

3.1 FLUID MECHANICS

L T P
Periods/Week 4 - 2

RATIONALE

Subject of Fluid Mechanics is a basic engineering subject and helps in solving fluid flow problems in the field of Civil Engineering. The subject deals with basic concepts and principles in hydrostatics, hydro kinematics and hydrodynamics and their application in solving fluid - mechanics problems.

DETAILED CONTENTS

1. Introduction: (2 periods)
 - 1.1 Fluids: Real and ideal fluids
 - 1.2 Fluid Mechanics, Hydrostatics, Hydrodynamics, Hydraulics
2. Properties of Fluids (definition only) (5 periods)
 - 2.1 Mass density, specific weight, specific gravity, viscosity, surface tension - cohesion, adhesion and, capillarity, vapour pressure and compressibility.
 - 2.2 Units of measurement and their conversion
3. Hydrostatic Pressure: (10 periods)
 - 3.1 Pressure, intensity of pressure, pressure head, Pascal's law and its applications.
 - 3.2 Total pressure, resultant pressure, and centre of pressure.
 - 3.3 Total pressure and centre of pressure on horizontal, vertical and inclined plane surfaces of rectangular, triangular, trapezoidal shapes and circular.
(No derivation)
4. Measurement of Pressure: (7 periods)
 - 4.1 Atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure.
 - 4.2 Piezometer, simple manometer and differential manometer, Bourdon gauge and dead weight pressure gauge.
5. Fundamentals of Fluid Flow: (8 periods)
 - 5.1 Types of Flow: Steady and unsteady flow, laminar and turbulent flow, uniform and non-uniform flow

- 5.2 Discharge and continuity equation (flow equation) {No derivation}
- 5.3 Types of hydraulic energy: Potential energy, kinetic energy, pressure energy. Hydraulic gradient line and total energy line.
- 5.4 Bernoulli's theorem; statement and description (without proof of theorem) and simple numerical problems.
- 6. Flow Measurements (brief description with simple numerical problems) (8 periods)
 - 6.1 Venturimeter and mouthpiece
 - 6.2 Pitot tube
 - 6.3 Orifice and Orificemeter
 - 6.4 Current meters
 - 6.5 Notches and weirs (simple numerical problems)
- 7. Flow through Pipes: (10 periods)
 - 7.1 Definition of pipe flow; Reynolds number, laminar and turbulent flow - explained through Reynold's experiment
 - 7.2 Critical velocity and velocity distributions in a pipe for laminar flow
 - 7.3 Head loss in pipe lines due to friction, sudden expansion and sudden contraction, entrance, exit, obstruction and change of direction (No derivation of formula)
 - 7.4 Flow from one reservoir to another through a long pipe of uniform cross section (simple problems)
 - 7.5 Pipes in series and parallel
 - 7.6 Water hammer phenomenon and its effects (only definition and description)
- 8. Flow through open channels: (11 periods)
 - 8.1 Definition of an open channel, uniform flow and non-uniform flow
 - 8.2 Discharge through channels using
 - i) Chezy's formula (no derivation)
 - ii) Manning's formula (no derivation)
 - iii) Simple Numerical Problems
 - 8.3 Most economical channel sections (no derivation)
 - i) Rectangular

- ii) Trapezoidal
- iii) Simple Numerical Problems

8.4 Head loss in open channel due to friction

9. Hydraulic Pumps: (3 periods)
 Hydraulic pump, reciprocating pump, centrifugal pumps (No numericals and derivations)
 (may be demonstrated with the help of working models)

Note: Visit to Hydraulic research station is must to explain the various concepts.

PRACTICAL EXERCISES

- i) To verify Bernoulli's Theorem
- ii) To find out venturimeter coefficient
- iii) To determine coefficient of velocity (C_v), Coefficient of discharge (C_d) Coefficient of contraction (C_c) of an orifice and verify the relation between them
- iv) To perform Reynold's experiment
- v) To verify loss of head in pipe flow due to
 - a) Sudden enlargement
 - b) Sudden contraction
 - c) Sudden bend
- vi) Demonstration of use of current meter and pitot tube
- vii) To determine coefficient of discharge of a rectangular notch/triangular notch.

INSTRUCTIONAL STRATEGY

Hydraulics being a fundamental subject, teachers are expected to lay considerable stress on understanding the basic concepts, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room and provide tutorial exercises so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject be supplemented by demonstrations and practical work in the laboratory. Visit to hydraulic research stations must be carried out.

RECOMMENDED BOOKS

1. Jagdish Lal, "Fluid Mechanics and Hydraulics" Delhi Metropolitan Book Co. Pvt Ltd.
2. Modi, PN, and Seth, SM; "Hydraulics and Fluid Mechanics", Standard Publishers Distributors, Delhi

3. Khurmi RS, "Hydraulics and Hydraulics Machines", S Chand and Co., Delhi
4. Likhi SK., Laboratory Manual in Hydraulics, Delhi Wiley Eastern.
5. Birinder Singh , "Fluid Mechanics", Kaptian Publishing, New Delhi.
6. Sarao A.S., "Fluid Mechanics", Tech. India Publication, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	2	2
2	5	7
3	10	17
4	7	11
5	8	12
6	8	12
7	10	17
8	11	18
9	3	4
Total	64	100

3.2 APPLIED MECHANICS

	L	T	P
Periods/week	4	-	2

RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

DETAILED CONTENTS

1. Introduction (08 period)
 - 1.1 Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Definition of Applied Mechanics.
 - 1.2 Definition, basic quantities and derived quantities of basic units and derived units
 - 1.3 Different systems of units (FPS, CGS, MKS and SI) and their conversion from one to another density, force, pressure, work, power, velocity, acceleration
 - 1.4 Concept of rigid body, scalar and vector quantities

2. Laws of forces (12 period)
 - 2.1 Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force
 - 2.2 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of super-position
 - 2.3 Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components
 - 2.4 Free body diagram
 - 2.5 Equilibrant force and its determination
 - 2.6 Lami's theorem (concept only)
[Simple problems on above topics]

3. Moment (10 period)
- 3.1 Concept of moment
 - 3.2 Moment of a force and units of moment
 - 3.3 Varignon's theorem (definition only)
 - 3.4 Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve, reaction at support)
 - 3.5 Parallel forces (like and unlike parallel force), calculating their resultant
 - 3.6 Concept of couple, its properties and effects
 - 3.7 General conditions of equilibrium of bodies under coplanar forces and beams, fixed support, roller, support, over hanging, Uniformly distributed load, point load, varying load
 - 3.8 Position of resultant force by moment
[Simple problems on the above topics]
4. Friction (10 period)
- 4.1 Definition and concept of friction, types of friction, force of friction
 - 4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction
 - 4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane, friction in simple screw jack
 - 4.4 Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:
 - a) Acting along the inclined plane Horizontally
 - b) At some angle with the inclined plane*[Simple problems on the above topics]*
5. Centre of Gravity (08 period)
- 5.1 Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies
 - 5.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion
 - 5.3 Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed
[Simple problems on the above topics]

6. Moment of Inertia (06 period)

Concept of moment of inertia and second moment of area and radius of gyration, theorems of parallel and perpendicular axis, second moment of area of common geometrical sections: rectangle, triangle, circle (*without derivations*). Second moment of area for L, T and I sections, section modulus.

7. Simple Machines (10 period)

- 7.1 Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines
- 7.2 Simple and compound machine (Examples)
- 7.3 Definition of ideal machine, reversible and self locking machine
- 7.4 Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency
- 7.5 System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency
- 7.6 Working principle and application of wheel and axle, different pulley blocks, simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application
[Simple problems on the above topics]

LIST OF PRACTICALS

- 1. Verification of the following laws:
 - a) Parallelogram law of forces
 - b) Triangle law of forces
 - c) Polygon law of forces
- 2. To verify the forces in different members of jib crane.
- 3. To verify the reaction at the supports of a simply supported beam.
- 4. To find the Mechanical Advantage, Velocity Ratio and efficiency in case of an inclined plane.
- 5. To find the Mechanical Advantage, Velocity Ratio and efficiency of a screw jack.
- 6. To find the Mechanical Advantage, Velocity Ratio and efficiency of worm and worm wheel.
- 7. To find Mechanical Advantage, Velocity Ratio and efficiency of single purchase crab.
- 8. To find out center of gravity of regular lamina.

9. To find out center of gravity of irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

RECOMMENDED BOOKS

1. A Text Book of Applied Mechanics by S Ramamurtham, Dhanpat Rai Publishing Co. Ltd.
2. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.
3. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi.
4. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	14
2	12	16
3	10	18
4	10	18
5	08	10
6	06	08
7	10	16
Total	64	100

3.3 SURVEYING - I

L T P
Periods/week 3 - 6

RATIONALE

The important functions of a diploma 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 the skill in each type of survey like chain surveying, compass surveying leveling, that the Civil Engineering diploma holder will normally be called upon to perform and plane table surveying,

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. Introduction: (05 periods)
 - 1.1 Basic principles of surveying
 - 1.2 Concept and purpose of surveying, measurements-linear and angular, units of measurements
 - 1.3 Instruments used for taking these measurements, classification based on surveying instruments

2. Chain surveying: (06 periods)
 - 2.1 Purpose of chain surveying, principles of chain surveying and its advantages and disadvantages
 - 2.2 Obstacles in chain surveying
 - 2.3 Direct and indirect ranging offsets and recording of field notes
 - 2.4 Errors in chain surveying and their corrections

3. Compass surveying: (10 periods)
 - 3.1 Purpose of compass surveying. Use of prismatic compass: Setting and taking observations

 - 3.2 Concept of following with simple numerical problems:
 - a) Meridian - Magnetic and true
 - b) Bearing - Magnetic, True and Arbitrary
 - c) Whole circle bearing and reduced bearing
 - d) Fore and back bearing
 - e) Magnetic dip and declination
 - 3.3 Local attraction - causes, detection, errors and corrections, problems on local attraction, magnetic declination and calculation of included angles in a compass traverse

4. Levelling: (14 periods)
- 4.1 Purpose of levelling, concept of a level surface, horizontal surface, vertical surface, datum, reduced level and bench marks
 - 4.2 Identification of various parts of Dumpy level and use of Dumpy level, Engineer' level, Auto level: advantages and disadvantages, use of auto level.
 - 4.3 Concepts of line of collimation, axis of the bubble tube, axis of the telescope and vertical axis
 - 4.4 Levelling staff: single piece, folding, invar precision staff, telescopic
 - 4.5 Temporary adjustment and permanent adjustment of dumpy level by two peg method.
 - 4.6 Concept of back sight, foresight, intermediate sight, change point, to determine reduce levels
 - 4.7 Level book and reduction of levels by
 - 4.7.1 Height of collimation method and
 - 4.7.2 Rise and fall method
 - 4.8 Arithmetic checks, problem on reduction of levels, fly levelling, check leveling and profile levelling (L-section and X-section), errors in levelling, permissible limits, reciprocal leveling. Numerical problems.
 - 4.9 Computations of Areas of regular figures and irregular figures. Simpson's rule: prismatic formula and graphical method use of planimeter for computation of areas, numerical problems
5. Plane Table Surveying (13 periods)
- 5.1 Purpose of plane table surveying, equipment used in plane table survey:
 - 5.2 Setting of a plane table:
 - (a) Centering
 - (b) Levelling
 - (c) Orientation
 - 5.3 Methods of plane table surveying
 - (a) Radiation,
 - (b) Intersection
 - (c) Traversing
 - (d) Resection
 - 5.4 Concept of Two point and Three point problems (Concept only)

5.5 Errors in plane table survey and precautions to control them. Testing and adjustment of plane table and alidad

PRACTICAL EXERCISES

I. Chain surveying:

- i)
 - a) Ranging a line
 - b) Chaining a line and recording in the field book
 - c) Taking offsets - perpendicular and oblique (with a tape only)
 - d) Setting out right angle with a tape
- ii) Chaining of a line involving reciprocal ranging
- iii) Chaining a line involving obstacles to ranging
- iv) Chain Survey of a small area.

