.2 Water supply fixtures and installations and terminology related to plumbing

B. WASTE WATER ENGINEERING

8. Introduction (04 hrs)

8.1 Purpose of sanitation

8.2 Necessity of systematic collection and disposal of waste

8.3 Definition of terms in sanitary engineering

8.4 Collection and conveyance of sewage

8.5 Conservancy and water carriage systems, their advantages and Disadvantages

8.6 (a) Surface drains (only sketches) : various types, suitability

(b) Types of sewage: Domestic, industrial, storm water and its seasonal variation

9. Sewerage System (05hrs)

9.1 Types of sewerage systems, materials for sewers, their sizes and joints

9.2 Appurtenance: Location, function and construction features. Manholes, drop manholes, tank hole, catch basin, inverted siphon, flushing tanks grease and oil traps, storm regulators, ventilating shafts

10. Laying and Construction of Sewers: (6 hrs)
    - 10.1 Setting out/alignment of sewers
    - 10.2 Excavations, checking the gradient with boning rods preparation of bedding, handling and jointing testing and back filling of sewers/pipes.
    - 10.3 Construction of surface mains and different sections required

11 Sewage characteristics: (4hrs)
    - 11.1 Properties of sewage and IS standards for analysis of sewage
    - 11.2 Physical, chemical and bacteriological parameters

12. Natural Methods of Sewerage Disposal (5 hrs)
    - 12.1 General composition of sewage and disposal methods
    - 12.2 Disposal by dilution
    - 12.3 Self purification of stream
    - 12.4 Disposal by land treatment
    - 12.5 Nuisance due to disposal

13. Sewage Treatment (9 hrs)
    - 13.1 Meaning and principle of primary and secondary treatment and activated sludge process their flow diagrams
    - 13.2 Introduction and uses of screens, grit chambers, detritus tanks, skimming tanks, plainsedimentation tanks, primary clarifers, secondary clarifers, filters, control beds, intermittent sand filters, trickling filters, sludge treatment and disposal, oxidation ponds (Visit to a sewage treatment plant)

14. Building Drainage (9 hrs)
    - 14.1 Aims of building drainage and its requirements
    - **14.2 Different sanitary fittings and installations
    - 14.3 Traps, seals, causes of breaking seals

** A field visit may be planned to explain and show the relevant things.

LIST OF PRACTICALS

1) To determine turbidity of water sample
2) To determine dissolved oxygen of given sample
3) To determine pH value of water
4) To perform jar test for coagulation
5) To determine BOD of given sample
6) To determine residual chlorine in water
7) To determine conductivity of water and total dissolved solids
8) To study the installation of following:
    a) Water meter
    b) Connection of water supply of building with main
    c) Pipe valves and bends
    d) Water supply and sanitary fittings

9) To study and demonstrate the joining/threading of GI Pipes, CI Pipes, SW pipes, D.I. pipes and PVC pipes.
10) To demonstrate the laying of SW pipes for sewers
11) Study of water purifying process by visiting a field lab.
12) To test house drainage

INSTRUCTIONAL STRATEGY:

Before imparting the instructions in the class room, visits to water works and sewage treatment plants can go a long way for increased motivation of students for learning in the class room. As the subject is of practical nature, lecture work be supplemented by field visits from time to time. Home assignments related to collection of information, pamphlets and catalogues from hardware shop dealing water supply and sanitary fittings will be very helpful for the students.

