0904 DIPLOMA IN CIVIL & ENVIRONMENTAL ENGINEERING
SEMESTER -I
090441 CONCRETE TECHNOLOGY

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, advantages of concrete, uses of concrete in comparison to other building materials

2. Ingredients of Concrete: (7 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: (7 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 ration law/Duff Abram's Water-cement ratio law: Limitations of water-cement law

4.2 Definition of strength of concrete, relation between water cement ratio and strength of concrete

5. Workability: (3 hrs)

5.1 Definition, phenomeno n of workability, concept of internal friction, segregation and harshness; factors affecting workability

5.2 Measurement of workability: slump test, compacting factor and vee bee consistometer; recommended slumps for placement in various conditions as per IS:456-2000 and SPECIFICATIONS-23-1982

6. Proportioning for Normal Concrete: (4 hrs)

6.1 Objectives of mix design, introduction to various grades as per IS:456-2000; proportioning for normal mix 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 normal and controlled concrete

7. Admixtures (Introduction as per IS:456-2000) (3 hrs)

7.1 Chemical admixtures (Plasticizers, Accelerators and Retarders, Water-reducing admixtures, Air-entraining admixtures)

7.2 Mineral admixtures

7.3 Fly ash

7.4 Silica fumes

7.5 Rice husk ash

7.6 Meta Kaolin

8. Special Concretes (6 hrs)

8.1 Concreting under special conditions

8.1.1 Cold weather concreting

8.1.2 Under water concreting

8.1.3 Hot weather concreting

8.2 Fibre reinforced concrete

8.3 Fly ash concrete

8.4 Silica fume concrete

8.5 Polymer concrete

9. Conducting 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 etc.

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

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

c) Profometer/covesometer

xii) Tests for compressive strength of concrete cubes for M-15 or 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) Sood, Hemant, Mittal LN and Kulkarni PD; "Laboratory Manual on Concrete Technology", CBS Publishers, New Delhi, 2002

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

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

iv) Gupta BL; "Text Book of Concrete Technology"; Standard Publishers Distributors

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

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

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

viii) Handoo, BL; and Puri, LD;"Concrete Technology"; New Delhi, Satya Prakashan

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

0904 DIPLOMA IN CIVIL & ENVIRONMENTAL ENGINEERING
SEMESTER -I
090442 WATER SUPPLY AND WASTE WATER ENGINEERING

RATIONALE

One of the basic necessities of life is potable water, which is not easily available to most of the people. Providing potable water, collection and disposal of waste water are important activities in the field of civil engineering. This subject imparts basic knowledge and skills in the field of water supply and waste water disposal engineering. Classroom instructions sho uld be supplemented by field visits to show functional details of water supply and waste water disposal systems. It is also recommended to invite professionals from field to deliver extension lectures on specialized operations

DETAILED CONTENTS

THEORY

PART-A: WATER SUPPLY

1. Introduction (1 hr)

   Water as a natural resource importance of hydrological cycle, significance of water quality and various components of public water supply scheme

2. Quantity of Water (5 hrs)

   2.1 Water demand for domestic, commercial, industrial and public utility purposes as per BIS standards

   2.2 Per capita demand

   2.3 Variations in rate of demand – hourly, daily, weekly and seasonal

   2.4 Methods of population forecasting and related numericals

   2.5 Design period and estimation of water requirement for public water supply scheme

3. Sources of Water Supply (3 hrs)

   3.1 Various sources of water (surface and underground sources)

3.2 Quantity and quality of water from various sources, selection of a suitable source

3.3 Development of springs, infiltration galleries and various types of wells, rain water harvesting and recharge of ground water

4. Intakes and Conveyance of Water (3 hrs)

4.1 Various types of intakes and their locations

4.2 Materials for conveyance of water: cast iron, GI, Steel, PVC, asbestos, cement, concrete timber etc. Suitability of various materials as per BIS specifications