II. Compass Surveying:

- i)
 - a) Study of prismatic compass
 - b) Setting the compass and taking observations
 - c) Measuring angles between the lines meeting at a point

III. Levelling:

- i)
 - a) Study of dumpy level and levelling staff
 - b) Temporary adjustments of various levels
 - c) Taking staff readings on different stations from the single setting and finding differences of level between them
- ii) To find out difference of level between two distant points by shifting the instrument
- iii) Longitudinal and cross sectioning of a road/railway/canal
- iv) Setting a gradient by dumpy and auto-level

IV. Plane Table Surveying:

- i)
 - a) Study of the plane table survey equipment
 - b) Setting the plane table
 - c) Marking the North direction
 - d) Plotting a few points by radiation method

- ii)
 - a) Orientation by
 - Trough compass
 - Back sighting
 - b) Plotting few points by intersection, radiation and resection method

- iii) Traversing an area with a plane table (at least five lines)

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. Technical visit to Survey of India, Northern Region and Great Trigonometrical Survey(GTS), Dehradun.

RECOMMENDED BOOKS

1. Hussain, SK and Nagraj, MS; "Text Book of Surveying"; New Delhi, S Chand and Co Ltd. New Delhi
2. Deshpande, RS; "A Text Book Surveying and Levelling"; Poona, United Book Corporation, New Delhi
3. Kocher, CL; "A Text Book of Surveying"; Ludhiana, Katson Publishing House, New Delhi
4. Kanetkar,TP and Kulkarni, SV., "Surveying and Leveling", Poona, AVG Parkashan, New Delhi
5. Kanetkar, TP; and Kulkarni, SV; "Surveying and Leveling" Poona, AVG Prakashan, Delhi
6. Mahajan, Sanjay "Surveying -I", Tech. Publication, Delhi
7. Punmia, BC; "Surveying and Leveling", Delhi Standard Publishers Distributors, Delhi
8. Shahai, PB; "A Text Book of Surveying", Oxford and IBH Publishing Co. New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted Periods)	Marks Allotted (%)
1	05	07
2	06	09
3	10	24
4	14	30
5	13	30
Total	48	100

3.4 CONSTRUCTION MATERIALS

L T P

Periods/week 4 - 2

RATIONALE

Civil Engineering diploma holders have to supervise construction of various types of civil works involving use of various materials like stones, bricks and tiles, cement and cement based products, lime, timber and wood based products, paints and varnishes, metals and other miscellaneous materials. The students should have requisite knowledge regarding characteristics, uses and availability of various building materials and skills in conducting tests to determine suitability of materials for various construction purposes. In addition, specifications of various materials should also be known (PWD/BIS) for effective quality control.

DETAILED CONTENTS THEORY

1. Building Stones: (06 periods)
 - 1.1 Classification of Rocks: (General Review)
 - 1.1.1 Geological classification: Igneous, sedimentary and metamorphic rocks
 - 1.1.2 Chemical classification; Calcareous, argillaceous and siliceous rocks
 - 1.1.3 Physical classification: Unstratified, stratified and foliated rocks
 - 1.2 General characteristics of stones – Marble, Kota stone, Granite, Sand, Trap, Basalt stone, Lime stone and Slate
 - 1.3 Requirements of good building stones
 - **1.4 Identification of common building stones
 - 1.5 Various uses of stones in construction
 - 1.6 Quarrying of stones by blasting and its effect on environment
2. Bricks and Tiles: (13 periods)
 - 2.1 Introduction to bricks
 - 2.2 Raw materials for brick manufacturing and properties of good brick making earth
 - 2.3 Manufacturing of bricks
 - 2.3.1 Preparation of clay (manual/mechanically)

**2.3.2 Moulding: hand moulding and machine moulding brick table; drying of bricks, burning of bricks, types of kilns (Bull's Trench Kiln and Hoffman's Kiln), process of burning, size and weight of standard brick; traditional brick, refractory brick, clay-flyash bricks, sun dried bricks, only line diagram of kilns

2.4 Classification and specifications of bricks as per BIS: 1077

2.5 Testing of common building bricks as per BIS: 3495

Compressive strength, water absorption – hot and cold water test, efflorescence, Dimensional tolerance, soundness

2.6 Tiles

2.6.1 Building tiles; Types of tiles-wall, ceiling, roofing and flooring tiles

2.6.2 Ceramic, terrazo and PVC tiles, : their properties and uses,

2.6.3 Vitrified tiles, Paver blocks.

2.7 Stacking of bricks and tiles at site

3. Cement: (10 periods)

**3.1 Introduction, raw materials, flow diagram of manufacturing of cement

3.2 Various types of Cements, their uses and testing: Ordinary portland cement, rapid hardening cement, low heat cement, high alumina cement, blast furnace slag cement, white and coloured cement, portland pozzolana cement, super sulphate cement, Tests of cement – fineness, soundness, initial and final setting time etc.as per B.I.S. Code.

3.3 Properties of cement

4. Lime: (04 periods)

4.1 Introduction: Lime as one of the cementing materials

4.2 Classification and types of lime as per BIS Code

4.3 Calcination and slaking of lime

5. Timber and Wood Based Products: (10 periods)

5.1 Identification and uses of different types of timber: Teak, Deodar, Shisham, Sal, Mango, Kail, Chir, Fir, Hollock, Champ

- ** 5.2 Market forms of converted timber as per BIS Code
- 5.3 Seasoning of timber: Purpose, methods of seasoning as per BIS Code
- 5.4 Properties of timber and specifications of structural timber
- 5.5 Defects in timber, decay in timber
- 5.6 Preservation of timber and methods of treatment as per BIS
- 5.7 Other wood based products, their brief description of manufacture and uses: laminated board, block board, fibre board, hard board, sunmica, plywood, veneers, nu-wood and study of the brand name and cost of the wood based products available in the market, Cement Panel Board, Moulded Door.

6. Paints and Varnishes: (07 periods)

- 6.1 Introduction, purpose and use of paints
- 6.2 Types, ingredients, properties and uses of oil paints, water paints and cement paints
- 6.3 Covering capacity of various paints
- 6.4 Types, properties and uses of varnishes
- 6.5 Trade name of different products.

7. Metals: (04 periods)

- 7.1 Ferrous metals: Composition, properties and uses of cast iron, mild steel, HYSD steel, high tension steel as per BIS.
- 7.2 Commercial forms of ferrous, metals.
- 7.3 Aluminium & Stainless Steel.

8. Miscellaneous Materials: (10 periods)

- 8.1 Plastics – Introduction and uses of various plastic products in buildings such as doors, water tanks and PVC pipes
- 8.2 Fibre Sheets and their manufacture process.
- 8.3 Types and uses of insulating materials for sound and thermal insulation
- 8.4 Construction chemicals like water proofing compound, epoxies, polymers
- 8.5 Water proofing, termite proofing and fire resistance materials – types and uses

8.6 Materials used in interior decoration works like POP, methods of doing POP

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

PRACTICAL EXERCISES:

- i) To identify the stones used in building works by visual examination
- ii) To determine the crushing strength of bricks
- iii) To determine the water absorption of bricks and efflorescence of bricks
- iv) To identify various types of timbers such as: Teak, Sal, Chir, Sissoo, Deodar, Kail & Hollock by visual examination only
- v) To determine fineness (by sieve analysis) of cement
- vi) To conduct field test of cement.
- vii) To determine normal consistency of cement
- viii) To determine initial and final setting times of cement
- ix) To determine soundness of cement
- x) To determine compressive strength of cement
- xi) The students should submit a report work on the construction materials, covering water proofing material, cements, steel, paints and timber products available in the local market. They will also show the competitive study based upon the cost, brand name, sizes available in the local market.

INSTRUCTIONAL STRATEGY

Teachers are expected to physically show various materials while imparting instructions. Field-visits should also be organized to show manufacturing processes and use of various materials in Civil engineering works. Students should be encouraged to collect sample of various building materials so as to create a museum of materials in the polytechnic.

RECOMMENDED BOOKS

- 1) Sharma, SK; and Mathur, GC; "Engineering Materials;" Delhi-Jalandhar, S. Chand and Co.
- 2) Surendra Singh; "Engineering Materials;" New Delhi, Vikas Publishing House Pvt. Ltd.
- 3) Chowdhuri, N; "Engineering Materials;" Calcutta, Technical Publishers of India.
- 4) Bahl, SK; "Engineering Materials;" Delhi, Rainbow Book Co.
- 5) TTTI, Chandigarh "Civil Engineering Materials;" New Delhi Tata McGraw Hill Publication
- 6) Kulkarni, GJ; "Engineering Materials;" Ahmedabad, Ahmedabad Book Depot.
- 7) Shahane; "Engineering Materials"; Poona, Allied Book Stall.
- 8) Gurcharan Singh; "Engineering materials", Delhi Standard Publishers Distributors
- 9) SC Rangawala, "Construction Materials", Charotar Publishers
- 10) Alam Singh, "Construction Materials"
- 11) Dr. Hemant Sood "Lab Manual in Testing of Engineering Materials", New Age International (P) Ltd., New Delhi
- 12) Handbook of Civil Engineering by PN Khanna.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	08
2	13	20
3	10	16
4	04	08
5	10	14
6	07	12
7	04	08
8	10	14
Total	64	100

3.5 BUILDING CONSTRUCTION

L T P
Periods/Week 5 - 2

RATIONALE

Diploma holders in Civil Engineering are supposed to effectively supervise construction of buildings. Effective supervision is essential to obtain/provide a fault free service from contractors to users. To perform above task, it is essential that students should have knowledge of various sub components of buildings like foundations, walls, roofs, staircases, floors etc., and their constructional details as well as preventive, remedial and corrective methods of common construction faults. Therefore, the subject of Building Construction is very important for Civil Engineering diploma holders.