REFERENCES

1. Duggal, KN; "Elements of Public Health Engineering";, S. Chand and Co. New Delhi
2. Rangwala, SC; "Water Supply and Sanitary Engineering"; Anand Charotar Book Stall
3. Kshirsagar, SR; "Water Supply Engineering"; Roorkee Publishing House, Roorkee
4. Kshirsagar, SR; "Sewage and Sewage Tratement"; Roorkee, Roorkee Publishing House
5. Hussain, SK; "Text Book of Water Supply and Sanitary Engineering"; Oxford and IBH Publishing Co, New Delhi,
6. Birdie, GS; "Water Supply and Sanitary Engineering"; Dhanpat Rai and Sons, Delhi
7. Garg, Santosh Kumar; "Water Supply Engineering"; Khanna Publishers, Delhi
8. Garg, Santosh Kumar; "Sewage and Waste Water Disposal Engineering"; Khanna Publishers, Delhi
9. Steel, EW; "Water Supply and Sewerage"; McGraw Hill.
10 Duggal, Ajay K and Sharma, Sanjay, "A Laboratory Manual in Public Health Engineering", , Galgotra Publications, 2006, New Delhi
11 Gurjar,B.R. " Sludge Treatment & Disposal" Oxford and IBH Co Pvt Ltd New Delhi.
12. Mahajan Sanjay, Water Supply and Waste Water Engineering, Satya Prakashan Ltd., Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	03
2	06	07
3	04	05
4	09	12
5	09	11
6	06	07
7	02	03
8	04	05
9	05	06
10	06	07
11	04	05
12	05	06
13	09	12
14	09	11
Total	**80**	**100**

4.3 IRRIGATION ENGINEERING

L	T	P
4	-	-

RATIONALE

Diploma holders in civil engineering have to supervise the construction, repair and maintenance of canals, head works, river training works, cross drainage works, regulatory and other works . Some of diploma holders are also engaged for preventing water logging and irrigation by tubewells. This subject imparts knowledge regarding hydrology, flow irrigation – storage and distribution system, constructional features of head works, river training works, cross drainage works, causes and prevention of water logging and construction of tube wells.

DETAILED CONTENTS

1. Introduction: (02 hrs)

    1.1 Definition of irrigation

    1.2 Necessity of irrigation

    1.3 History of development of irrigation in India

    1.4 Major, medium and minor irrigation projects

2. Water Requirement of Crops (06 hrs)

    2.1 Principal crops in India and their water requirements

    2.2 Crop seasons – Kharif and Rabi

    2.3 Soil water, soil crop and water relationships, duty, delta and base period, their relationship

    2.4 Gross commanded area (GCA), culturable commanded area (CCA), intensity of irrigation, irrigable area

3. Hydrological Cycle Catchment Area and Run-off (06 hrs)

    Rainfall , definition rain-gauges – automatic and non-automatic, methods of estimating average rainfall (Arithmatic system); catchment area runoff, factors affecting runoff, hydrograph, basic concept of unit hydrograph.

4. Methods of Irrigation (07 hrs)

4.1 Flow irrigation - its advantages and limitations

4.2 Lift Irrigation – Tube well and open well irrigation, their advantages and disadvantages

4.3 Sprinkler irrigation conditions favourable and essential requirements for sprinkler irrigation, sprinkler system – classification and component parts

4.4 Drip irrigation, suitability of drip irrigation, layout, component parts, advantages

5. Canals (08 hrs)

5.1 Classification, apurtenancs of a canal and their functions, sketches of different canal cross-sections (unlined)

5.2 Various types of canal lining - their related advantages and disadvantages, sketches of different lined canal x-sections

5.3 Breaches and their control

5.4 Maintenance of lined and unlined canals

6. Tube Well Irrigation (09 hrs)

6.1 Introduction, occurrence of ground water, location and command, advantages and disadvantages, comparison with canal irrigation

6.2 Tube wells, explanation of terms: water table, radius of influence, depression head, cone of depression, confined and unconfined aquifers. Yield of a well and methods of determining yield of well

6.3 Types of tube wells, cavity, strainer and slotted type;

6.4 Method of boring, installation of well assembly, development of well, pump selection and installation and maintenance

6.5 Water Harvesting Techniques: Need and requirement of various methods, Run-off from roof top and ground surface, construction of recharge pits and recharge wells and their maintenance.