4.3 Joints in various types of pipes

4.4 Numerical on conveyance of water

5. Quality of Water (3 hrs)

5.1 Impurities in water

5.2 BIS standards of potable water

5.3 Necessity for the analysis of water

5.4 Sampling techniques, physical, chemical and bacteriological tests and their significance

6. Treatment of Water (5 hrs)

6.1 Objectives of water treatment and various types of treatment processes

6.2 Purpose and types of screening, aeration, straining and sedimentation

6.3 Coagulation and flocculation: common coagulants, optimum dose and feeding devices

6.4 Filtration: significance and theory of filtration; types, working, suitability and operational problems of filters

6.5 Disinfection: necessity, types of disinfectants, and requirements of a good disinfectant, chlorination: practices of chlorination, break point chlorination, residual chlorine and chlorine demand, application of chlorine

6.6 Flow diagram of various treatment processes

7. Storage and Distribution of Water (5 hrs)

7.1 Clear water reservoir site selection and determination of its capacity by mass-curve method

7.2 Adequate pressure in distribution pipes, layouts of distribution systems along with their merits and demerits

7.3 Systems of water supply: continuous and intermittent, their advantages and disadvantages

7.4 Appurtenances sluice, reflux and air relief valves, bib cock, stopcocks, fire hydrants, water meters and their working

7.5 Pumps and pumping of water, estimatio n of HP of pumps for water supply

7.6 Detection and prevention of leakage of water, maintenance of distribution network

8. Laying of Pipes: (3 hrs)

8.1 Setting out alignment of pipes

8.2 Excavation for laying of pipes and precautions to be observed

8.3 Handling, lowering, laying and jointing of pipes

8.4 Testing of pipe lines

8.5 Back filling and restoration to original surface

9. Plumbing and Water Supply Installations (3 hrs)

9.1 General principles as per BIS standards

9.2 Service connections

9.3 Water supply fixtures and installations

9.4 Hot and cold water supply
9.5 Estimation of pipe sizes

PART-B: WASTE WATER ENGINEERING

10. Introduction (2 hrs)

10.1 Purpose of sanitation, necessity of systematic collection and disposal of waste water

10.2 Definition of terms in waste water engineering

10.3 Systems of sanitation: conservancy and water carriage systems, their advantages and disadvantages

10.4 Systems of sewerage: advantages, disadvantages and their suitability

11. Design of Sewers (5 hrs)

11.1 Quantity of sanitary and storm sewage, variation in flow and their importance, dry weather flow

11.2 Form and materials of sewers and BIS specifications

11.3 Conditions of flow, self- cleansing and limiting velocities, hydraulic formulae for flow of sewage in sewers

11.4 Numerical on design of sewers by use of nomograms

11.5 Sewer appurtenances: location, function and construction features, manholes, drop manholes, catch basin inverted siphon, flushing tanks, greese and oil trap, storm water regulators and ventilating shafts

12. Construction and Laying of Sewers (3 hrs)

12.1 Setting out alignment of sewers

12.2 Excavation, setting the gradient with boning rod, preparation of bed, handling and jointing, testing, back filling and restoration to original surface

13. Characteristics and Testing of Waste Water (3 hrs)

13.1 Composition and decomposition of waste water
13.2 Sampling; physical, chemical and bacteriological analysis of waste water

14. Natural Methods of waste water Disposal (3 hrs)

14.1 Decomposition of waste water

14.2 Waste water disposal methods: disposal by dilution and self-purification of stream, disposal by land treatment

14.3 Nuisance due to disposal

15. Waste Water Treatment (4 hrs)

15.1 Meaning and principles of primary and secondary treatment

15.2 Constructional details of screens, grit chambers, skimming tanks and primary clarifiers

15.3 Trickling filters, activated sludge process and their merits and demerits. Secondary clarifiers and oxidation ditch

16. Treatment and Disposal of Sludge (2 hrs)

16.1 Disposal of wet sludge

16.2 Sludge digestion, sludge drying and its disposal

17. Building Drainage (6 hrs)

17.1 Aims of building drainage and its principles

17.2 General layout of house drainage as per BIS specifications

17.3 Different sanitary fittings

17.4 Traps, seals, causes and prevention of breaking of water seals

17.5 Testing of house drainage

18. Rural Sanitation (4 hrs)

18.1 Drainage, topography, alignments of lanes and by- lanes, storm water, natural drainage, development of drains, size and gradient of drains

18.2 Disposal of night soil, collection and disposal of garbage and refuse, septic tanks, cess pools, pit privies, bore hole latrines and soak pits