DETAILED CONTENTS

THEORY:

1. Introduction: (01 periods)
 - 1.1 Definition of a building, classification of buildings based on occupancy
 - 1.2 Different parts of a building

2. Foundations: (06 periods)
 - 2.1 Concept of foundation and its purpose
 - 2.2 Types of foundation-shallow and deep
 - **2.2.1 Shallow foundation - constructional details of: Spread foundations for walls, thumb rules for depth and width of foundation and thickness of concrete block, stepped foundation, masonry pillars and concrete columns
 - 2.3 Earthwork
 - 2.3.1 Layout/setting out for surface excavation, cutting and filling
 - 2.3.2 Excavation of foundation, trenches, shoring, timbering and de- watering

3. Walls: (07 periods)
 - 3.1 Purpose of walls
 - 3.2 Classification of walls - load bearing, non-load bearing, dwarf wall, retaining, breast walls and partition walls
 - 3.3 Classification of walls as per materials of construction: brick, stone, reinforced brick, reinforced concrete, precast, hollow and solid concrete block and composite masonry walls
 - 3.4 Partition walls: Constructional details, suitability and uses of brick and wooden partition walls
 - 3.5 Mortars: types, selection of mortar and its preparation
 - 3.6 Scaffolding, construction details and suitability of mason's brick layers and tubular scaffolding, shoring, underpinning

4. Masonry

(08 periods)

- 4.1 Brick Masonry: Definition of terms like header, stretcher, queen closer, king closer, frog and quoin, course, bond, facing, backing, hearting, jambs, reveals, soffit, plinth, pillars and pilasters
 - 4.1.1 Bond – meaning and necessity; English, flemish bond and other types of bonds
 - 4.1.2 Construction of brick walls –methods of laying bricks in walls, precautions observed in the construction of walls, methods of bonding new brick work with old (toothing, raking, back and block bonding), Expansion and contraction joints
 - 4.1.3 Importance towards special care during execution on: soaking of bricks, maintenance of bonds and plumb, filling of horizontal and vertical joints, masonry work, restriction height of construction on a given day, every fourth course, earthquake resistance measure, making of joints to receive finishes

4.2 Stone Masonry

- 4.2.1 Glossary of terms – natural bed, bedding planes, string course, corbel, cornice, block in course grouting, moulding, templates, corner stone, bond stone, throating, through stone, parapet, coping, pilasters and buttress
- 4.2.2 Types of stone masonry: rubble masonry - random and coursed; Ashlar masonry, principles to be observed in construction of stone masonry walls
- 4.2.3 Importance towards special care during execution of stone masonry work on dressing of stone, size and placing of bond and corner stones, filling joints, proper packing of internal cavities of rubble masonry wall, raking of joints to receive finishes

5. Arches and Lintels:

(06 periods)

- 5.1 Meaning and use of arches and lintels:
- 5.2 Glossary of terms used in arches and lintels - abutment, pier, arch ring, intrados, soffit, extrados, voussoiers, springer, springing line, crown, key stone, skew back, span, rise, depth of an arch, haunch, spandril, jambs, bearing, thickness of lintel, effective span
- 5.3 Arches:
 - 5.3.1 Types of Arches - Semi circular, segmental, elliptical and parabolic, flat, inverted and relieving
 - 5.3.2 Stone arches and their construction
 - 5.3.3 Brick arches and their construction
- 5.4 Lintels
 - 5.4.1 Purpose of lintel
 - 5.4.2 Materials used for lintels
 - 5.4.3 Cast-in-situ and pre-cast lintels
 - 5.4.4 Lintel along with sun-shade or chhajja

- **6. Doors, Windows and Ventilators: (05 periods)
- 6.1 Glossary of terms with neat sketches
 - 6.2 Classification based on materials i.e. wood, metal and plastic and their suitability for different situations. Different type of doors- panel door, flush door, flazed door, rolling shutter, steel door, sliding door, plastic and aluminium doors
 - 6.3 Window – Panel window, glazed windows (fixed and openable) ventilators, sky light window, Louvres shutters, plastic and aluminium windows.
 - 6.4 Door and window frames – materials and sections, door closures, hold fasts
- *7. Damp Proofing and Water Proofing (08 periods)
- 7.1 Dampness and its ill effects on bricks, plaster, wooden fixtures, metal fixtures and reinforcement, damage to aesthetic appearance, damage to heat insulating materials, damage to stored articles and health, sources and causes of dampness
 - 7.2 Sources of dampness - moisture penetrating the building from outside e.g. rainwater, surface water, ground moisture. Moisture entrapped during construction i.e. moisture in concrete, masonry construction and plastering work etc. Moisture which originates in the building itself i.e. water in kitchen and bathrooms etc.
 - 7.3 Damp proofing materials and their specifications: rich concrete and mortar, bitumen, bitumen mastic, polymer coating, use of chemicals
 - 7.4 Damp proofing of : basement, ground floors, plinth and walls, special damp proofing arrangements in bathrooms, WC and kitchen, damp proofing for roofs and window sills
- **8. Floors (07 periods)
- 8.1 Glossary of terms-floor finish, topping, under layer, base course, rubble filling and their purpose
 - 8.2 Types of floor finishes - cast-in-situ, concrete flooring (monolithic, bonded) Terrazzo tile flooring, stone (marble and kota) flooring, PVC flooring, Terrazzo flooring, glazed tiles flooring, Timber flooring, description with sketches. The methods of construction of concrete, terrazzo and timber floors and their BIS specifications
 - 8.3 Special emphasis on level/slope/reverse slope in bathrooms, toilets, kitchen, balcony and staircase
9. Roofs (05 periods)
- 9.1 Types of roofs, concept of flat, pitched and arched roofs
 - 9.2 Glossary of terms for pitched roofs - batten, eaves, fascia board, gable, hip, lap, purlin, rafter, rag bolt, valley, ridge, rain water gutter, anchoring bolts
 - 9.3 False ceilings using gypsum, plaster boards, cellotex, fibre boards
 - 9.4 Special emphasis on maintenance of slopes, overlaps of roofing materials, applicability and problems of wind ties, size of anchoring bolts

10. Stairs (05 periods)
- 10.1 Glossary of terms: Staircase, winders, landing, stringer, newel, baluster, riser, tread, width of staircase, hand-rail, nosing
 - 10.2 Classification of staircase on the basis of material – RCC, timber, steel, Aluminium
 - 10.3 Planning and layout of staircase: Relations between rise and tread, determination of width of stair, landing etc
 - 10.4 Various types of layout - straight flight, dog legged, open well, quarter turn, half turn (newel and geometrical stairs), bifurcated stair, spiral stair
11. Surface Finishes (05 periods)
- 11.1 Plastering - classification according to use and finishes like plain plaster, grit finish, rough cast, pebble dashed, concrete and stone cladding etc., dubbing, proportion of mortars used for different plasters, techniques of plastering and curing
 - 11.2 Pointing - different types of pointing and their methods
 - 11.3 Painting - preparation of surface, primer coat and application of paints on wooden, steel and plastered wall surfaces
 - 11.4 Application of white washing, colour washing and distempering, polishing, application of cement and plastic paints
 - 11.5 Selection of appropriate paints/finishes for interior and exterior surfaces
 - 11.6 Importance of preparation of surfaces such as hacking, grooving etc before application of surface finishes
12. Anti Termite Measures (As per IS 6313 –I – III) (04 periods)
- 12.1 Introduction, site preparation and chemicals used in anti-termite treatment
 - 12.2 Treatment of masonry foundation
 - 12.3 Treatment of RCC foundation
 - 12.4 Treatment of top surface of earth filling
 - 12.5 Treatment of junction of walls and floors
 - 12.6 Treatment along external perimeter of building
 - 12.7 Treatment and selection of timber
 - 12.8 Treatment in existing buildings
13. Building Planning (06 periods)
- 13.1 Site selection: Factors to be considered for selection of site for residential, commercial, industrial and public building
 - 13.2 Basic principles of building planning, arrangement of doors, windows, cupboards etc for residential building
 - 13.3 Orientation of building as per IS: 7662 in relation to sun and wind direction, rains, internal circulation and placement of rooms within the available area, concept of Vastu-Shastra
 - 13.4 Planning of building services
 - 13.5 Introduction to National Building code.

14 Building Services (05 periods)
Introduction to fire fighting systems, Ducting for Air-conditioning, service lines for cable telephone, and electrical wiring, garbage disposal systems.

15. Elementary idea of interior decoration, wall paneling, false ceiling, flooring etc. (02 periods)

Note * An expert may be invited from field/industry for extension lecture
** A field visit may be planned to explain and show the relevant things

PRACTICAL EXERCISES

- i) Demonstration of tools and plants used in building construction
- ii) To prepare Layout of a building: two rooms building with front verandah
- iii) To construct brick bonds (English bond only) in one, one and half and two brick thick: (a) Walls for L, T and cross junction (b) Columns
- iv) Demonstration of following items of work at construction site by:
 - a) Timbering of excavated trenching
 - b) Damp proof courses laying
 - c) Construction of masonry walls
 - d) Laying of flooring on an already prepared lime concrete base
 - e) Plastering and pointing exercise
 - f) Constructing RCC work
 - g) Pre-construction and post construction termite treatment of building and woodwork

INSTRUCTIONAL STRATEGY

While imparting instructions in this subject, teachers are expected to take students to work site and explain constructional process and special details for various sub-components of a buildings. It is also important to make use of audio visual aids/video films (if available) to show specialised operations. The practical work should be given due importance and efforts should be made that each student should perform practical work independently. For carrying out practical works, polytechnics should have construction yard where enough raw materials is made available for students to perform practical work

RECOMMENDED BOOKS

1. Gupta, Sushil Kumar, Singla, DR, and Juneja BM; "A Text Book of Building Construction"; Ludhiana, Katson Publishing House.
2. Deshpande, RS and Vartak, GV; "A Text Book of Building Construction"; Poona, United Book Corporation.
3. Rangwala, SC: "Building Construction"; Anand, Charotar Book Stall
4. Kulkarni, GJ; "A Text Book of Building Construction"; Ahmedabad Book Depot
5. Arora, SP and Bindra, SP; "A Text Book of Building Construction"; New Delhi Dhanpt Rai and Sons.
6. Sharma,SK and Kaul, BK; "A Text Book of Building Construction"; Delhi, S Chand and Co.