7. Dams (07 hrs)

7.1 Classification of dams; earthen dams - types, causes of failure; cross-section of zoned earthen dams, method of construction, gravity dams – types, cross-sections of a dam, method of construction

7.2 Concept of small and micro dams

7.3 Concept of spillways and energy dissipators

8. Canal Head Works and Regulatory Works (06 hrs)

Definition, object, general layout, functions of different parts of head works. Difference between weir and barrage

9. Cross Drainage Works (04 hrs)

9.1 Functions and necessity of the following types: aqueduct, super passage, level crossing, inlet and outlet, pipe crossing

9.2 Sketches of the above cross drainage works

10. Definitions of following Hydraulic Structures with Sketches (02 hrs)

10.1 Falls

10.2 Cross and head regulators

10.3 Outlets

10.4 Canal Escapes

11. River Training Works (04 hrs)

Methods of river training, guide banks, retired (levees) embankments, groynes and spurs, pitched island, cut-off

12. Water Logging and Drainage and Ground Water Re-charge (03 hrs)

12.1 Definition of water logging – its causes and effects, detection, prevention and remedies

12.2 Reclamation of soil

12.3 Surface and sub-surface drains and their layout

12.4 Concept and various techniques used for ground water re-charge

INSTRUCTIONAL STRATEGY

The teaching of the subject should be supplemented by field visits at regular intervals of time to expose the students to irrigation works. Students should be asked to prepare and interpret drawings of various irrigation works.

RECOMMENDED BOOKS

1. Bharat Singh, `Fundamentals of Irrigation Engineering', , Nem Chand and Bros, Roorkee

2. Garg, Santosh Kumar, `Irrigation Engineering and Hydraulics Structures', Khanna Publishers, Delhi,

3. Punmia, BC; and Pande Brij Bansi Lal, `Irrigation and Water Power Engineering', Delhi, Standard Publishers Distributors, Delhi,

4. Sharma, RK; `Text Book of Irrigation Engineering and Hydraulics Structures', , Oxford and IBH Publishing Company, New Delhi

5. Sharma, SK; `Principles and Practice of Irrigation Engineering', Prentice Hall of India Pvt. Ltd., New Delhi,

6. Varshney RS, Gupta SC, Gupta RL at all. “Theory and Design of Irrigation Structures”, Vol. I and II,

7. Saharsabudhe SR, “Irrigation Engineering and Hydraulic Structures”

8. Priyani BB, ‘The Fundamental Principles of Irrigtion and Water Power

9. BIS Codes

10. Wan. E. Houk, “Irrigation Engineering” Vol. I and II

11. Central Ground Water Board and Central Water Commission Guidelines and Reference Books.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	03
2	06	08
3	06	08
4	07	13
5	08	12
6	09	15
7	07	12
8	06	09
9	04	06
10	02	03
11	04	06
12	03	05
Total	**64**	**100**

4.4 SURVEYING – II

L	T	P
2	-	6

RATIONALE

The important functions of a civil engineer includes the jobs of detailed surveying, plotting of survey data, preparation of survey maps and setting out works

While framing the curriculum for the subject of surveying, stress has been given to the development of knowledge and skill in theodolite surveying, tachometry surverying, curves and use of minor and modern instruments have been included in this subject.

Field work should be a selected one so that student can check his work and have an idea of the results the extent of error in the work done by him. As far as possible, the surveys done should be got plotted, as this will also reveal errors in the work and develop skill in plotting.

DETAILED CONTENTS

1. Contouring: (05 hrs)

   Concept of contours, purpose of contouring, contour interval and horizontal equivalent, factors effecting contour interval, characteristics of contours, methods of contouring: Direct and indirect, use of stadia measurements in contour survey, interpolation of contours; use of contour map, Drawing cross section from a contour map; marking alignment of a road, railway and a canal on a contour map, computation of earth work and reservoir capacity from a contour map

2. Theodolite Surveying: (09 hrs)

   Working of a transit vernier theodolite, axes of a theodolite and their relation; temporary adjustments of a transit theodolite; concept of transiting, swinging, face left, face right and changing face; measurement of horizontal and vertical angles. Prolonging a line (forward and backward) measurement of bearing of a line; traversing by included angles and deflection angle method; traversing by stadia measurement, theodolite triangulation, plotting a traverse; concept of coordinate and solution of omitted measurements (one side affected), errors in theodolite survey and precautions taken to minimize them; limits of precision in theodolite traversing. Height of objects – accessible and non-accessible bases

3. Tacho-metric surveying (04 hrs)

   Tachometry, Instruments to be used in tachometry, methods of tachometry, stadia system of tachometry, general principles of stadia tachometry, examples of stadia tachometry and Numerical problems.