18.3 Biogas plant: construction details, use and maintenance

PRACTICAL EXERCISES

1. To determining pH value, conductivity and turbidity of water sample along with their field applications of water sample and their field applications

2. To determine optimum alum dose for coagulation of raw water

3. To determine residual chlorine and chloride demand of water

4. Threading/Joining of GI, CI, and plastic pipes

5. Installation of the following

   a) Service connection: water supply to the building
   b) Water meter
   c) Valves and fittings

6. Water supply connection to bathrooms, bath tubs, showers and geysers

7. To determine total, dissolved and suspended solids in a given waste water sample

8. To determine chemical oxygen demand (COD)

9. To determine Biochemical oxygen demand (BOD)

10. Installation of sanitary fittings: wash basin, water closets (Indian and European), flushing cisterns and their connections to anti-syphonage pipe

11. Installation and testing of house drainage

12. Construction of inspection chamber

13. Laying and testing of sewers

14. Assembling parts of a septic tank

15. Assembling parts of a Biogas plant

INSTRUCTIONAL STRATEGY

As the subject is of practical nature, classroom instructions be supplemented by field visits. Visits to water and waste water treatment plants will motivate the students for learning in the classroom. Collection of information, pamphlets and catalogues from the manufacturers of water supply and sanitary fittings will be very help ful for the students.

RECOMMENDED BOOKS

1. Kshirsagar, SR; "Water Supply Engineering", Roorkee Publishing House, Roorkee

2. Kshirsagar, SR; " waste water and waste water Treatment", Roorkee Publishing House, Roorkee

3. Garg, SK; "Water Supply Engineering", Khanna Publisher, Delhi

4. Garg, SK; " waste water and Waste Water Disposal", Khanna Publishers, Delhi

5. Deswal, SS and Deswal S; "Environmental Engineering", Dhanpat Rai and Co. (P) Ltd., New Delhi

6. Bridie, GS; "Water Supply and Sanitary Engineering", Dhanpat Rai and Co., (P) Ltd., New Delhi

7. Kamala, S; "Environmental Engineering", Tata McGraw Hill Co., Delhi

8. Mathur RP, "Water and Waste Water Testing Laboratory Manual", Nem Chand and Brothers, Roorkee

9. Duggal, Ajay K, "Laboratory Manual in PHE for Polytechnic Students", Technical Teachers' Training Institute, Chandigarh

10. BIS Code related to Water Supply & Waste Water

11. Water Supply Manual issued by M/O Urban Development

0904 DIPLOMA IN CIVIL & ENVIRONMENTAL ENGINEERING
SEMESTER -I
090443 SOIL AND FOUNDATION ENGINEERING

RATIONALE

Civil Engineering diploma engineers are required to supervise the construction of roads and 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 Engineering subject in the curriculum for Diploma Course in Civil Engineering.

The subject covers only such topics as 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, 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

2.3 Simple numerical problems with the help of phase diagrams

3. Soils Classification and Identification: (4 hrs)

3.1 Particle size, shape and their effect on engineering properties of soil

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 limits-definitions, use and practical significance

3.5 Field identification tests for soils

3.6 BIS soil classification system as per IS 1498; basis, symbols, major divisions and sub divisions, groups, plasticity chart; procedure to be followed in classifying a given soil into a group

3.7 Black cotton soils: Properties and their effect on construction of buildings and other structures

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 occurance with emphasis on practical significance of:
a) Consolidation and consolidation settlement
b) Creep
c) Plastic flow
d) Heaving
e) Lateral movement

6.2 Definition and practical significance of compression index, coefficient of consolidation, degree of consolidation.

6.3 Meaning of total settlement, uniform settlement, differential settlement and rate of settlement and their importance

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: (5 hrs)

7.1 Examples of shear failure in soils

7.2 Factors contributing to shear strength of soils, Coulomb's law

7.3 Determination of shearing strength, vane shear test, direct shear test and unconfined compression test. Brief idea about triaxial shear test.