7. Sushil Kumar; "Building Construction"; Standard Publishers Distributors, Delhi
8. Moorthy, NKR; "A Text Book of Building Construction"; Poona, Engineering Book Publishing Co.
9. SP – 62 Hand Book of BIS
10. B.I.S. – 6313 Part 1, 2, 3
11. National Building Code
12. Handbook of Civil Engineering by PN Khanna
13. Video films on Damp proofing, water proofing, surface finishes

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	01	01
2	06	08
3	07	08
4	08	10
5	06	08
6	05	06
7	08	11
8	07	08
9	05	06
10	05	06
11	05	06
12	04	06
13	06	08
14	05	06
15	02	02
Total	80	100

3.6 BUILDING DRAWING

L T P
- - 4

RATIONALE

Drawing is the language of engineers. Engineering is incomplete without a thorough knowledge of drawing. A Civil Engineering diploma holder must be capable of sketching detailed constructional drawing of various components of building for the purpose of communication with the craftsman. Planning of small buildings, developing a line plan, dimensioning, key plan, drainage plan should be a part of curriculum. The diploma engineer must be conversant with reading and interpretation of drawing for execution of work.

DETAILED CONTENTS

Drawing No. 1: (2 sheets)

Details of spread footing foundations, load bearing and non-load bearing wall for given thickness of walls with the help of given data or rule of the thumb, showing offsets, position of DPC. The details of the concrete and brick plinth protection have to be shown in the drawing.

Drawing No. 2: (one sheet)

Plans of 'T' and Corner junction of walls of 1 Brick, 1-1/2 Brick and 2 brick thick in English bond

Drawing No. 3: (2 sheets)

Detailed drawing of basement, single wooden floor, double wooden floor.

Drawing No.4 (3 sheets)

Elevation, sectional plan and sectional side elevation of flush door, glazed door, panelled door and window, Aluminium door and window with wire gauge shutter. Sketches of various joints of different members.

Drawing No.5 (one sheet)

Draw at least one sheet using CAD software

Drawing No. 6: (2 sheet)

Drawing plan, elevation of a small building by measurement and foundation detail and sectional elevation.

Drawing No.7 (4 sheets)

Drawing detailed plan, elevation and section of a two room residential building from a given line plan, showing details of foundations, roof and parapet

Drawing No. 8

(one sheet)

Drawings of following floors

Cement concrete floors on ground and at first floor

- i) Conglomerate (Concrete Flooring)
- ii) Bonded cement concrete flooring
- iii) Terrazo flooring
- iv) Ceramic/vitrified tile flooring

Drawing No. 9:

(one sheet)

Drawing of flat roof, showing the heat/thermal insulation provisions.

Drawing No.10

Draw at least one sheet using CAD software

NOTE:

- a) All drawings should be as per BIS code and specifications in SI Units
- b) Intensive practice of reading and interpreting building drawings should be given
- c) Some practice should be done to prepare drawings on AutoCAD

RECOMMENDED BOOKS

1. Civil Engineering Drawing by RS Malik, Asia Publishing House
2. Civil Engineering Drawing by V.B.Sikka. Katson Publishing, Ludhiana
3. Civil Engineering Drawing by NS Kumar; IPH, New Delhi
4. Principles of Building Drawing by MG Shah and CM Kale, MacMillan, Delhi
5. Building Construction by Moorthy NRK
6. Civil Engg Drawing by Layal
7. Zaidi, SKA and Siddiqui, Suhail; Drawing and Design of Residential and Commercial Buildings, Standard Publishers and Distributors, Delhi.
8. SP : 20
9. National Building Code

3.7. ELECTRICAL & MECHANICAL ENGINEERING SYSTEMS

L T P
Periods/week 4 - 2

RATIONALE

A diploma holder has to assist in activities of installation, operation and maintenance etc of different machines and equipment. These activities are not branch specific and instead require him to know basics of civil, electrical and mechanical engineering. The subject of General Engineering has been included to impart basic knowledge of civil, electrical and mechanical engineering to the students.

DETAILED CONTENTS

PART-A

MECHANICAL ENGINEERING

Theory

1. **Transmission of Power** (8 periods)
 - 1.1 Belt Drives:
Types of belts, belt materials, cross and flat belt drives, advantages of V-belt drive over flat belt drive.
 - 1.2 Gears Drives:
Types of gears (briefly), types of gear trains

2. **Internal Combustion Engines** (09 periods)
 - 2.1 Classification of IC engines
 - 2.2 Working principles of two stroke and four stroke engines
 - 2.3 Working principles of petrol engine and diesel engines
 - 2.4 Gas turbines (working principle only)
 - 2.5 Using principle of prime motor used in high power single phase and three phase generators used in building

3. **Refrigeration and Air Conditioning System** (8 periods)
 - 3.1 Different types of refrigeration principles and refrigerants
 - 3.2 Working of domestic refrigerator
 - 3.3 Working of Window type AC system
 - 3.4 Working of Split AC System
 - 3.5 Working of Centralized Air Conditioning System

- 4. Hydraulics** (6 periods)
- 4.1 Classification of pumps (reciprocating and centrifugal)
 - 4.2 Working principles of both reciprocating and centrifugal pumps
 - 4.3 Turbine: Working principles of impulse turbine and reaction turbine
- 5. Working principle of lift used in modern building** (1 period)

PRACTICAL EXERCISES IN MECHANICAL ENGINEERING

1. Demonstration and study of main parts of 4 stroke petrol and diesel engines by actually dismantling them (The idea is to acquaint the students with the most common troubles occurring in the engines)
2. Demonstration and study of main parts of 2 stroke petrol engine by actually dismantling it. (The idea is to acquaint the students with the most common trouble occurring in the engines)
3. Demonstration and study of gas turbines through models
4. Demonstration and study of different hydraulic pumps
5. Demonstration and study of various drives for transmission of powers i.e. models of belts and gears.
6. Demonstration and study of air conditioning system in a building
7. Demonstration and study of domestic refrigerating system
8. Demonstration and study of Prime motor used in three phase generating set

PART B

ELECTRICAL ENGINEERING

Theory

Electrical:

1. Basic Quantities of Electricity: (4 periods)
 - 1.1 Definition of voltage, current, power and energy with their units
 - 1.2 Name of the instruments used for measurement of different electrical quantities such as voltmeter, ammeter, wattmeter, energy meter.
 - 1.3 Connection of the instruments in electric circuit
2. Application and Advantages of Electricity: (3 periods)
 - 2.1 Difference between AC and DC
 - 2.2 Various applications of electricity
 - 2.6 Advantages of electrical energy over other types of energy
3. Various Types of Power Plants: (3 periods)
 - 3.1 Elementary block diagram of thermal, hydro and nuclear power stations
 - 3.2 Brief explanation of the principle of power generation in above power stations

4. Transmission and Distribution System (6 periods)
 - 4.1 Key diagram of 3 phase transmission and distribution system
 - 4.2 Brief functions of accessories of transmission line
 - 4.3 Distinction between high and low voltage distribution system
 - 4.4 Identification of three phase wires, neutral wires and the earth wire on a low voltage distribution system
 - 4.5 Identification of the voltage between phases and between one phase and neutral
 - 4.6 Distinction between three phase and single phase supply
5. Supply from the Poles to the Distribution Board: (4 periods)
 - 5.1 Arrangement of supply system from pole to the distribution board
 - 5.2 Function of service line, energy meter, main switch, distribution board
6. Domestic Installation: (4 periods)
 - 6.1 Distinction between light and fan circuits and single phase power circuit, sub circuits
 - 6.2 Various accessories and parts of installation, identification of wiring systems, such as batton, conduct, caring and coping
 - 6.3 Common safety measures and earthing
 - 6.4 Introduction to BIS code of safety and wiring installation
7. Electric Motors and Pumps: (6 periods)
 - 7.1 Definition and various application of single phase and three phase motors
 - 7.3 Conversion of horse power in watts or kilowatts
 - 7.4 Type of pumps and their applications
 - 7.5 Use of direct online starter and star delta starter
8. Installation of Generators (2 periods)
 - 8.1 Working of single phase and three phase generators.
 - 8.2 Installation of generators with panel diagram etc.
9. Electrical circuits idea used in buildings (2 periods)
 - 9.1 Basic elementary circuit idea of lift, stage lightening, internal wiring for telephone, internet and PBX.

PRACTICAL EXERCISES IN ELECTRICAL ENGINEERING:

1. Use of Megger:

Objective: To make the students familiar with different uses of different electrical instruments.

2. Connection of a three phase motor and starter including fuses and reversing of direction of rotation.

Objective: Students may be made familiar with the equipment needed to control a three-phase motor
The students must experience that by changing any two phases, the direction of rotation is reversed.

3. Connection of a lamp, ceiling fan, socket outlet, geyser, floor grinder, voltage stabilizer etc.

Objective: Students may be made familiar with the different types of equipment and circuits used in the domestic installations

4. Treatment of electric shock

Note: The teacher may give a demonstration how an electric shock must be treated.

Objective: Students must be trained to treat the persons suffering from an electric shock

5. Demonstration and study of Domestic installation components used in single phase and three phase wiring

6. Demonstration and study of distribution line components

1. Demonstration and study of different electrical circuits used in Generator, Lift, Stage lightening etc.

8. Demonstration and study of distribution board

Note: Students may be asked to study the distribution board in the institution and note down all accessories.

Objective: Students must be made familiar with the distribution board

9. Connections and taking reading of an energy meter (1ϕ & 3ϕ)

Objective: Students may be asked to connect an energy meter to a load and calibrate reading

10. Demonstration and study of submersible motor pump set and its working

Objective: To tell use of the set in water supply and irrigation works.

RECOMMENDED BOOKS

Mechanical Engineering

1. General Mechanical Engineering by M. Adithan; TTTI, Chandigarh
2. Basic Civil and Mechanical Engineering by Jayagopal; Vikas Publications, New Delhi
3. IC Engines and Automobile Engineering by Dr.MP Poonia, Standard Publishers, New Delhi
4. Refrigeration and Air Conditioning by RK Rajput; SK Kataria and sons; Ludhiana
5. Theory of Machines by RS Khurmi and JK Gupta; S. Chand and Company Ltd., New Delhi

Electrical Engineering

1. Electrical Technology Part 1: Basic Electrical Engineering by Theraja, BL; S Chand and Company, New Delhi
2. Principles of Electrical Engineering by Gupta BR, S Chand and Company, New Delhi
3. Basic Electrical Engineering by Mehta VK; S Chand and Company, New Delhi
4. Basic Electricity and Measurements by Suryanarayan NV and N Delhi; Tata McGraw Hill, 1987, New Delhi
5. Basic Electrical and Electronics Engineering by SK Sahdev; Dhanpat Rai and sons, New Delhi
6. Basic Electrical Engineering by PS Dhogal, Tata McGraw Hill, New Delhi
7. Basic Electricity by BR Sharma; Satya Parkashan, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Part-A

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	8	25
2	9	29
3	8	25
4	6	19
5	1	2
Total	32	100

Part-B

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	4	12
2	3	9
3	3	9
4	6	18
5	4	16
6	4	14
7	4	14
8	2	4
9	2	4
Total	32	100

4.1 CONCRETE TECHNOLOGY

L T P
Periods/week 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.