4. Curves: (10 hrs)

4.1 Simple Circular Curve:

Need and definition of a simple circular curve; Elements of simple circular curve - Degree of the curve, radius of the curve, tangent length, point of intersection (Apex point), tangent point, length of curve, long chord deflection angle, Apex distance and Mid-ordinate. Setting out of simple circular curve:

a) By linear measurements only:
   - Offsets from the tangent
   - Successive bisection of arcs
   - Offsets from the chord produced

b) By tangential angles using a theodolite

4.2 Transition Curve:

Need (centrifugal force and super elevation) and definition of transition curve; requirements of transition curve; length of transition curve for roads; by cubic parabola; calculation of offsets for a transition curve; setting out of a transition curve by tangential offsets only

4.3 Vertical curve

Setting out of a vertical curve

5. Introduction to the use of Modern Surveying equipment and techniques such as: (02 hrs)

a) EDM or Distomat
b) Planimeter
c) Total station
d) Introduction to remote sensing, GIS and GPS

6 Minor Instruments:- (02 hrs)

6.1. Introduction and use of minor instruments like Ceylon Ghat Tracer, Clinometer, Pantagraph, Abney Level etc.

6.2. Use of planimeter for computing areas

NOTE: No sketch of the instruments may be asked in the examination

PRACTICAL EXERCISES

I. Contouring:

i) Preparing a contour plan by radial line method by the use of a Tangent Clinometer/Tachometer

ii) Preparing a contour plan by method of squares

iii) Preparing a contour plan of a Road/Railway track/Canal by taking cross sections.

II. Theodolite:

i) Taking out the Theodilite, mounting on the tripod and placing it back in the box

ii) Study of a transit vernier theodolite; temporary adjustments of theodolite

iii) Reading the vernier and working out the least count, measurement of horizontal angles by repetition and reiteration methods

iv) Measurement of vertical angles and use of tachometric tables

v) Measurement of magnetic bearing of a line

vi) Running a closed traverse with a theodolite (at least five sides) and its plotting

vii) Height of objects with and without accessible bases

III. Curves

i) Setting out of a simple circular curve with given data by the following methods
   a) Offsets from the chords produced
   b) One theodolite method

IV Minor instruments:

i) Demonstration and use of minor instruments like Ceylon Ghat Tracer, Tangent Clinometer, Pantagraph, Abney level etc.
ii) Use of planimeter for computing areas

V Demonstration of digital instruments through field visits to Survey of India and other government agencies.

VI Total Station (only demonstrations).

INSTRUCTIONAL STRATEGY

This is highly practice-oriented course. While imparting theoretical instructions, teachers are expected to demonstrate the use of various instruments in surveying, stress should be laid on correct use of various instruments so as to avoid/minimize errors during surveying. It is further recommended that more emphasis should be laid in conducting practical work by individual students

RECOMMENDED BOOKS

1. Hussain, SK and Nagraj, MS "Text Book of Surveying";, S Chand and Co Ltd., New Delhi
2. Deshpande, RS "A Text Book Surveying and Levelling"; United Book Corporation, Pune,
3. Kocher, CL; "A Text Book of Surveying"; Katson Publishing House Ludhiana,
4. Kanetkar,TP and Kulkarni, SV., "Surveying and Leveling", Poona, AVG Parkashan, Pune
5. Kanetkar, TP; and Kulkarni, SV; "Surveying and Leveling-Vol.2" AVG Prakashan, Pune
6. Punima, BC; "Surveying and Leveling ", Standard Publishers Distributors, Delhi
7. Shahai, PB; "A Text Book of Surveying ", Oxford and IBH Publishing Co.
8. Lilly Sant “Remote Sensing and Image Interpretation”
9. Mahajan, Sanjay, “Surveying-II”, Satya Prakashan, Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	05	16
2	09	28
3	04	12
4	10	34
5	02	05
6	02	05
Total	**32**	**100**

4.5 RCC DESIGN

L	T	P
5	-	-

RATIONALE

This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise RC Construction and fabrication. He may also be required to design simple structural elements, make changes in design depending upon availability of materials (bars of different diameters). This subject thus deals with elementary design principles as per IS:456-2000

