Curriculum for

Diploma Programme in

CIVIL ENGINEERING

Campus:
Puran Murti Campus
Kami Road, Sonepat (Delhi-NCR), Haryana - 131001, India
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FOURTH SEMESTER

FOURTH SEMESTER (CIVIL ENGINEERING)

Sr. No	Subject	STUDY SCHEME Hrs/week L	T	P	Credit	EVALUATION SCHEME						Total Marks
						Internal Assessment		External Assessment (Examination)				
						Theory	Practical	Written Paper		Practical		
						Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
4.1	Concrete Technology	4	-	2	5	25	25	100	3	50	3	200
4.2	Water Supply & Waste Water Engineering	4	-	2	5	25	25	100	3	50	3	200
4.3	Irrigation Engineering	3	-	-	3	25	-	100	3	-	-	125
4.4	Surveying – II	3	-	6	6	25	25	100	3	50	3	200
4.5	Soil Mechanics & Foundation Engineering	4	-	2	5	25	25	100	3	50	3	200
4.6	Water Supply & Waste Water Engineering and Irrigation Engineering Drawing	-	-	3	2	50	-	100	3	-	-	150
	Soft Skills-II	-	-	2	-	-	25	-	-	-	-	25
	Total	18		17	26	175	125	600	-	200	-	1100

Note: 1. Survey camp will be held after 4th semester for minimum 10 days in a sub mountainous area away from polytechnic preferably in camp conditions. Details are given at Sr. No. 5.3 in 5th Semester.

2 **Industrial Training:** After examination of 4th Semester, the students shall go for training in a relevant industry/field organization for a period of 8 weeks and will prepare a diary. It shall be evaluated during 5th semester by his/her teacher in charge for 100 marks. The students shall also prepare a report at the end of training and shall present it in a seminar, which will be evaluated for another 100 marks. This evaluation will be done by assigned lecturer in charge in the presence of one subject expert from other Institution/representative from Industry or field/representative from Construction Sector Skill Council/Training and Placement Officer.

4.1 CONCRETE TECHNOLOGY

L T P
4 - 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.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Evaluate physical properties of cement concrete as per IS codes
- Conduct various tests on aggregate in laboratory to evaluate their characteristics
- Interpret the grading charts of different aggregates and evaluate fineness modulus of aggregates
- Evaluate workability and strength of concrete
- Recognise bleeding, segregation, harshness defects in fresh concrete
- Explain hydration process of cement, water to cement (w/s) ratio and analyze relationship between compressive strength and w/c ratio
- Conduct various destructive and non-destructive (NDT) test
- Design mix of concrete as per IS code
- Describe the use of different admixture to enhance the properties of concrete
- Explain the feature of special concretes
- Demonstrate how to carry out various concreting operation

DETAILED CONTENTS

Introduction: Definition of concrete, properties of concrete, uses of concrete in comparison to other building materials.

1. Advantages and disadvantages of concrete. (03 Hours)

2. Ingredients of Concrete: (08 Hours)
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: Water Quality requirements as per IS:456-2000

3. Water Cement Ratio: (03 Hours)
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. Properties of Concrete: (11 Hours)
4.1 Properties in plastic state: Workability, Segregation, Bleeding and Harshness
4.1.1 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
4.2 Properties in hardened state: Strength, Durability, Impermeability, Dimensional changes;

5. Concrete Mix Design (10 Hours)
5.1 Objectives of mix design, introduction to various grades as per IS:456-2000; proportioning for nominal mix design as prescribed by IS 456-2000
5.2 Adjustment on site for: Bulking of fine aggregate, water absorption of aggregate, workability
5.3 Difference between nominal and controlled concrete
5.4. Introduction to IS-10262-2009-Code for controlled mix design.