DETAILED CONTENTS THEORY

1. Introduction: Definition of concrete, uses of concrete in comparison to other building materials. (03 periods)
2. Ingredients of Concrete: (07 periods)
 - 2.1 Cement: physical properties of cement; different types of cement as per IS Codes
 - 2.2 Aggregates:
 - 2.2.1 Classification of aggregates according to size and shape
 - 2.2.2 Characteristics of aggregates: Particle size and shape, surface texture, specific gravity of aggregate; bulk density, water absorption, surface moisture, bulking of sand, deleterious materials, soundness
 - 2.2.3 Grading of aggregates: coarse aggregate, fine aggregate; All-in- aggregate; fineness modulus; interpretation of grading charts
 - 2.3 Water: Quality requirements as per IS:456-2000
3. Water Cement Ratio: (03 periods)
 - 3.1 Hydration of cement, principle of water-cement ratio, Duff Abram's Water-cement ratio law: Limitations of water-cement ratio law and its effects on strength of concrete
4. Workability: (08 periods)
 - 4.1 Workability factors affecting workability, Measurement of workability: slump test, compacting factor and Vee Bee consistometer; Recommended slumps for placement in various conditions as per IS:456-2000/SP-23

5. Properties of Concrete: (09 periods)
 - 5.1 Properties in plastic state: Workability, Segregation, Bleeding and Harshness
 - 5.2 Properties in hardened state: Strength, Durability, Impermeability, Dimensional changes;
6. Proportioning for Normal Concrete: (05 periods)
 - 6.1 Objectives of mix design, introduction to various grades as per IS:456-2000; proportioning for nominal mix design as prescribed by IS 456-2000
 - 6.2 Adjustment on site for: Bulking of fine aggregate, water absorption of aggregate, workability
 - 6.3 Difference between nominal and controlled concrete
 - 6.4. Introduction to IS-10262-2009-Code for controlled mix design
7. Introduction to Admixtures (chemicals and minerals) for improving performance of concrete (04 periods)
8. Special Concretes (only features) (07 periods)
 - 8.1 Concreting under special conditions, difficulties and precautions before, during and after concreting
 - 8.1.1 Cold weather concreting
 - 8.1.2 Under water concreting
 - 8.1.3 Hot weather concreting
 - 8.2 Ready mix concrete
 - 8.3 Fibre reinforced concrete
 - 8.4 Polymer Concrete
 - 8.5 Fly ash concrete
 - 8.6 Silica fume concrete
9. Concreting Operations: (16 periods)
 - **9.1 Storing of Cement:
 - 9.1.1 Storing of cement in a warehouse
 - 9.1.2 Storing of cement at site
 - 9.1.3 Effect of storage on strength of cement
 - 9.1.4 Determination of warehouse capacity for storage of Cement

- **9.2 Storing of Aggregate: Storing of aggregate at site
- 9.3 Batching (to be shown during site visit)
 - 9.3.1 Batching of Cement
 - 9.3.2 Batching of aggregate by:
 - 9.3.2.1 Volume, using gauge box (farma) selection of proper gauge box
 - 9.3.2.2 Weight spring balances and batching machines
 - 9.3.3 Measurement of water
- ** 9.4 Mixing:
 - 9.4.1 Hand mixing
 - 9.4.2 Machine mixing - types of mixers, capacities of mixers, choosing appropriate size of mixers, operation of mixers
 - 9.4.3 Maintenance and care of machines
- **9.5 Transportation of concrete: Transportation of concrete using: wheel barrows, transit mixers, chutes, belt conveyors, pumps, tower crane and hoists etc.
- 9.6 Placement of concrete:

Checking of form work, shuttering and precautions to be taken during placement
- ** 9.7 Compaction:
 - 9.7.1 Hand compaction
 - 9.7.2 Machine compaction - types of vibrators, internal screed vibrators and form vibrators
 - 9.7.3 Selection of suitable vibrators for different situations
- 9.8 Finishing concrete slabs - screeding, floating and trowelling
- 9.9 Curing:
 - 9.9.1 Objectives of curing, methods of curing like ponding, membrane curing, steam curing, chemical curing
 - 9.9.2 Duration for curing and removal of form work
- 9.10 Jointing: Location of construction joints, treatment of construction joints, expansion joints in buildings - their importance and location
- 9.11 Defects in concrete: Identification of and methods of repair

10. Importance and methods of non-destructive tests (introduction only) (02 periods)

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

PRACTICAL EXERCISES:

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

INSTRUCTIONAL STRATEGY

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

RECOMMENDED BOOKS

- i) Kulkarni, PD; Ghosh, RK and Phull, YR; "Text Book of Concrete Technology"; Oxford and IBH Publishing Co. New Delhi
- ii) Krishnamurthy, KT; Rao, A Kasundra and Khandekar, AA; "Concrete Technology"; Dhanpat Rai and Sons, Delhi,

- iii) Gupta BL and Gupta Amit; "Text Book of Concrete Technology"; Standard Publishers Distributors, Delhi.
- iv) Varshney, RS;"Concrete Technology";, Oxford and IBH Publishing, New Delhi
- v) Neville, AM; "Properties of Concrete", Pitman (ELBS Edition available), London
- vi) Orchard; "Concrete Technology"; Vol I, II, and III
- vii) Handoo, BL; Puri, LD and Mahajan Sanjay "Concrete Technology"; Satya Prakashan, New Delhi,
- viii) Sood, Hemant, Mittal LN and Kulkarni PD; "Laboratory Manual on Concrete Technology", CBS Publishers, New Delhi, 2002
- ix) Vazirani, VN; and Chandola, SP; "Concrete Technology"; Khanna Publishers, Delhi,
- x) Gambhir, ML; "Concrete Technology";, MacMillan India Ltd., New Delhi
- xi) Siddique, R., "Special Structural Concretes", , Galgotia Publishers Pvt. Ltd. Delhi
- xii) Birinder Singh, "Concrete Technology", Kaption Publications, Ludhiana,
- (xiii) Module on 'Special Concretes by Dr Hemant Sood , NITTTR Chandigarh
- (xiv) Concrete Technology by P Dayaratman
- (xv) Video programme on different experiments in 'Concrete Technology' developed by NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	03	04
2	07	12
3	03	04
4	08	08
5	09	18
6	05	08
7	04	07
8	07	12
9	16	25
10	02	02
Total	64	100

4.2 SOIL AND FOUNDATION ENGINEERING

L T P
Periods/week 4 - 2

RATIONALE

Civil Engineering diploma engineers are required to supervise the construction of structural buildings, 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: (03 periods)
 - 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 J&K, 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 periods)
 - 2.1 Constituents of soil and representation by a phase diagram
 - 2.2 Definitions of void ratio, porosity, water content, degree of saturation, 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 periods)
 - 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 periods)
- 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 periods)
- 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 periods)
- 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 Characteristics of Soils: (09 periods)
- 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 Examples of shear failure in soils
8. Compaction: (04 periods)
- 8.1 Definition and necessity of compaction
 - 8.2 Laboratory compaction test (standard and modified proctor test as per BIS) 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: (08 periods)
- 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 periods)
- 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 of soil
 - 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 geosynthetics.
11. Foundation Engineering: (10 periods)
- Concept of shallow and deep foundation; types of shallow foundations: isolated, combined, 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 Undisturbed 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 content and maximum dry density

8. Demonstration of Unconfined Compression Test
 - a) Specimen preparation
 - b) Conducting the test
 - c) Plotting the graph
 - d) Interpretation of results and finding/bearing capacity

9. Demonstration of:
 - a) Direct Shear and Vane Shear Test on sandy soil samples
 - b) Permeability 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"; Standard Publishers, Delhi
- ii) Bharat Singh and Shamsheer Prakash; "Soil Mechanics and Foundations Engineering", Nem Chand and Bros, Roorkee,
- iii) Sehgal, SB, "A Text Book of Soil Mechanics"; CBS Publishers and Distributors, Delhi,
- iv) Gulati, SK and Manoj Dutta, "Geotechnical Engineering ", Tata McGraw Hill, Delhi,
- v) Ranjan Gopal and Rao ASR "Basic and Applied Soil Mechanics", New Age Publication (P) Ltd., New Delhi
- vi) Singh Harbhajan "Soil and Foundation Engineering", Abhishek Publishers, Chandigarh
- vii) S Mittal and JP Shukla, "Soil Testing for Engineers", Khanna Publishers Ltd., Delhi
- viii) BIS Codes IS 6403 (latest edition) and IS 1498 (latest edition)
- ix) Jagroop Singh, "Soil and Foundation Engineering", Eagle Parkashan, Jalandhar
- x) Rabinder Singh, "Soil and Foundation Engg." SK Kataria and Sons, Ludhiana
- xi) NITTTR, Chandigarh, "Shallow Foundations"
- xii) Video films on Geo-technical Laboratory Practices by NITTTR, Chandigarh

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	03	05
2	04	06
3	04	06
4	04	06
5	04	06
6	04	06
7	09	14
8	04	06
9	08	16
10	10	12
11	10	17
Total	64	100

4.3 WATER SUPPLY AND WASTE WATER ENGINEERING

L T P
Periods/week 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

A. WATER SUPPLY

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

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

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

4. Water Treatment (brief introduction) (09 periods)
 - **4.1 Sedimentation - purpose, types of sedimentation tanks
 - **4.2 Coagulation flocculation - 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) Aeration fountain (ii) mixer (iii) flocculator, (iv) classifier, (v) slow and rapid sand filters (vi) chlorination chamber.