DETAILED CONTENTS

1. Introduction (02 hrs)

   1.1 Concept of Reinforced Cement Concrete (RCC)
   1.2 Reinforcement Materials:
   - Suitability of steel as reinforcing material
   - Properties of mild steel and HYSD steel
   1.3. Loading on structures as per IS: 875

2. Introduction to following methods of RCC design (02 hrs)
   2.1 Working stress method
   2.2 Limit state method

3. Shear and Development Length (04 hrs)

   3.1 Shear as per IS:456-2000 by working stress method
   i) Shear strength of concrete without shear reinforcement
   ii) Maximum shear stress
   iii) Shear reinforcement

4. Singly Reinforced Beam (Working stress method) (08 hrs)

   4.1 Basic assumptions and stress strain curve, neutral axis, balanced, under-reinforcement and over reinforced beams, Moment of resistance for singly reinforced beam.

   4.2 Design of singly reinforced beam including sketches showing reinforcement details.

5. Concept of Limit State Method (08 hrs)

5.1 Definitions and assumptions made in limit state of collapse (flexure)
5.2 Partial factor of safety for materials
5.3 Partial factor of safetyfor loads
5.4 Design loads
5.5 Stres block, parameters

6. Singly Reinforced beam (10 hrs)

Theory and design of singly reinforced beam by Limit State Method

7. Doubly Reinforced Beams (09 hrs)

Theory and design of simply supported doubly reinforced rectangular beam by Limit State Method

8. Behaviour of T beam, inverted T beam, isolated T beam and 'L' beams (No Numericals) (04 hrs)

9. One Way Slab (10 hrs)

Theory and design of simply supported one way slab including sketches showing reinforcement details (plan and section) by Limit State Method..

10. Two Way Slab (10 hrs)

Theory and design of two-way simply supported slab with corners free to lift, no provisions for torsional reinforcement by Limit State Method including sketches showing reinforcement details (plan and two sections)

11. Axially Loaded Column (10 hrs)

11.1 Definition and classification of columns
11.2. Effective length of column,
11.3. Specifications for longitudinal and lateral reinforcement
11.4. Design of axially loaded square, rectangular and circular short columns by Limit State Method including sketching of reinforcement(sectional elevation and plan)

12. Prestressed Concrete (03 hrs)

12.1. Concept of pre-stressed concrete
12.2. Methods of pre-stressing : pre-tensioning and post tensioning
12.3. Advantages and disadvantages of prestressing
12.4. Losses in pre-stress

Important Note:

Use of BIS:456-2000 is permitted in the examination.

INSTRUCTIONAL STRATEGY

Teachers are expected to give simple problems for designing various RCC structural members. For creating comprehension of the subject, teachers may prepare tutorial sheets, which may be given to the students for solving. It would be advantageous if students are taken at construction site to show form work for RCC as well as placement of reinforcement in various structural members. Commentary on BIS:456 may be referred along with code for relevant clauses.

RECOMMENDED BOOKS

1. Punmia, BC; "Reinforced Concrete Structure Vol I", Standard Publishers, Delhi
2. Ramamurtham, S; "Design and Testing of Reinforced Structures", Dhanpat Rai and Sons, Delhi
3. Gambhir, M.L., "Reinforced Concrete Design", Macmillan India Limited
4. Singh, Birinder "RCC Design and Drawing", Kaption Publishing House, New Delhi
5. Singh Harbhajan "Design of Reinforced Concrete Structure Design" Abhishek Publishers Ltd., Chandigarh
6. Mallick, SK; and Gupta, AP; "Reinforced Concrete", Oxford and IBH Publishing Co, New Delhi.
7. Singh Harbhajan, Limit Stat of RCC Design"; Abhishek Publishers Ltd.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	03
2	02	03
3	04	05
4	08	10
5	08	10
6	10	12
7	09	12
8	04	5
9	10	12
10	10	12
11	10	12
12	03	04
Total	**80**	**100**