6. Introduction to Admixtures (chemicals and minerals) for improving performance of concrete (03 Hours)

7. Special Concretes (only features) (07Hours)
7.1 Concreting under special conditions, difficulties and precautions before, during and after concreting
7.1.1 Cold weather concreting
7.1.2 Under water concreting
7.1.3 Hot weather concreting
7.2 Ready mix concrete
7.3 Fibre reinforced concrete
7.4 Polymer Concrete
7.5 Fly ash concrete
7.6 Silica fume concrete

8. Concreting Operations: (16 Hours)
**8.1 Storing of Cement:
8.1.1 Storing of cement in a warehouse
8.1.2 Storing of cement at site

8.1.3 Effect of storage on strength of cement
8.1.4 Determination of warehouse capacity for storage of Cement
**8.2 Storing of Aggregate: Storing of aggregate at site
8.3 Batching (to be shown during site visit)
8.3.1 Batching of Cement
8.3.2 Batching of aggregate by:
8.3.2.1 Volume, using gauge box (farma) selection of proper gauge box
8.3.2.2 Weight spring balances and batching machines
8.3.3 Measurement of water
** 8.4 Mixing:
8.4.1 Hand mixing
8.4.2 Machine mixing - types of mixers, capacities of mixers, choosing appropriate size of mixers, operation of mixers
8.4.3 Maintenance and care of mixers
**8.5 Transportation of concrete: Transportation of concrete using: wheel barrows, transit mixers, chutes, belt conveyors, pumps, tower crane and hoists etc.
8.6 Placement of concrete:
Checking of form work, shuttering and precautions to be taken during placement
** 8.7 Compaction:
8.7.1 Hand compaction
8.7.2 Machine compaction - types of vibrators, internal screed vibrators and form vibrators
8.7.3 Selection of suitable vibrators for different situations
8.8 Finishing concrete slabs - screeding, floating and trowelling
8.9 Curing:
8.9.1 Objective of curing, methods of curing like ponding, membrane curing, steam curing, chemical curing
8.9.2 Duration for curing and removal of form work
8.10 Jointing: Location of construction joints, treatment of construction joints, expansion joints in buildings - their importance and location
8.11 Defects in concrete: Identification of defects and methods of removing defects

9. Importance and methods of non-destructive tests (introduction only) (3 Hours)

9.1. Rebound Hammer Test
9.2. Pulse Velocity method
NOTE: ** A field visit may be planned to explain and show the relevant things

PRACTICAL EXERCISES:

1. To determine the physical properties of cement such as fineness, consistency, setting time, soundness and compressive strength of cement as per IS Codes
2. To determine flakiness at elongation Index of coarse aggregate
3. To determine silt content in fine aggregate
4. Determination of specific gravity and water absorption of aggregates
5. Determination of bulk density and voids of aggregates
6. Determination of particle size distribution of fine, coarse and all-in-aggregate by sieve analysis (grading of aggregate)
7. To determine bulking of fine aggregates
8. To determine workability by slump test and to verify the effect of water, fine aggregate/coarse aggregate ratio and aggregate/Cement ratio on slump
9. Compaction factor test for workability
10. Non destructive test on concrete by:

a) Rebound Hammer Test
b) Ultrasonic Pulse Velocity Test

11. To determine compressive strength of concrete cubes for different grades of concrete
12. To determine flexural strength of concrete beam

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 also be demonstrated to students tPeriodsough video programmes developed in the field of ‘concrete technology’ by NITTTR, Chandigarh.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work,
- Report writing
- Viva-Voce

RECOMMENDED BOOKS

1. "Concrete Technology by Krishnamurthy, KT Rao, A Kasundra and Khandekar, AA; Dhanpat Rai and Sons, Delhi
2. "Text Book of Concrete Technology" by Gupta BL and Gupta Amit; Standard Publishers Distributors, Delhi.
3. “Concrete Tecnology” by Handoo, BL, Puri, LD and Mahajan Sanjay; Satya Prakashan, New Delhi.
4. "Laboratory Manual on Concrete Technology" by Sood, Hemant, Mittal LN and Kulkarni PD; CBS Publishers, New Delhi
5. “Concrete Technology” by Birinder Singh; Kaption Publications, Ludhiana,
6. Module on “Special Concretes by Dr. Hemant Sood; NITTTR Chandigarh
7. Video programme on different experiments in ‘Concrete Technology’ developed by NITTTR, Chandigarh.
8. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS **Topic No.**	**Time Allotted (Hours)**	**Marks Allotted (%)**
1	03	04
2	08	13
3	03	04
4	11	17
5	10	16
6	03	04
7	07	12
8	16	26
9	03	04
Total	**64**	**100**

4.2 WATER SUPPLY AND WASTE WATER ENGINEERING

L T P
4 - 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 supplemented 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 specialized operations.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:
- Calculate the water requirement for a particular population
- Check and improve the quality of water by giving required treatment to water
- Calculate the size of different pipes to carry water
- Lay the network of pipes for water supply as well as sewerage in a building
- Draw the location of different appurtenances
- Carry out the disposal of sewage
- Supervise the water supply and waste water schemes