5. Conveyance of Water (09 periods)
- **5.1 Different types of pipes - cast iron, PVC, steel, asbestos cement, concrete and lead pipes. Their suitability and uses, types of joints in different types of pipes.
 - 5.2 Appurtenances: Sluice, air, reflux valves, relief valves, scour valves, bib cocks, stop cocks, fire hydrants, water meters their working and uses
 - 5.3 Distribution site: Requirement of distribution, minimum head and rate, methods of layout of distribution pipes
 - 5.3.1 Systems of water supply - Intermittent and continuous service reservoirs - types, necessity and accessories.
 - 5.3.2 Wastage of water - preventive measures
 - 5.3.3 Maintenance of distribution system
 - 5.3.4 Leakage detection
6. Laying out Pipes (06 periods)
- 6.1 Setting out alignment of pipes
 - 6.2 Excavation for laying of pipes and precautions to be taken in laying pipes in black cotton soil.
 - 6.3 Handling, lowering beginning and jointing of pipes
 - 6.4 Testing of pipe lines
 - 6.5 Back filling
 - 6.6 Use of boring rods
7. Building Water Supply (02 periods)
- 7.1 Connections to water main (practical aspect only)
 - **7.2 Water supply fixtures and installations and terminology related to plumbing

B. WASTE WATER ENGINEERING

8. Introduction (04 periods)
- 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 (05 periods)
- 9.1 Types of sewerage systems, materials for sewers, their sizes and joints
 - 9.2 Appurtenance: Location, function and construction features. Manholes, drop manholes, tank hole, catch basin, inverted siphon, flushing tanks grease and oil traps, storm regulators, ventilating shafts

10. Laying and Construction of Sewers: (6 periods)
 10.1 Setting out/alignment of sewers
 10.2 Excavations, checking the gradient with boning rods preparation of bedding, handling and jointing testing and back filling of sewers/pipes.
 10.3 Construction of surface mains and different sections required
- 11 Sewage characteristics: (4 periods)
 11.1 Properties of sewage and IS standards for analysis of sewage
 11.2 Physical, chemical and bacteriological parameters
12. Natural Methods of Sewerage Disposal (5 periods)
 12.1 General composition of sewage and disposal methods
 12.2 Disposal by dilution
 12.3 Self purification of stream
 12.4 Disposal by land treatment
 12.5 Nuisance due to disposal
13. Sewage Treatment (9 periods)
 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, plain sedimentation tanks, primary clarifiers, secondary clarifiers, filters, control beds, intermittent sand filters, trickling filters, sludge treatment and disposal, oxidation ponds (Visit to a sewage treatment plant)
14. Building Drainage (9 periods)
 14.1 Aims of building drainage and its requirements
 **14.2 Different sanitary fittings and installations
 14.3 Traps, seals, causes of breaking seals

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

LIST OF PRACTICALS

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

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

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.

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

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

4.4 IRRIGATION ENGINEERING

L T P
Periods/week 4 - -

RATIONALE

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

DETAILED CONTENTS

1. Introduction: (02 periods)
 - 1.1 Definition of irrigation
 - 1.2 Necessity of irrigation
 - 1.3 History of development of irrigation in India
 - 1.4 Major, medium and minor irrigation projects
2. Water Requirement of Crops (06 periods)
 - 2.1 Principal crops in India and their water requirements
 - 2.2 Crop seasons – Kharif and Rabi
 - 2.3 Soil water, soil crop and water relationships, duty, delta and base period, their relationship and evapotranspiration
 - 2.4 Gross commanded area (GCA), culturable commanded area (CCA), intensity of irrigation, irrigable area
3. Hydrological Cycle, Catchment Area and Run-off (06 periods)

Rainfall , definition rain-gauges – automatic and non-automatic, methods of estimating average rainfall (Arithmetic system); catchment area runoff, factors affecting runoff, hydrograph, basic concept of unit hydrograph.
4. Methods of Irrigation (07 periods)
 - 4.1 Flow irrigation - its advantages and limitations
 - 4.2 Lift Irrigation – Tube well and open well irrigation, their advantages and disadvantages

- 4.3 Sprinkler irrigation conditions favourable and essential requirements for sprinkler irrigation, sprinkler system – classification and component parts
- 4.4 Drip irrigation, suitability of drip irrigation, layout, component parts, advantages
- 5. Canals (08 periods)
 - 5.1 Classification, apurtenancs of a canal and their functions, sketches of different canal cross-sections (unlined)
 - 5.2 Various types of canal lining - their related advantages and disadvantages, sketches of different lined canal x-sections
 - 5.3 Breaches and their control
 - 5.4 Maintenance of lined and unlined canals
- 6. Tube Well Irrigation (09 periods)
 - 6.1 Introduction, occurrence of ground water, location and command, advantages and disadvantages, comparison with canal irrigation
 - 6.2 Tube wells, explanation of terms: water table, radius of influence, depression head, cone of depression, confined and unconfined aquifers. Yield of a well and methods of determining yield of well
 - 6.3 Types of tube wells, cavity, strainer and slotted type;
 - 6.4 Method of boring, installation of well assembly, development of well, pump selection and installation and maintenance
 - 6.5 Water Harvesting Techniques: Need and requirement of various methods, Run-off from roof top and ground surface, techniques for ground water recharge construction of recharge pits and recharge wells and their maintenance.
- 7. Dams (07 periods)
 - 7.1 Classification of dams; earthen dams - types, causes of failure; cross-section of zoned earthen dams, method of construction, gravity dams – types, cross-sections of a dam, method of construction
 - 7.2 Concept of small and micro dams
 - 7.3 Concept of spillways and energy dissipators

8. Canal Head Works and Regulatory Works (06 periods)
Definition, object, general layout, functions of different parts of head works. Difference between weir and barrage
9. Cross Drainage Works (04 periods)
- 9.1 Functions and necessity of the following types: aqueduct, super passage, level crossing, inlet and outlet, pipe crossing
- 9.2 Sketches of the above cross drainage works
10. Definitions of following Hydraulic Structures with Sketches (02 periods)
- 10.1 Falls
- 10.2 Cross and head regulators
- 10.3 Outlets
- 10.4 Canal Escapes
11. River Training Works (04 periods)
Methods of river training, guide banks, retired (levees) embankments, groynes and spurs, pitched island, cut-off
12. Water Logging and Drainage (03 periods)
- 12.1 Definition of water logging – its causes and effects, detection, prevention and remedies
- 12.2 Reclamation of soil
- 12.3 Surface and sub-surface drains and their layout

INSTRUCTIONAL STRATEGY

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

RECOMMENDED BOOKS

1. Bharat Singh, 'Fundamentals of Irrigation Engineering', , Nem Chand and Bros, Roorkee
2. Garg, Santosh Kumar, 'Irrigation Engineering and Hydraulics Structures', Khanna Publishers, Delhi,
3. Punmia, BC; and Pande Brij Bansi Lal, 'Irrigation and Water Power Engineering', Delhi, Standard Publishers Distributors, Delhi,
4. Sharma, RK; 'Text Book of Irrigation Engineering and Hydraulics Structures', , Oxford and IBH Publishing Company, New Delhi
5. Sharma, SK; 'Principles and Practice of Irrigation Engineering', Prentice Hall of India Pvt. Ltd., New Delhi,
6. Varshney RS, Gupta SC, Gupta RL at all. "Theory and Design of Irrigation Structures", Vol. I and II,
7. Saharsabudhe SR, "Irrigation Engineering and Hydraulic Structures"
8. Priyani BB, 'The Fundamental Principles of Irrigation and Water Power
9. BIS Codes
10. Wan. E. Houk, "Irrigation Engineering" Vol. I and II
11. Central Ground Water Board and Central Water Commission Guidelines and Reference Books.

SUGGESTED DISTRIBUTION OF MARKS

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

4.5 SURVEYING – II

L T P
Periods/week 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 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: (08 periods)
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: (12 periods)
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 (06 periods)
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: (15 periods)
- 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: (03 periods)
- a) EDM or Distomat
 - b) Total station
 - c) Introduction to remote sensing and GPS
- 6 Minor Instruments:- (04 periods)
- 6.1. Introduction and use of minor instruments like Ceylon Ghat Tracer, Clinometer, Pantograph, Abney Level etc.
 - 6.2. Use of planimeter for computing areas

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

PRACTICAL EXERCISES

- I. Contouring:
- i) Preparing a contour plan by radial line method by the use of a Tangent Clinometer/Tachometer
 - ii) Preparing a contour plan by method of squares

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

II. Theodolite:

- i) Taking out the 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 and use of minor instruments like Ceylon Ghat Tracer, Tangent Clinometer, Pantograph, Abney level etc.
- ii) Use of planimeter for computing areas

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

VI Total Station (only demonstrations).

INSTRUCTIONAL STRATEGY

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

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	16
2	12	28
3	06	12
4	15	34
5	03	05
6	04	05
Total	32	100

4.6 STRUCTURAL MECHANICS

L T P
Periods/week 5 - 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 (02 periods)
 - 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 periods)
 - 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 and HYSD steel, mechanical properties, factor of safety.
 - 2.6 Temperature stresses and strains

3. Shear Force and Bending Moment: (18 periods)
- 3.1 Concept of a beam and supports (Hinges, Roller and Fixed), types of beams: simply supported, cantilever, propped, over hang, cantilever and continuous beams (only concept).
 - 3.2 Types of loads (dead load, live load, snow load, wind load seismic load as per IS Codes 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 Stresses in Beams: (08 periods)
- 4.1 Concept of pure/simple bending
 - 4.2 Assumptions made in the theory of simple bending, derivation and application of bending equation 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
5. Combined Direct and Bending Stresses: (10 periods)
- 5.1. Concentric and eccentric loads single axis eccentricity only
 - 5.2. Effect of eccentric load on the section stresses due to eccentric loads, Numerical in the case of short columns.
 - 5.3. Simple problems on stability of masonry dams and retaining walls
6. Shear Stresses in Beams (06 periods)
- 6.1 Concept of shear stresses in beams, shear stress distribution in rectangular, circular I, T, L sections (Formula to be stated, no derivation)
7. Slope and Deflection: (08 periods)
- Necessity for determination of slope and deflection
Moment area theorem (no derivation, numerical problems)

8. Columns: (06 periods)

8.1 Theory of columns

8.2 Euler's and Rankine Formula (No derivation)

9. Analysis of Trusses: (08 periods)

9.1 Concept of a perfect, redundant and deficient frames

9.2 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) Testing of HYSD Steel
- iii) Determination of Young's modulus of elasticity for steel wire with searl's apparatus
- iv) Determination of modulus of rupture of a concrete beam
- v) Determination of maximum deflection and young's modulus of elasticity in simply supported beam with load at middle third point
- vi) 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) Mechanics & Material by Kirpal Singh, Standard Publication, New Delhi
- ii) Ramamrutham, S., "Strength of Materials", Dhanpat Rai and Sons., New Delhi
- iii) Ram Chandra, "Applied Mechanics and Strength of Materials", Standard Publishers. Delhi:
- iv) Punmia, BC., "Strength of Materials", Standard Publishers, Delhi,
- v) Prasad VS " Structural mechanics Galgotia publications Pvt Ltd, Delhi

- vi) Sadhu Singh “Strengths of Materials” Standard Publishers, New Delhi
- vii) Singh Birinder “Structural Mechanics” Kaption Publishers, Ludhiana
- viii) Singh Harbhajan, “ Structural Mechanics” ., Abhishek Publishers, Chandigarh
- ix) Singh Harbhajan, “Design of Masonry and Timber Structures” Abhishek Publishers, Chandigarh.
- x) SOM by C.M.Verma, J.P.N. Publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	02	04
2	14	17
3	18	27
4	08	10
5	10	12
6	06	06
7	08	08
8	06	06
9	08	10
Total	80	100

4.7 PHE & IRRIGATION ENGINEERING DRAWING

L T P
Periods/week - - 6

RATIONALE

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

DETAILED CONTENTS

Drawings Exercises

A) WATER SUPPLY AND WASTE WATER ENGINEERING DRAWING

1. Drains and Sewers

Cross section of standard types of open drains (circular, v-shaped and μ -shaped) with their foundations

Cross section of earthen ware and RCC sewer pipes

Cross sections of masonry sewers (circular and egg shaped)

2. Traps, manholes and inspection chamber

Detailed section of floor trap and gully trap

Detailed plan and section of an inspection chamber

Detailed plan and section of a manhole

3. Septic Tank and Soak Pit

Detailed plan and cross sections of a domestic septic tank with soak pit for 25 users

4. Bath room and W.C connections:

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

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

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

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

B) IRRIGATION ENGINEERING DRAWING:

1. Typical cross-section of a channel
 - L-section of a channel for given data
 - Typical cross section of an unlined and lined channel in cutting, partly cutting and partly filling and fully in filling with given design data.
2. Layout plan of a canal head works.
3. Draw the typical L-section of a weir
4. Draw the X-section of an Earthen Dam
 - i) Homogeneous
 - ii) Zoned type
 - iii) Diaphragm type
5. Cross section of a tube well
6. Layout and cross section of rain water harvesting system.

