

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, brief introduction to properties of concrete, uses of concrete in comparison to other building materials (2 hrs)
2. Ingredients of Concrete: (6 hrs)
 - 2.1 Cement: physical properties of cement; different types of cement:
 - 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. Properties of Concrete: (8 hrs)
 - 3.1 Properties in plastic state, Workability, Segregation, Bleeding and Harshness
 - 3.2 Properties in hardened state: Strength, Durability, Impermeability, Dimensional changes;

4. Water Cement Ratio: (2 hrs)
 - 4.1 Principle of water-cement ratio law/Duff Abram's Water-cement ratio law: Limitations of water-cement ratio law and its effects on strength of concrete
5. Workability: (4 hrs)
 - 5.1 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
6. Proportioning for Nominal Concrete: (4 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
7. Admixtures (Introduction as per IS:456-2000) (3 hrs)
 - 7.1 Chemical admixtures
 - 7.2 Mineral admixtures
 - 7.2.1 Fly ash
 - 7.2.2 Silica fumes
 - 7.2.3 Rice husk ash
 - 7.2.4 Meta Kaolin
8. Special Concretes (6 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 Fly ash concrete

- 8.5 Self compacting 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 on site
- 9.3 Batching:
- 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 by 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 pans, 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 Objective 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) (1 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 BIS Codes
- ii) To determine flakiness and elongation index of coarse aggregates
- iii) Method 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) 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:
 - a) To verify the effect of water, fine aggregate/coarse aggregate ratio and aggregate/Cement ratio on slump
 - b) To test compressive strength of concrete cubes with varying water cement ratio
- x) Compaction factor test for workability
- xi) Non destructive test on concrete by:
 - a) Rebound Hammer Test
 - b) Ultrasonic Pulse Velocity Test
- xii) Tests for compressive strength of concrete cubes for M-20

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.

RECOMMENDED BOOKS

- i) Kulkarni, PD; Ghosh, RK and Phull, YR; "Text Book of Concrete Technology"; New Delhi Oxford and IBH Publishing Co.
- ii) Krishnamurthy, KT; Rao, A Kasundra and Khandekar, AA; "Concrete Technology"; Delhi, Dhanpat Rai and Sons.
- iii) Gupta BL and Gupta Amit; "Text Book of Concrete Technology"; Standard Publishers Distributors, Delhi.
- iv) Varshney, RS;"Concrete Technology";New Delhi, Oxford and IBH Publishing
- v) Neville, AM; "Properties of Concrete" London, Pitman (ELBS Edition available)
- vi) Orchard; "Concrete Technology"; Vol I, II, and III
- vii) Handoo, BL; and Puri, LD;"Concrete Technology"; New Delhi, Satya Prakashan
- 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"; Delhi, Khanna Publishers
- x) Gambhir, ML; "Concrete Technology"; New Delhi, MacMillan India Ltd.
- xi) Siddique, R., "Special Structural Concretes", New Delhi, Galgotia Publishers Pvt. Ltd. Delhi
- xii) Birinder Singh, "Concrete Technology", Ludhiana, Kaption Publications
- (xiii) Module on 'Special Connects by Dr Hemant Sood , NITTTR Chandigarh

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	4
2	6	12
3	8	16
4	2	4
5	4	8
6	4	8
7	3	5
8	6	12
9	12	20
10	1	1
Total	48	100

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 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 specialised operations.

DETAILED CONTENTS THEORY

A. WATER SUPPLY

- | | | |
|----|---|---------|
| 1. | Introduction | (2 hrs) |
| | 1.1 Necessity and brief description of water supply system. | |
| 2. | Quantity of Water | (6 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. | Sources of Water | (4hrs) |
| | 3.1 Surface water sources, their quality and suitability | |
| | 3.2 Sub surface water sources, quality and suitability | |
| 4. | Quality of Water | (4 hrs) |
| | 4.1 Meaning of pure water and methods of analysis of water | |
| | 4.2 Physical, Chemical and bacteriological tests and their significance | |
| | 4.3 Standard of potable water as per Indian Standard | |
| | 4.4 Maintenance of purity of water | |
| 5. | Water Treatment (brief introduction) | (6 hrs) |
| | **5.1 Sedimentation - purpose, types of sedimentation tanks | |
| | **5.2 Coagulation flocculation - usual coagulation and their feeding | |
| | **5.3 Filtration - significance, types of filters, their suitability | |