DETAILED CONTENTS
A. WATER SUPPLY

1. Introduction (02 Hours)
1.1 Necessity and brief description of water supply system.
1.2 Sources of water – surface/sub-surface sources

Quantity of Water (06 Hours)
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 (03 Hours)
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

4. Water Treatment (brief introduction) (09 Hours)
**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 **(07 Hours)**

**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

6. Laying of Pipes **(04 Hours)**

6.1 Setting out alignment of pipes
6.2 Excavation for laying of pipes and precautions to be taken
6.3 Handling, lowering and jointing of pipes
6.4 Testing of pipe lines
6.5 Back filling

7. Building Water Supply **(02 Hours)**

7.1 Connections to water main (practical aspect only)
**7.2 Water supply fittings (with sketches) and terminology related to plumbing
B. WASTE WATER ENGINEERING

8. Introduction **(04 Hours)**

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 **(04 Hours)**

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: **(05 Hours)**

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 drains and different sections required

11 Sewage Characteristics: **(03 Hours)**

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 **(04 Hours)**

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 (08 Hours)

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 (03 Hours)

14.1 Aims of building drainage and its requirements
**14.2 Different sanitary fittings and installations
14.3 Traps
** 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/tPeriodseading of GI Pipes, CI Pipes, SWG pipes, PVC pipes and copper pipes.
10) To demonstrate the laying of SWG pipes for sewers
11) Study of water purifying process by visiting a field lab.
12) Demonstration of plumbing tools.

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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work,
- Report writing of field visit
- Viva-Voce

RECOMMENDED BOOKS

1. “Elements of Public Health Engineering” by Duggal, KN; S. Chand and Co. New Delhi
2. “Water Supply and Sanitary Engineering” by Rangwala, SC; Charotar Book Stall, Anand
3. “Water Supply Engineering” by Kshirsagar, SR; Roorkee Publishing House, Roorkee
4. “Sewage and Sewage Tratement” by Kshirsagar, SR; Roorkee Publishing House, Roorkee
5. “Water Supply and Sanitary Engineering” by Birdie, GS; Dhanpat Rai and Sons, Delhi
6. “Water Supply Engineering” by Garg, Santosh Kumar; Khanna Publishers, Delhi
7. “Sewage and Waste Water Disposal Engineering” by Garg, Santosh Kumar; Khanna Publishers, Delhi
8 “A Laboratory Manual in Public Health Engineering” by Duggal, Ajay K and Sharma, Sanjay; Galgotia Publications, 2006, New Delhi
9 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:
http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS **Topic No.**	**Time Allotted (Hours)**	**Marks Allotted (%)**
1	02	03
2	06	10
3	03	04
4	09	14
5	07	12
6	04	06
7	02	03
8	04	06
9	04	06
10	05	08
11	03	05
12	04	06
13	08	12
14	03	05
Total	**64**	**100**

4.3 IRRIGATION ENGINEERING

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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.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Explain concept of necessity of irrigation in India
- Recognise different crops and their water requirements
- Define rainfall and runoff
- Measure rainfall and read rain gauges and hydrographs
- Monitor construction and maintenance work of canal and canal linings
- Monitor installation of tubewells and water harvesting techniques
- Supervise maintenance and construction work of canal head works and cross regulators
- Supervise construction of various river training works
- Carry out desilting operation of canals

DETAILED CONTENTS

THEORY

1. Introduction: (02 Hours)
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 (04 Hours)
2.1 Principal crops in India and their water requirements
2.2 Crop seasons – Kharif and Rabi
2.3 Soil water, soil crop and crop 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 (04 Hours)
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 (05 Hours)
4.1 Flow irrigation - its advantages and limitations
4.2 Lift Irrigation – Tubewell, submersible and well irrigation 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 (05 Hours)
5.1 Classification, apurtenancs of a canal and their functions, sketches of different canal cross-sections
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 (07 Hours)
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 and their choice-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 (05 Hours)
7.1 Classification of dams; earth dams - types, causes of failure; cross-section of zoned earth dam, 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 (04 Hours)
Definition, object, general layout, functions of different parts of head works. Difference between weir and barrage