INSTRUCTIONAL STRATEGY

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

RECOMMENDED BOOKS

1. Loyal JS “Civil Engineering Drawing”, Satya Parkashan, New Delhi
2. Chandel RP “ Civil Engineering Drawings”
3. Kumar; NS “ Civil Engineering Drawing “ IPH, New Delhi
4. Malik RS and Meo GA, “Civil Engineering Drawing” Asian Publishing House, New Delhi

4.8 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 4 weeks duration to be organised 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 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.

Internal assessment and external assessment 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 behaviour, 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, if any. 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%

5.1 REINFORCED CONCRETE DESIGN

L T P
Period/Week 6 - -

RATIONALE

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

DETAILED CONTENTS

1. Introduction (03 periods)
 - 1.1 Concept of Reinforced Cement Concrete (RCC)
 - 1.2 Reinforcement Materials:
 - Suitability of steel as reinforcing material
 - Properties of mild steel and HYSD steel
 - 1.3. Loading on structures as per IS: 875
2. Introduction to following methods of RCC design (03 periods)
 - 2.1 Working stress method
 - 2.2 Limit state method
3. Shear and Development Length (05 periods)
 - 3.1 Shear as per IS:456-2000 by working stress method
 - i) Shear strength of concrete without shear reinforcement
 - ii) Maximum shear stress
 - iii) Shear reinforcement
4. Singly Reinforced Beam (Working stress method) (12 periods)
 - 4.1 Basic assumptions and stress strain curve, neutral axis, balanced, under-reinforcement and over reinforced beams, Moment of resistance for singly reinforced beam.
 - 4.2 Design of singly reinforced beam including sketches showing reinforcement details.
5. Concept of Limit State Method (09 periods)
 - 5.1 Definitions and assumptions made in limit state of collapse (flexure)
 - 5.2 Partial factor of safety for materials
 - 5.3 Partial factor of safety for loads
 - 5.4 Design loads
 - 5.5 Stress block, parameters
6. Singly Reinforced beam (11 periods)

- Theory and design of singly reinforced beam by Limit State Method. Check for shear, Check for deflection, check for development length
7. Doubly Reinforced Beams (11 periods)
Theory and design of simply supported doubly reinforced rectangular beam by Limit State Method
 8. Behaviour of T beam, inverted T beam, isolated T beam and 'L' beams (No Numericals) (05 periods)
 9. One Way Slab (11 periods)
Theory and design of simply supported one way slab including sketches showing reinforcement details (plan and section) by Limit State Method. Check for shear, Check for deflection,
 10. Two Way Slab (11 periods)
Theory and design of two-way simply supported slab with corners free to lift, no provisions for torsional reinforcement by Limit State Method including sketches showing reinforcement details (plan and two sections)
 11. Axially Loaded Column (11 periods)
 - 11.1 Definition and classification of columns
 - 11.2. Effective length of column,
 - 11.3. Specifications for longitudinal and lateral reinforcement
 - 11.4. Design of axially loaded square, rectangular and circular short columns by Limit State Method including sketching of reinforcement(sectional elevation and plan)
 12. Prestressed Concrete (04 periods)
 - 12.1. Concept of pre-stressed concrete
 - 12.2. Methods of pre-stressing : pre-tensioning and post tensioning
 - 12.3. Advantages and disadvantages of prestressing
 - 12.4. Losses in pre-stress

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

INSTRUCTIONAL STRATEGY

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

RECOMMENDED BOOKS

1. Punmia, BC; "Reinforced Concrete Structure Vol I", Standard Publishers, Delhi
2. Ramamurtham, S; "Design and Testing of Reinforced Structures", Dhanpat Rai and Sons, Delhi
3. Gambhir, M.L., "Reinforced Concrete Design", Macmillan India Limited
4. Singh, Birinder "RCC Design and Drawing", Kaption Publishing House, New Delhi

5. Singh Harbhajan “Design of Reinforced Concrete Structures” Abhishek Publishers Ltd., Chandigarh
6. Mallick, SK; and Gupta, AP; "Reinforced Concrete", Oxford and IBH Publishing Co, New Delhi.
7. Singh Harbhajan “Limit State RCC Design” Abhishek Publishers Ltd., Chandigarh

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	03	03
2	03	03
3	05	05
4	12	10
5	09	10
6	11	12
7	11	12
8	05	5
9	11	12
10	11	12
11	11	12
12	04	04
Total	96	100

5.2 HIGHWAY & AIRPORTS ENGINEERING

L T P
Period/Week 5 - 2

RATIONALE

Construction of roads is one of the area in which diploma holders in Civil Engineering may get employment. These diploma holders are responsible for construction and maintenance of highways and airports. Basic concepts of road geo-metrics, surveys and plans, elements of traffic engineering, road materials, construction of rigid and flexible pavements, special features of hill roads, road drainage system and various aspects of maintenance find place in above course.

DETAILED CONTENTS

1. Introduction (02 periods)
 - 1.1 Importance of Highway engineering
 - 1.2 Functions of IRC, CRRI, MORT&H, NHAI
 - 1.3 IRC classification of roads
 - 1.4 PMGSY and MNERGA Roads

2. Road Geometrics (10 periods)
 - 2.1 Glossary of terms used in road geo-metrics and their importance: Right of way, formation width, road margin, road shoulder, carriage way, side slopes, kerbs, formation levels, camber and gradient
 - 2.2 Average running speed, stopping and passing sight distance
 - 2.3 Necessity of curves, horizontal and vertical curves including transition curves. Super elevation and methods of providing super elevation
 - 2.4 Sketch of typical cross-sections in cutting and filling on straight alignment and at a curve

(Note: No design/numerical problem to be taken)

3. Highway Surveys and Plan (10 periods)
 - 3.1 Topographic map, reading the data given on a topographic map
 - 3.2 Basic considerations governing alignment for a road in plain and hilly area
 - 3.3 Highway location; marking of alignment

4. Road Materials (10 periods)

- 4.1 Different types of road materials in use; soil, aggregate, binders – bitumen, cutback, Emulsion and Modified Bitumen (CRMB, PMB)
- 4.2 Binders: Common binders; bitumen, properties as per BIS specifications, penetration, softening point, ductility and viscosity test of bitumen, procedures and significance, cut back and emulsion and their uses, Bitumen modifiers

5. Road Pavements (12 periods)

- 5.1 Road pavement: Flexible and rigid pavement, their merits and demerits, typical cross-sections, functions of various components
- 5.2. Introduction to California Bearing Ratio, method of finding CBR value and its significance. Aggregate : Source and types, important properties, strength, durability
- 5.3 Sub-grade preparation: Setting out alignment of road, setting out bench marks, control pegs for embankment and cutting, borrow pits, making profiles of embankment, construction of embankment, compaction, preparation of subgrade, methods of checking camber, gradient and alignment as per recommendations of IRC, equipment used for subgrade preparation. Stabilization of subgrade. Types of stabilization mechanical stabilization, lime stabilization, cement stabilization, fly ash stabilization etc.(introduction only)
- 5.4 Introduction to Sub Base Course and Base Course:
 - a) Granular base course:
 - (i) Water Bound Macadam (WBM)
 - (ii) Wet Mix Macadam (WMM)
 - b) Bitumen Courses:
 - (i) Bituminous Macadam
 - (ii) Dense Bituminous Macadam (DBM)
 - c) *Methods of construction as per MORT&H
- 5.5 Surfacing:
 - a) * Types of surfacing
 - i) Prime coat and tack coat
 - ii) Surface dressing with seal coat

- iii) Open graded premix carpet
- iv) Mix seal surfacing
- v) Semi dense bituminous concrete
- vi) Bituminous Concrete/Asphaltic concrete
- vii) Mastic Asphalt

b) * Methods of constructions as per MORT&H specifications and quality control..

5.6 Rigid Pavements:

Construction of concrete roads as per IRC specifications: Form work laying, mixing and placing the concrete, compacting and finishing, curing, joints in concrete pavement, equipment used.