7.4 Drainage conditions of test and their significance

7.5 Stress and strain curve, peak strength and ultimate strength, their significance

7.6 Numerical problems

8. Soil Compaction: (4 hrs)

8.1 Various terms used to discuss degree of compaction 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

8.3 Field compaction; methods and equipment, choice of equipment

8.4 Compaction control; Density control, field density test,(sand replacement), moisture control, Proctor's needle and its use, thickness control, jobs of an embankment supervisor in relation to compaction

9. Bearing Capacity (6 hrs)

9.1 Concept of bearing capacity

9.2 Definition and significance of ultimate bearing capacity, net safe bearing capacity and allowable bearing pressure

9.3 Bearing capacity from building BIS codes (IS 6403)

9.4 Factors affecting bearing capacity

9.5 Concept of vertical stress distribution in soils due to foundation loads, pressure bulb

9.6 Plate load test (no procedure details) and interpretation of its results, limitations of plate load test

9.7 Application of SPT and unconfined compression test and direct shear test in estimation of bearing capacity

9.8 Soil properties governing choice of foundation type

9.9 Improvement of bearing capacity (elementary), sand drain method compaction, use of geotextiles, grouting.

10. Soil Exploration: (4 hrs)

10.1 Purpose and scope of soil exploration, economical aspects

10.2 Undertaking planning of subsurface investigations

10.3 Influence of soil conditions on exploratory programme

10.4 Possibility of misjudgment of subsoil conditions

10.5 Location, depth and spacing of exploration

10.6 Influence of size of project and type of structure on exploratory programme

10.7 Methods of soil exploration; Reconnaissance, Trial pits, borings, (Auger, wash, rotary, percussion to be briefly dealt), SPT (Brief description and information collected)

10.8 Groundwater level measurement

10.9 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.

10.10 Presentation of soil investigation results

11. Foundation Engineering: (8 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; constructional features of pile foundations, pile classification on the basis of material, method of load transmission, method of installation..

PRACTICAL EXERCISES

i) 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

ii) 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

iii) Determination of water content by oven drying method and rapid moisture meter

iv) 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

v) 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

vi) Specific gravity of soil solids by pycnometer

vii) 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

viii) Laboratory Compaction Tests

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 Content and maximum dry density

ix) Determination of permeability of soil samples by constant head and falling head methods

a) Preparation of sample

b) Preparing set up

c) Conduct the test

d) Determination of permeability

e) Interpretation of results

x) Unconfined Compression Test

a) Specimen preparation

b) Conducting the test

c) Plotting the graph

d) Interpretation of results and finding bearing capacity

xi) Direct shear test on sandy soil samples

xii) Conduct of standard penetration test

xiii) Vane shear test on cohesive soils

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 Shamsher 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"; McGraw Hill.

v) Gulati, SK; "Engineering Properties of Soils", Tata McGraw Hill

vi) Ramana, TR.,Krishnamurthy, S., Duggal, AK., "Soil Sampling and Testing – A Laboratory Manual, TTTI, Chandigarh CBS Publishers

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) BIS Codes IS 6403 (latest edition) and IS 1498 (latest edition)

0904 DIPLOMA IN CIVIL & ENVIRONMENTAL ENGINEERING
SEMESTER -I
090444 SURVEYING – II

RATIONALE

The important functions of a civil technician 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 the skill in each type of survey like chain surveying, compass surveying and levelling that the Civil Engineering diploma holder will normally be called upon to perform. Plane table surveying, contouring, theodolite surveying, curves and use of minor instruments have been also 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: (6 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: (8 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.

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

4. Curves: (6 hrs)

Simple Circular Curve:

4.1 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: (4 hrs)

Study and 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

f) Planimeter

6. Study and Use of Modern Surveying equipment such as: (4 hrs)

a) Auto level

b) Digital planimeter

c) Micro-optic theodolite

d) Digital theodolite

e) EDM

f) Total station

g) Introduction to GIS

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 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

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

ii) Setting out a circular curve with transition length by linear measurements

IV. Demonstration of digital instruments like Autolevel, digital Planimeter, microoptic theodolite, digital theodolite

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 belaid 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 individua l 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.

0904 DIPLOMA IN CIVIL & ENVIRONMENTAL ENGINEERING
SEMESTER -I
090445 STRUCTURAL MECHANICS

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 structural mechanics. 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 Tensile test, compressive test, impact test, fatigue test, torsion test.