- 5.4 Necessity of disinfection of water, forms of chlorination, break point chlorine, residual chlorine, application of chlorine.
- 5.5 Flow diagram of different treatment units, functions of (i) Aeration fountain (ii) mixer (iii) flocculator, (iv) classifier, (v) slow and rapid sand filters (vi) chlorination chamber.
6. Conveyance of Water (5 hrs)
- **6.1 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.
- 6.2 Appurtenances: Sluice, air, reflux valves, relief valves, scour valves, bib cocks, stop cocks, fire hydrants, water meters their working and uses
- 6.3 Distribution site: Requirement of distribution, minimum head and rate, methods of layout of distribution pipes
- 6.3.1 Systems of water supply - Intermittent and continuous service reservoirs - types, necessity and accessories.
- 6.3.2 Wastage of water - preventive measures
- 6.3.3 Maintenance of distribution system
- 6.3.4 Leakage detection
7. Laying out Pipes (4 hrs)
- 7.1 Setting out alignment of pipes
- 7.2 Excavation for laying of pipes and precautions to be taken
- 7.3 Handling, lowering beginning and jointing of pipes
- 7.4 Testing of pipe lines
- 7.5 Back filling
- 7.6 Use of boring rods
8. Building Water Supply (2 hrs)
- 8.1 General principles as per Indian Standards
- 8.2 Connections to water main
- **8.3 Water supply fixtures and installations and terminology related to plumbing
- B. WASTE WATER ENGINEERING**
9. Introduction (4 hrs)
- 9.1 Purpose of sanitation
- 9.2 Necessity of systematic collection and disposal of waste
- 9.3 Definition of terms in sanitary engineering
- 9.4 Collection and conveyance of sewage
- 9.5 Conservancy and water carriage systems, their advantages and Disadvantages
- 9.6 (a) Surface drains (only sketches) : various types, suitability
(b) Types of sewage: Domestic, industrial, storm water and its seasonal variation
- +10. Sewerage System (5hrs)
- 10.1 Types of sewerage systems, materials for sewers, their sizes and joints

- 10.2 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
11. Laying and Construction of Sewers: (6 hrs)
- 11.1 Setting out/alignment of sewers
- 11.2 Excavations, checking the gradient with boring rods preparation of bedding, handling and jointing testing and back filling.
- 11.3 Construction of surface mains and different sections required
12. Sewage characteristics:
- 12.1 Properties of sewage ISI standards for analysis of sewage
- 12.2 Physical chemical and bacteriological parameters (4hrs)
13. Natural Methods of Sewerage Disposal (5 hrs)
- 13.1 General composition of sewage and disposal methods
- 13.2 Disposal by dilution
- 13.3 Self purification of stream
- 13.4 Disposal by land treatment
- 13.5 Nuisance due to disposal
14. Sewage Treatment (6 hrs)
- 14.1 Meaning and principle of primary and secondary treatment and activated sludge process their flow diagrams
- 14.2 Introduction and uses of screens, grit chambers, detritus tanks, skimming tanks, plain sedimentation tanks, primary clarifiers, secondary clarifiers, filters, control beds, intermittent sand filters, trickling filters, sludge treatment and disposal, oxidation ponds
15. Building Drainage (6 hrs)
- 15.1 Aims of building drainage and its requirements
- 15.2 General layout at house drainage arrangement as per BIS: 1742
- **15.3 Different sanitary fittings and installations
- 15.4 Traps, seals, causes of breaking seals
- 15.5 Testing of house drainage. (3hrs)

** 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, and plastic pipes
- 10) To demonstrate the laying of SW pipes for sewers

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	4
2	6	9
3	4	6
4	4	6
5	6	9
6	4	8
7	4	6
8	2	4
9	4	6
10	5	8
11	6	8
12	4	8
13	3	9
14	3	10
15	3	
Total	80	100

SOIL 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.