9. Cross Drainage Works **(04 Hours)**

9.1 Functions and necessity of the following types: aqueduct, super passage, level crossing, inlet and outlet
9.2 Sketches of the above cross drainage works

10. Definitions of following Hydraulic Structures with Sketches **(02 Hours)**
10.1 Falls
10.2 Cross and head regulators

10.3 Outlets

10.4 Canal Escapes

11. River Training Works **(03 Hours)**
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 Hours)**
12.1 Definition of water logging – its causes and effects, detection, prevention and remedies

12.2 Surface and sub-surface drains and their layout
12.3 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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-Voce

RECOMMENDED BOOKS

1. Irrigation Engineering and Hydraulics Structures by Garg, Santosh Kumar; Khanna Publishers, Delhi,
2. Irrigation and Water Power Engineering' by Punmia, BC and Pande Brij Bansi Lal; Standard Publishers Distributors, Delhi
3 “Irrigation Engineering and Hydraulic Structures” by Saharsabudhe SR
4 BIS Codes 5. Central Ground Water Board and Central Water Commission Guidelines and Reference Books.
6. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:
http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS **Topic No.**	**Time Allotted (Hours)**	**Marks Allotted (%)**
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2	04	08
3	04	08
4	05	10
5	05	10
6	07	15
7	05	10
8	04	08
9	04	08
10	02	04
11	03	08
12	03	06
Total	**48**	**100**

4.4 SURVEYING – II

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3 - 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.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:
- Interpolate contours on a given sheet of paper
- Align a proposed road
- Draw a contour plan of an area
- Calculate earth work for a road from a contour map
- Prolong a line with theodolite
- Conduct closed traversing
- Measure horizontal and vertical angles
- Set out simple circular curve
- Read Total Station, EDM and Auto level

DETAILED CONTENTS

1. Contouring: (08 Hours)

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

2. Theodolite Surveying: (12 Hours)

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

3. Tacho-metric surveying (08 Hours)

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

4. Curves: (15 Hours)

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: (05 Hours)

a) EDM or Distomat
b) Planimeter (Digital)
c) Total station
d) Introduction to remote sensing and GPS
e) Auto level
f) Digital theodolite

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 Periodic field visits to Survey of India and other government agencies.

VI. To plot an area with he help of Total Station

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

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work,
- Report writing
- Drawing
- Viva-Voce

RECOMMENDED BOOKS

1. "A Text Book of Surveying" by Kocher, CL; Katson Publishing House Ludhiana,
2. "Surveying and Leveling" by Kanetkar,TP and Kulkarni, SV; AVG Parkashan, Pune
3. "Surveying and Leveling-Vol.2" by Kanetkar, TP and Kulkarni, SV; AVG Prakashan, Pune
4. "Surveying and Leveling " by Punima, BC; Standard Publishers Distributors, Delhi
5. “Surveying-II” by Mahajan, Sanjay; Satya Prakashan, Delhi
6. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:
http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS **Topic No.**	**Time Allotted (Hours)**	**Marks Allotted (%)**
1	08	17
2	12	27
3	08	15
4	15	31
5	05	10
Total	**48**	**100**

4.5 SOIL MECHANICS AND FOUNDATION ENGINEERING

L T P
4 - 2

RATIONALE

Civil Engineering diploma engineers are required to supervise the construction of roads, pavements, dams, embankments, and other Civil Engineering structures. As such the knowledge of basic soil engineering is the pre-requisite for these engineers for effective discharge of their duties. This necessitates the introduction of Soil and Foundation Engineering subject in the curriculum for Diploma Course in Civil Engineering.
The subject covers only such topics which will enable the diploma engineers to identify and classify the different types of soils, their selection and proper use in the field for various types of engineering structures.
The emphasis will be more on teaching practical aspect rather than theory.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Identify and classify various types of soils
- Select particular type of foundation according to loading of structure
- Determine shear strength of soil
- Carry out compaction of soils as per density
- Calculate bearing capacity of soil
- Calculate liquid limit and plastic limit of soil
- Calculate maximum dry density of soil and optimum moisture content of soil
- Perform various tests of the soil