2. Simple Stresses and Strains: (8 hrs)

    2.1 Concept of stress, normal and shear stresses, stresses due to torsion.

    2.2 Concept of strain and deformation, longitudinal and transverse strain, poisson's ratio, volumetric strain

    2.3 Hooke's law, modulii 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

2.7 Concept of principal plains, principal stresses and strains

3. Bending Moment and Shear Force: (12 hrs)

3.1 Concept of a beam and supports (Hinges, Roller and Fixed), types of beams: simply supported, cantilever, propped cantilever, fixed and continuous beams.

3.2 Types of loads (dead load, live load, snow load, wind 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 and uniformly varying loads

3.5 Relationship between load, shear force and bending moment, point of maximum bending moment and contraflexure.

4. Second Moment of Area: (3 hrs)

4.1 Concept of second moment of area, radius of gyration

4.2 Theorems of parallel and perpendicular axes

4.3 Second moment of area for sections of: Rectangle, Triangle, Circle, Trapezium, Angle, Tee, I, Channel and, Compound. (No Derivation)

5. Bending and Shear Stresses: (6 hrs)

5.1 Theory of simple bending

5.2 Assumptions and Application of the equation M/I = F/Y = E/R (no derivation)

5.3 Moment of resistance, sectional modulus and maximum/permissible bending stresses in circular, rectangular, I,T and L sections; Comparison of strengths of the above sections.

5.4 Concept of shear stresses in beams, shear stress distribution in rectangular, I and T section (Formula to be stated, no derivation)

6. Slope and Deflection: (6 hrs)

6.1 Necessity for determination of slope and deflection

6.2 Moment area theorems (no derivation)

6.3 Computation of slopes and deflections using moment area theorems for:

(a) Simply supported beam with UDL over entire span and concentrated load at any point

(b) Cantilever with UDL over entire span and concentrated load at free end

7. Columns and Struts (4 hrs)

Theory of columns, Euler's critical load, empirical design formulae, Rankine's, secant and parabolic formulae, I.S. formulae (Rankin's - Merchant formulae)

8. Combined Direct and Bending Stresses: (3 hrs)

8.1 Concentric and eccentric loads, eccentricity

8.2 Effect of eccentric load on the section, stresses due to eccentric loads, examples in the case of short columns.

9. Analysis of Trusses: (4 hrs)

9.1 Concept of a frame, perfect, redundant and deficient frame, end supports, ideal and practical trusses.

9.2 Analysis of trusses by:

(a) Method of joints

(b) Method of sections and

(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 yo ung'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) Vazirani, VN and Ratwani, MM., "Analysis of Structures Vol. I", Delhi, Khanna Publishers.

ii) Ramamrutham, S., "Strength of Materials", New Delhi Dhanpat Rai and Sons.

iii) Punmia, BC., "Strength of Materials", Delhi, Standard Publishers Distributors.

iv) Natrajan, V., "Elements of Strength of Materials", New Delhi, Oxford and IBH Publishing Co.

v) Ram Chandra, "Applied Mechanics and Strength of Materials", Delhi: Standard Publishers.

vi) VS prasad “Structural mechanics; Galgotia publications Pvt ltd.

vii) Chakarborty, ‘Strength of Materials; SK Kataria and Sons

viii) RK Dhawan, ‘A Text Book on Strength of Materials”, Jalandhar IPH

ix) SS Bhavikatti, “Structural Analysis” Vol. I & II, Vikas Publishing House Pvt. Ltd., New Delhi

x) Sadhu Singh “Strengths of Materials” Standard Publishers, New Delhi

0904 DIPLOMA IN CIVIL & ENVIRONMENTAL ENGINEERING
SEMESTER -I
090446 PUBLIC HEALTH ENGINEERING DRAWING

RATIONALE

Diploma holders in Civil Engineering are expected to supervise construction of water supply and waste water 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

1. Drains and Sewers

    1.1 Cross section of standard types of open drains (circular, v-shaped and **m**-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

    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

    Detailed plan and cross sections of a domestic septic tank and soak pit for 5-10 users with details of open jointed pipes as per BIS Code.

4. Bath room and W.C connections:

   4.1 Cross-section through the external wall of lavatories at ground and first floor showing the single and double 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 the plan and section of a two bed roomed single and double strayed residential building showing details of water supply and waste water installation and drainage systems. Show the drainage and water supply up to the municipal systems on the site plan also.

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

INSTRUCTIONAL STRATEGY

Teachers are expected to develop skills in preparation 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 y 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