DETAILED CONTENTS

THEORY

1. Introduction: (3 hrs)
 - 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 Uttaranchal dunes and loess, glacial deposits, 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: (4 hrs)
 - 2.1 Constituents of soil and representation by a phase diagram
 - 2.2 Definitions and meaning of void ratio, porosity, degree of saturation, water content, specific gravity, unit weight, dry 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 (4 hrs)

- 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
 - 3.7 Black cotton soils (Introduction and limitations only)
4. Flow of Water Through Soils: (4 hrs)
- 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) (4 hrs)
- 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 (4 hrs)
- 6.1 Meaning, conditions/situations of occurrence with emphasis on practical significance of:
 - a) Consolidation and consolidation 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. Strength Characteristics of Soils: (9 hrs)
 - 7.1 Factors contributing to shear strength of soils, Coulomb's law
 - 7.2 Determination of shearing strength by direct shear test, unconfined compression test and vane shear test
 - 7.3 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 hrs)
 - 8.1 Definition and necessity of compaction
 - 8.2 Laboratory compaction test (standard and modified as per BIS) definition and importance of optimum water content, maximum dry density; moisture dry density relations for typical soils with different compactive efforts
 - 8.2 Compaction control; Density control, field density test, core method, 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 hrs)
 - 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 hrs)
- 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 Plate load test (no procedure details) and its limitations
- 10.7 Application of SPT and unconfined compression test and direct shear test in estimation of bearing capacity
- 10.8 Soil properties governing choice of foundation type
- 10.9 Improvement of bearing capacity (elementary), sand drain method compaction, use of geotextiles, grouting.
11. Foundation Engineering: (10 hrs)
- Concept of shallow and deep foundation; types of shallow foundations 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 the 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
2. Extraction of Disturbed and Undisturbed Samples
 - a) Extracting a block sample
 - b) Extracting a tube sample
 - c) Extracting a disturbed samples for mechanical analysis. Compaction and limit test
 - d) Field identification of samples
3. 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
4. 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
5. 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
6. 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
7. Unconfined Compression Test
 - a) Specimen preparation
 - b) Conducting the test
 - c) Plotting the graph
 - d) Interpretation of results and finding/bearing capacity

8. (a) Demonstrate about of Direct shear and vane shear tests on sandy soil samples
(b) Perinea liability test apparatus

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.

RECOMMENDED BOOKS

- i) Punmia, BC; "Soil Mechanics and Foundations"; Delhi Standard Publishers Distributors.
- ii) Bharat Singh and Shamsheer Prakash; "Soil Mechanics and Foundations Engineering"; Roorkee, Nem Chand and Bros.
- iii) Sehgal, SB; "A Text Book of Soil Mechanics"; Delhi, CBS Publishers and Distributors
- iv) Bowles, Joseph E; "Engineering Properties of soils and their Measurement"; Delhi, Tata McGraw Hill.
- v) Gulati, SK and Manoj Dutta; "Geotechnical Engineering ", Delhi, Tata McGraw Hill
- vii) Khan, Iqbal H, "A Text Book of Geotechnical Engineering", Delhi, Prentice Hall of India
- viii) Ranjan Gopal and Rao ASR "Basic and Applied Soil Mechanics", New Age Publication (P) Ltd., New Delhi
- ix) S Mittal and JP Shukla, "Soil Testing for Engineers", Khanna Publishers Ltd.
- x) Duggal, AK., Ramana, TR., Krishnamurthy, S., "Soil Sampling and Testing - A Laboratory Manual, Galgotra Publications, 2006
- xi) BIS Codes IS 6403 (latest edition) and IS 1498 (latest edition)
- xii) Jagroop Singh, Soil and Foundation Engineering, Eagle Parkashan, Jalandhar

- xiii) Rabinder Singh” Soil and foundation engg SK Kataria and sons, Ludiana
- xiv) Shallow Foundations, NITTTR Chandigarh

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	3	5
2	4	6
3	4	6
4	4	6
5	4	6
6	4	6
7	9	14
8	4	6
9	8	16
10	10	12
11	10	17
Total	64	100

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 surveying, 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: (5 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: (9 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 (4 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. Minor Instruments: (2hrs)

Introduction to the use of the instruments given below to be explained in addition to providing practice:

- a) Abney level
- b) Tangent clinometer
- c) Ceylon Ghat Tracer
- d) Pentagraph
- a) Planimeter

6. Introduction to the use of Modern Surveying equipment and techniques such as:

(2 hrs)

- a) Auto level
- b) Digital planimeter
- c) Micro-optic theodolite
- d) Digital theodolite
- e) EDM and GPS
- f) Total station
- g) Introduction to remote sensing

NOTE:

- a) For various surveying equipment relevant Indian Standards should be followed
- b) 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 Theodolite, 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 of minor instruments like Ceylon Ghat Tracer, Tangent Clinometer, Pantagraph etc.