DETAILED CONTENTS

1. Introduction: (03 Hours)

1.1 Importance of Soil Studies in Civil Engineering
1.2 Geological origin of soils with special reference to soil profiles in India: residual and transported soil, alluvial deposits, lake deposits, local soil found in Punjab, dunes and loess, glacial deposits, black cotton soils, conditions in which above deposits are formed and their engineering characteristics.
1.3 Names of organizations dealing with soil engineering work in India, soil map of India

2. Physical Properties of Soils: (04 Hours)

2.1 Constituents of soil and representation by a phase diagram
2.2 Definitions of void ratio, porosity, degree of saturation, water content, specific gravity, unit weight, bulk density/bulk unit weight, dry unit weight, saturated unit weight and submerged unit weight of soil grains and correlation between them
2.3 Simple numerical problems with the help of phase diagrams

3. Classification and Identification of Soils (04 Hours)

3.1. Particle size, shape and their effect on engineering properties of soil, particle size classification of soils
3.2 Gradation and its influence on engineering properties
3.3 Relative density and its use in describing cohesionless soils
3.4 Behaviour of cohesive soils with change in water content, Atterberg's limit - definitions, use and practical significance
3.5 Field identification tests for soils
3.6 Soil classification system as per BIS 1498; basis, symbols, major divisions and sub divisions, groups, plasticity chart; procedure for classification of a given soil

4. Flow of Water Through Soils: (04 Hours)

4.1 Concept of permeability and its importance
4.2 Darcy's law, coefficient of permeability, seepage velocity and factors affecting permeability
4.3 Comparison of permeability of different soils as per BIS
4.4 Measurement of permeability in the laboratory

5. Effective Stress: (Concept only) (04 Hours)

5.1 Stresses in subsoil
5.2 Definition and meaning of total stress, effective stress and neutral stress
5.3 Principle of effective stress
5.4 Importance of effective stress in engineering problems

6. Deformation of Soils (04 Hours)

6.1 Meaning, conditions/situations of occurrence with emphasis on practical significance of:
a) Consolidation and settlement
b) Creep
c) Plastic flow
d) Heaving
e) Lateral movement
f) Freeze and thaw of soil
6.2 Definition and practical significance of compression index, coefficient of consolidation, degree of consolidation.
6.3 Meaning of total settlement, uniform settlement and differential settlement; rate of settlement and their effects
6.4 Settlement due to construction operations and lowering of water table
6.5 Tolerable settlement for different structures as per BIS

7. Shear Strength of Soil: (09 Hours)

7.1. Concept and Significance of shear strength
7.2 Factors contributing to shear strength of cohesive and cohesion less soils, Coulomb's law
7.3 Determination of shearing strength by direct shear test, unconfined compression test and vane shear test. Drainage conditions of test and their significance
7.4 Stress and strain curve, peak strength and ultimate strength, their significance
7.5 Examples of shear failure in soils
7.6 Numerical problems

8. Compaction: (4 Hours)

8.1 Definition and necessity of compaction
8.2 Laboratory compaction test (standard and modified proctor test as per IS) definition and importance of optimum water content, maximum dry density; moisture dry density relationship for typical soils with different compactive efforts
8.3. Compaction control; Density control, measurement of field density by core cutter method and sand replacement method, moisture control, Proctor's needle and its use, thickness control, jobs of an embankment supervisor in relation to compaction

9. Soil Exploration: (8 Hours)

9.1 Purpose and necessity of soil exploration
9.2 Reconnaissance, methods of soil exploration, Trial pits, borings (auger, wash, rotary, percussion to be briefly dealt)
9.3 Sampling; undisturbed, disturbed and representative samples; selection of type of sample; thin wall and piston samples; area ratio, recovery ratio of samples and their significance, number and quantity of samples, resetting, sealing and preservation of samples.
9.4 Presentation of soil investigation results

10 Bearing Capacity of soil (10 Hours)

10.1 Concept of bearing capacity
10.2 Definition and significance of ultimate bearing capacity, net safe bearing capacity and allowable bearing pressure
10.3 Guidelines of BIS (IS 6403) for estimation of bearing capacity
10.4 Factors affecting bearing capacity
10.5 Concept of vertical stress distribution in soils due to foundation loads, pressure bulb
10.6 Applications of SPT, unconfined compression test and direct shear test in estimation of bearing capacity
10.7 Plate load test (no procedure details) and its limitations
10.8 Improvement of bearing capacity by sand drain method, compaction, use of geo-synthetics.