4.6 CIVIL ENGINEERING DRAWING - II

L	T	P
-	-	6

RATIONALE

Diploma holders in Civil Engineering are expected to supervise construction of water supply and wastewater treatment works and irrigation structures. This subject aims at imparting skills for preparing water supply and waste water and irrigation engineering drawings to develop competencies for reading the drawings, and their execution in their field

DETAILED CONTENTS

Drawings Exercises

A) WATER SUPPLY AND WASTE WATER ENGINEERING DRAWING

1. Drains and Sewers

   Cross section of standard types of open drains (circular, v-shaped and μ-shaped) with their foundations
   Cross section of earthen ware and RCC sewer pipes
   Cross sections of masonry sewers (circular and egg shaped)

2. Traps, manholes and inspection chamber

   Detailed section of floor trap and gully trap
   Detailed plan and section of an inspection chamber
   Detailed plan and section of a manhole

3. Septic Tank and Soak Pit

   Detailed plan and cross sections of a domestic septic tank with soak pit for 10 and 50 users

4. Bath room and W.C connections:

   4.1 Cross-section through the external wall of lavatories at ground and first floor showing the one and two pipe system and the connections of the lavatory to inspection chamber

   4.2. Plan of a bathroom showing positions of lavatory, bath tub, wash-basin, taps and showers

5. Draw sectional elevation of a two storeyed building showing details of one pipe and two pipes systems with sanitation system.

6. Practice of reading water supply and sanitary engineering working drawings (PWD/urban Development agencies) including hot water and cold water supply system of a two room set.
7. Detailed Layout Plan of Sewage Treatment Plant for a residential area and Effluent Treatment Plant for an industrial unit.

B) IRRIGATION ENGINEERING DRAWING:

1. Typical cross-section of a channel
   - L-section of a channel for given data
   - Typical cross section of an unlined and lined channel in cutting, partly cutting and partly filling and fully in filling with given design data.

2. Layout plan of a canal head works.
3. Draw the typical L-section of a weir
4. Draw the X-section of an Earthen Dam
   i) Homogeneous
   ii) Zoned type
   iii) Diaphragm type

5. Cross section of a tube well
6 Layout and cross section of rain water harvesting system.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop skills in preparation and interpretation of water supply and waste water engineering drawings as per BIS codes of practice. Attention must be paid towards line work, specifications writing, dimensioning, proportioning and accuracy for industrial unit at different intervals of time. Reading and interpreting actual field drawings should also be practiced so as to develop necessary competency in the students.

RECOMMENDED BOOKS

1. Layal JS "Civil Engineering Drawing", Satya Parkashan, New Delhi

2. Chandel RP " Civil Engineering Drawings"

3. Kumar; NS " Civil Engineering Drawing " IPH, New Delhi

4. Malik RS and Meo GA, "Civil Engineering Drawing" Asian Publishing House, New Delhi

ENTREPRENEURIAL AWARENESS CAMP

The employment opportunities for diploma holders especially in public sector are dwindling. The diploma holders need to explore the possibilities of becoming entrepreneurs. For this, they must be acquainted with entrepreneurship development, scope of setting up small-scale industry, existing business opportunities, financial support available and various aspects of managing business. In this context, an entrepreneurial awareness camp is suggested. During the camp, experts from various organizations such as banks, financial corporations, service institutes etc. may be invited to deliver expert lectures. Successful entrepreneurs may also be invited to interact with the students. Students may be encouraged to read papers or give seminar during the camp on Entrepreneurship Development related topics.

The camp is to be organized at a stretch for two to three days during fourth semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject

1. Who is an entrepreneur?
2. Need for entrepreneurship, entrepreneurial career and self employment
3. Scenario of development of small scale industries in India
4. Entrepreneurial history in India, Indian values and entrepreneurship
5. Assistance from District Industries Centres, Commercial Banks, State Financial Corporations, Small industries Service Institutes, Research and Development Laboratories and other Financial and Development Corporations
6. Considerations for product selection
7. Opportunities for business, service and industrial ventures
8. Learning from Indian experiences in entrepreneurship (Interaction with successful entrepreneurs)
9. Legal aspects of small business
10. Managerial aspects of small business