- ii) Use of planimeter for computing areas
- V. Demonstration of digital instruments like Autolevel, digital planimeter, microoptic theodolite, digital theodolite, digital distance meter through visits to survey of India Dehradun .

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

- i) Narinder Singh; "Surveying"; New Delhi, Tata McGraw Hill Publishing Co Ltd.
- ii) Hussain, SK and Nagraj, MS; "Text Book of Surveying"; New Delhi, S Chand and Co Ltd.
- iii) Deshpande, RS; "A Text Book Surveying and Levelling"; Poona, United Book Corporation
- iv) Kocher, CL; "A Text Book of Surveying"; Ludhiana, Katson Publishing House
- v) Kanetkar, TP and Kulkarni, SV., "Surveying and Leveling", Poona, AVG Parkashan
- vi) Kanetkar, TP; and Kulkarni, SV; "Surveying and Leveling-Vol.2" Poona, AVG Prakashan
- vii) Punima, BC; "Surveying and Leveling - Vol. 2", Delhi Standard Publishers Distributors, Delhi
- viii) Shahai, PB; "A Text Book of Surveying Vol. 2", Oxford and IBH Publishing Co.
- ix) Lilly Sant "Remote Sensing and Image Interpretation"

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	5	16
2	9	28
3	4	12
4	10	34
5	2	5
6	2	5
Total	32	100

STRENGTH OF MATERIALS

L T P
4 - 2

RATIONALE

This is a basic engineering subject. The purpose of the subject is to impart basic knowledge and skill regarding properties of materials, concept of stresses and strains, bending moment and shear force diagrams, second moment of area, bending and shear stresses, slope and deflection and analysis of trusses. The above knowledge will be useful for designing simple structural components. This subject is very important to develop basic concepts and principles related to strength of materials. This subject will also enable the students to continue their further education.

DETAILED CONTENTS

THEORY:

1. Properties of Materials (2 hrs)
 - 1.1 Classification of materials, elastic materials, plastic materials, ductile materials, brittle materials.
 - 1.2 Introduction to tensile test, compressive test, impact test, fatigue test, torsion test on metals.
2. Simple Stresses and Strains: (14 hrs)
 - 2.1 Concept of stress, normal and shear stresses,
 - 2.2 Concept of strain and deformation, longitudinal and transverse strain, poisson's ratio, volumetric strain
 - 2.3 Hooke's law, moduli of elasticity and rigidity, Bulk modulus of elasticity, relationship between the elastic constants.
 - 2.4 Stresses and strains in bars subjected to tension and compression. Extension of uniform bar under its own weight, stress produced in compound bars (two or three) due to axial load.
 - 2.5 Stress-strain diagram for mild steel, mechanical properties, factor of safety.
 - 2.6 Temperature stresses and strains
3. Bending Moment and Shear Force: (18 hrs)
 - 3.1 Concept of a beam and supports (Hinges, Roller and Fixed), types of beams: simply supported, cantilever, propped, over hang, cantilever, fixed