11. Foundation Engineering: (10 Hours)

Concept of shallow and deep foundation; types of shallow foundations: combined, isolated, strip, mat, and their suitability. Factors affecting the depth of shallow foundations, deep foundations, type of piles and their suitability; pile classification on the basis of material, pile group and pile cap.

PRACTICAL EXERCISES

1. To determine the moisture content of a given sample of soil

2. Auger Boring and Standard Penetration Test

a) Identifying the equipment and accessories
b) Conducting boring and SPT at a given location
c) Collecting soil samples and their identification
d) Preparation of boring log and SPT graphs
e) Interpretation of test results

3. Extraction of Disturbed and Undistrubed Samples

a) Extracting a block sample
b) Extracting a tube sample
c) Extracting a disturbed samples for mechanical analysis.
d) Field identification of samples

4. Field Density Measurement (Sand Replacement and Core Cutter Method)
a) Calibration of sand
b) Conducting field density test at a given location
c) Determination of water content
d) Computation and interpretation of results

5. Liquid Limit and Plastic Limit Determination:
a) Identifying various grooving tools
b) Preparation of sample
c) Conducting the test
d) Observing soil behaviour during tests
e) Computation, plotting and interpretation of results

6. Mechanical Analysis
a) Preparation of sample
b) Conducting sieve analysis
c) Computation of results
d) Plotting the grain size distribution curve
e) Interpretation of the curve

7 Laboratory Compaction Tests (Standard Proctor test)
a) Preparation of sample
b) Conducting the test
c) Observing soil behaviour during test
d) Computation of results and plotting
e) Determination of optimum moisture and maximum dry density

8. Direct Shear Test

9. Permeability Test

10. Demonstration of Unconfined Compression Test

a) Specimen preparation
b) Conducting the test
c) Plotting the graph
d) Interpretation of results and finding/bearing capacity

11. Demonstration of Vane shear Test

INSTRUCTIONAL STRATEGY

The teacher while imparting instructions are expected to lay greater emphasis on the practical aspects rather than theory and mathematical treatment. To bring clarity regarding concepts and principles involved, teachers should organize demonstrations in the laboratories and fields. It is necessary to create understanding that soils fail either under shear or settlement due to heavy loads. This can be shown by making use of photographs on working models of such failures. Efforts should be made in the practical classes that students perform practical exercises individually. Conduct of viva examination at the end of each practical work will develop clear understanding about the concepts and principles related to this subject.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and Practical work
- Report Writing
- Viva-voce

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2. "Soil Mechanics and Foundations Engineering" by Bharat Singh and Shamsher Prakash; Nem Chand and Bros, Roorkee,
3. "Soil Sampling and Testing - A Laboratory Manual by Duggal, AK., Ramana, TR.,Krishnamurthy, S; Galgotia Publications, Delhi
4. BIS Codes IS 6403 (latest edition) and IS 1498 (latest edition)
5. “Shallow Foundations” by NITTTR, Chandigarh
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11	10	17
Total	**64**	**100**

SOFT SKILLS – II

L T P
- - 2

RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. The diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:
- Develop Communication Skills
- Work in a team
- Learn to resolve conflict by appropriate method
- Identify leadership traits and learn self motivation
- Follow ethics

DETAILED CONTENTS

- Concept of team building, behavior in a team
- Developing Interpersonal Relations- empathy, sympathy
- Communication skills-improving non-verbal communication
- Conflict Management
- Motivation
- Leadership
- Professional Ethics and Values
- Health, Hygiene, Cleanliness and Safety

In addition, the students must participate in the following activities to be organized in the institute
- Sports
- NCC/NSS
- Camp – Environment awareness
- Cultural Event

Note : Extension Lectures by experts may be organized. There will be no examination for this subject.

INDUSTRIAL TRAINING

Industrial training provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice.

For this purpose, students at the end of fourth semester need to be sent for industrial training for a minimum of 6 weeks upto 8 weeks duration to be organized during the semester break starting after IV Semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A teacher may guide a group of 4-5 students. A minimum of one visit per week by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An internal assessment of 100 and external assessment of 100 marks have been provided in the study and evaluation scheme of V Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behavior, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry. The components of evaluation will include the following.

a) Punctuality and regularity 15%
b) Initiative in learning new things 15%
c) Relationship with workers 15%
d) Industrial training report 55%