- and continuous beams, introduction to determinate and indeterminate structures
- 3.2 Types of loads (dead load, live load, snow load, wind load seismic load etc) and types of loading (point, uniformly distributed and uniformly varying loads)
 - 3.3 Concept of bending moment and shear force, sign conventions
 - 3.4 Bending Moment and shear force diagrams for cantilever, simply supported and overhanging beams subjected to concentrated, uniformly distributed
 - 3.5 Relationship between load, shear force and bending moment, point of maximum bending moment, and point of contraflexure.
4. Bending and Shear Stresses: (8 hrs)
- 4.1 Concept of pure/simple bending
 - 4.2 Assumptions made in the theory of simple bending and application of bending equation (no derivation) to circular cross-section, I section, T&L sections only
 - 4.3 Moment of resistance
 - 4.4 Calculations of bending stresses in simply supported beam
 - 4.5 Concept of shear stresses in beams, shear stress distribution in rectangular, circular I, T, L sections (Formula to be stated, no derivation)
5. Slope and Deflection: (6 hrs)
- 5.1 Necessity for determination of slope and deflection
 - 5.2 Moment area theorem (no derivation, no numerical)
6. Columns: (4hrs)
- Theory of columns Eulers and Rankine Formula
7. Combined Direct and Bending Stresses: (6hrs)
- 7.1 Concentric and eccentric loads single axis eccentricity only
 - 7.2 Effect of eccentric load on the section stresses due to eccentric loads, Numerical in the case of short columns.
 - 7.3 Simple problems on stability of masonry retaining walls (overturning and sliding)

8. Analysis of Trusses: (6 hrs)
- 8.1 Concept of a perfect, redundant and deficient frames
- 8.2 Assumptions and analysis of trusses by:
- (a) Method of joints
 - (b) Method of sections
 - (c) Graphical method

PRACTICAL EXERCISES

- i) Determination of yield stress, ultimate stress, percentage elongation and plot the stress strain diagram and compute the value of young's modulus on mild steel
- ii) Determination of Young's modulus of elasticity for steel wire with searl's apparatus
- iii) Determination of modulus of rupture of a timber beam
- iv) Determination of maximum deflection and young's modulus of elasticity in simply supported beam with load at middle third
- v) Verification of forces in a framed structure

INSTRUCTIONAL STRATEGY

Teachers are expected to give simple exercises involving the applications of various concepts and principles being taught in the subject. Efforts should be made to prepare tutorial sheets on various topics and students should be encouraged/guided to solve tutorial sheets independently. In the practical works, individual students should be given opportunities to do practical work, make observations and draw conclusions. Teachers should also conduct viva examination in which stress should be given on the understanding of basic concepts and principles.

RECOMMENDED BOOKS

- i) Ramamrutham, S., "Strength of Materials", New Delhi Dhanpat Rai and Sons.
- ii) Ram Chandra, "Applied Mechanics and Strength of Materials", Delhi: Standard Publishers.
- iii) Punmia, BC., "Strength of Materials", Delhi, Standard Publishers Distributors.
- iv) VS Prasad " Structural mechanics Galgotia publications Pvt Ltd
- v) Sadhu Singh "Strengths of Materials" Standard Publishers, New Delhi

- vi) Strength of Materials by MM Malhotra
- vii) Strength of Materials by Birinder Singh Kaption Publishers Ludhiana

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	4
2	14	24
3	18	34
4	8	12
5	6	4
6	4	4
7	6	10
8	6	8
Total	64	100

PUBLIC HEALTH ENGINEERING DRAWING

L T P
- - 4

RATIONALE

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

DETAILED CONTENTS

Drawings Exercises

PART A : WATER SUPPLY AND WASTE WATER ENGINEERING DRAWING

1. Drains and Sewers (8 hrs)
 - 1.1 Cross section of standard types of open drains (circular, v-shaped and μ -shaped) with their foundations
 - 1.2 Cross section of earthen ware and RCC sewer pipes
 - 1.3 Cross sections of masonry sewers (circular and egg shaped)

2. Traps, manholes and inspection chamber (10 hrs)
 - 2.1 Detailed section of floor trap and gully trap
 - 2.2 Detailed plan and section of an inspection chamber
 - 2.3 Detailed plan and section of a manhole

3. Septic Tank and Soak Pit (8 hrs)

Detailed plan and cross sections of a domestic septic tank with soak pit for 5-10 users

4. Bath room and W.C connections: (16 hrs)
 - 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. (14 hrs)

6. Practice of reading water supply and sanitary engineering working drawings (PWD/urban Development agencies) including hot water and cold water supply system (8 hrs)

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 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. Civil Engineering Drawings by RP Chandel
2. Civil Engineering Drawing by NS Kumar; IPH, New Delhi
3. Civil Engineering Drawing by RS Malik and GA Meo; 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