6. Hill Roads: (06 periods)

6.1 Introduction: Typical cross-sections showing all details of a typical hill road, partly in cutting and partly in filling

6.2 Special problems of hill areas

6.2.1 Landslides: Causes, prevention and control measures, use of geogrids, geoflexiles, geo-synthetics

6.2.2 Drainage

6.2.3 Soil erosion

6.2.4 Snow: Snow clearance, snow avalanches, frost

6.2.5 Land Subsidence

7. Road Drainage: (06 periods)

7.1 Necessity of road drainage work, cross drainage works

7.2 Surface and subsurface drains and storm water drains. Location, spacing and typical details of side drains, side ditches for surface drainage. Intercepting drains, pipe drains in hill roads, details of drains in cutting embankment, typical cross sections

8. Road Maintenance: (06 periods)

- 8.1 Common types of road failures of flexible pavements: Pot hole, rutting, alligator cracking, upheaval - their causes and remedies (brief description)
 - 8.2 Maintenance of bituminous road such as seal-coat, patch-work and recarpeting.
 - 8.3 Maintenance of concrete roads-filling cracks, repairing joints, maintenance of shoulders (berms), maintenance of traffic control devices
9. Road Construction Equipment: (08 periods)
- Output and use of the following plant and equipment
- 9.1 Hot mix plant
 - 9.2 Tipper, tractors (wheel and crawler) scraper, bulldozer, dumpers, shovels, grader, roller, dragline
 - 9.3 Asphalt mixer and tar boilers
 - 9.4 Road pavers
- 10 Airport Engineering :- (10 periods)
- 10.1 Necessity of study of airport engineering, aviation transport scenario in India.
 - 10.2 Factors to be considered while selecting a site for an airport with respect to zoning laws.
 - 10.3 Introduction to Runways, Taxiways and Apron

* **An expert may be invited from field/industry for extension lecture on this topic.**

PRACTICAL EXERCISES

1. Determination of penetration value of bitumen
2. Determination of softening point of bitumen
3. Determination of ductility of bitumen
4. Determination of impact value of the road aggregate
5. Determination of abrasion value (Los Angeles') of road aggregate
6. Determination of the California bearing ratio (CBR) for the sub-grade soil
7. Visit to Hot mix plant
8. Visit to highway construction site for demonstration of operation of:
Tipper, tractors (wheel and crawler), scraper, bulldozer, dumpers, shovels, grader, roller, dragline, road pavers, JCB etc.
9. Mixing and spraying equipment
10. A compulsory visit to Ready Mix Concrete plant.
11. Determination of Viscosity of Tar/Bitumen

INSTRUCTIONAL STRATEGY

While imparting instructions, it is recommended that emphasis should be laid on constructional details and quality control aspects. Students should be asked to prepare sketches and drawings, clearly indicating specifications and constructional details for various sub components of a highway. It will be also advantageous to organize field visits to show the actual construction of roads at site.

RECOMMENDED BOOKS

- i) Khanna, SK and Justo, CEG, "Highway Engineering", Nem Chand and Bros., Roorkee
- ii) Vaswani, NK, "Highway Engineering" , Roorkee Publishing House, Roorkee,
- iii) Priyani, VB, "Highway and Airport Engineering" Anand, Charotar Book Stall

- iv) Sehgal, SB; and Bhanot, KL; "A Text Book on Highway Engineering and Airport" S Chand and Co, Delhi
- v) Bindra, SP; "A Course on Highway Engineering" , Dhanpat Rai and Sons, New Delhi
- vi) Sharma, RC; and Sharma, SK; "Principles and Practice of Highway Engineering", Asia Publishing House, New Delhi
- vii) Duggal AK, Puri VP., "Laboratory Manual in Highway Engineering", New Age Publishers (P) Ltd, Delhi,
- viii) NITTTR, Chandigarh "Laboratory Manual in Highway Engineering",
- ix) RK Khitoliya, "Principles of Highway Engineering (2005)", Dhanpat Rai Publishing Co., New Delhi
- x) Rao, GV' Transportation Engineering
- xi) Duggal AK, "Maintenance of Highway – a Reader", NITTTR, Chandigarh
- xii) Duggal AK "Types of Highway constitution ", NITTTR Chandigarh
- xiii) Rao, "Airport Engineering"
- xiv) Singh,Jagrup, "Highway Engineering", Eagle Publications Jalandhar

IRC Publications

- i) MORTH Specifications for Road and Bridge Works (Fifth Revision)
- ii) MORTH Pocket book for Highway Engineers, 2001
- iii) MORTH Manual for Maintenance of Roads, 1983

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted	Marks Allotted (%)
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	(Periods)	
1	02	04
2	10	12
3	10	12
4	10	12
5	12	14
6	06	08
7	06	08
8	06	08
9	08	10
10	10	12
Total	80	100

5.3 RAILWAYS, BRIDGES AND TUNNELS

	L	T	P
Period/Week 5	-	-	-

RATIONALE

The subject will cater to the needs of those technicians who would like to find employment in the construction of railway tracks, bridges and tunnels. The subject aims at providing broad based knowledge regarding various components and construction of railway track, bridges and tunnels

DETAILED CONTENTS

PART – I: RAILWAYS

(35 periods)

1. Introduction to Indian Railways
2. Railway surveys: Factors influencing the railways route, brief description of various types of railway survey
3. Classification of permanent way describing its component parts
4. Rail Gauge: Definition, types, practice in India
5. Rails – types of rails
6. Rail Fastenings: Rail joints, types of rail joints, fastenings for rails, fish plates, bearing plates
7. Sleepers: Functions of sleepers, types of sleepers, requirements of an ideal material for sleepers.
8. Ballast: Function of ballast, requirements of an ideal material for ballast
9. Crossings and signalings: Brief description regarding different types of crossings/ signalings (Latest electronics operated signal devices)
10. Maintenance of track: Necessity, maintenance of track, inspection of soil, track and fixtures; maintenance and boxing of ballast maintenance gauges, tools
11. Earth work an drainage: Features of rail road, bed level, width of formation, side slopes, drains, methods of construction, requirement of drainage system

PART-II: BRIDGES

(35 periods)

12. Introduction
Bridge – its function and component parts, difference between a bridge and a culvert
13. Classification of Bridges
Their structural elements and suitability:
 - 13.1 According to life-permanent and temporary
 - 13.2 According to deck level – Deck, through and semi-through
 - 13.3 According to material –timber, masonry, steel, RCC, pre-stressed
 - 13.4 According to structural form;
 - Grade Separators-Railway Overbridges (ROB), Railway underbridge (RUB)
 - Beam type –RCC, T-Beam, steel girder bridges, plate girder and box girder, balanced cantilever, Trussed bridges.
 - Arch type – open spandrel and filled spandrel barrel and rib type
 - Suspension type – unstiffened and stiffened and table (its description with sketches)
 - According to the position of highest flood level submersible and non submersible
 - 13.5 IRC classification
14. Bridge Foundations: Introduction to open foundation, pile foundation, well foundation
15. Piers, Abutments and Wingwalls
 - 15.1 Piers-definition, parts; types –solid (masonry and RCC), open
 - 15.2 Abutments and wing walls – definition, types of abutments (straight and tee), abutment with wing walls (straight, splayed, return and curved)
 - 15.3 Launching of Equipment Bridges
16. Bridge bearings
Purpose of bearings; types of bearings – fixed plate, rocker and roller.
17. Maintenance of Bridges
 - 17.1 Inspection of Steel and Equipment bridges
 - 17.2 Routine maintenance

18. Definition and necessity of tunnels
19. Typical section of tunnels for a national highway and single and double broad gauge railway track
20. Ventilation –necessity and methods of ventilation, by blowing, exhaust and combination of blowing and exhaust
21. Drainage method of draining water in tunnels
22. Lighting of tunnels

- Notes:** i) Field visits may be organized to Bridge construction site or a Bridge/Tunnel construction site/Railways tracks to explain the various components and a field visit report shall be prepared by the students, as teamwork
- ii) Examiners should set questions from all the parts

INSTRUCTIONAL STRATEGY

This subject is of practical nature. While imparting instructions, teachers are expected to organize demonstrations and field visits to show various components and construction of railway track, bridges and tunnel.

RECOMMENDED BOOKS

1. Vaswani, NK, “Railway Engineering”, Publishing House, Roorkee
2. Rangwala, SC, “Railway Engineering”, Anand, Charotar Book Stall
3. Deshpande, R, “A Text Book of Railway Engineering”, Poonam United Book Corporation
4. Algia, JS “Bridge Engineering”, Anand, Charotar Book Stall
5. Victor Johnson, “Essentials of Bridge Engineering” Oxford and IBH, Delhi
6. Rangwala S.C., “Bridge Engineering”, Anand, Charotar Book Stall
7. IRC Bridge Codes
8. MORTH drawings for various types of bridges
9. MORTH pocket books for bridge Engineers, 2000 (First Revision)
10. Subhash C Saxena, “Tunnel Engineering”, Dhanpat Rai and Sons, Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	35	43
2	35	43
3	10	14
Total	80	100

5.4 QUANTITY SURVEYING AND VALUATION

L T P
Periods/week 6 - -

RATIONALE

Diploma holders in Civil Engineering are supposed to prepare material estimates for various Civil Engineering works namely; buildings, irrigation works, public health works and roads etc. In addition, they must have basic knowledge regarding analysis of rates, contracting, principles of valuation. Therefore, this subject has great importance for diploma holders in Civil Engineering.

DETAILED CONTENTS

1. Introduction to quantity surveying and its importance. Duties of quantity surveyor (02 periods)
2. Types of estimates (03 periods)
 - 2.1 Preliminary estimates
 - Plinth area estimate
 - Cubic rate estimate
 - Estimate per unit base
 - 2.2 Detailed estimates
 - Definition
 - Stages of preparation – details of measurement and calculation of quantities and abstract
3. Measurement (03 periods)
 - 3.1 Units of measurement for various items of work as per BIS:1200
 - 3.2 Rules for measurements
 - 3.3 Different methods of taking out quantities – centre line method and long wall and short wall method
4. Preparation of Detailed and Abstract Estimates from Drawings for: (28 periods)
 - 4.1 A small residential building with a flat roof and pitched roof building comprising of
 - Two rooms with W.C., bath, kitchen and verandah
 - 4.2 Earthwork for unlined channel
 - 4.3 WBM road and pre-mix carpeting
 - 4.4 Single span RCC slab culvert

- 4.5 Earthwork for plain and hill roads
- 4.6 RCC work in beams, slab, column and lintel, foundations
- 4.7 users septic tank - 25 users

- 5. Calculation of quantities of materials for (12 periods)
 - 5.1 Cement mortars of different proportion
 - 5.2 Cement concrete of different proportion
 - 5.3 Brick/stone masonry in cement mortar
 - 5.4 Plastering and pointing
 - 5.5 White washing, painting
 - 5.6 R.C.C. work in slab, beams

- 6. Analysis of Rates (16 periods)
 - 6.1 Steps involved in the analysis of rates. Requirement of material, labour, sundries, contractor's profit and overheads
 - 6.2 Analysis of rates for finished items when data regarding labour, rates of material and labour is given:
 - Earthwork in excavation in hard/ordinary soil and filling with a concept of lead and lift
 - RCC in roof slab/beam/lintels/columns
 - Brick masonry in cement mortar
 - Cement Plaster
 - White washing, painting
 - Stone masonry in cement mortar

- 7 Contractorship (10 periods)
 - Meaning of contract
 - Qualities of a good contractor and their qualifications
 - Essentials of a contract
 - Types of contracts, their advantages, dis-advantages and suitability, system of payment
 - Single and two cover-bids; tender, tender forms and documents, tender notice, submission of tender and deposit of earnest money, security deposit, retention money, maintenance period

- Classification and types of contracting firms/construction companies
- 8 Preparation of Tender Document based on Common Schedule Rates (CSR/SOR) (14 periods)
- Introduction to CSR and calculation of cost based on premium on CSR/SOR
 - Exercises on writing detailed specifications of different types of building works from excavation to foundations, superstructure and finishing operation
 - Exercises on preparing tender documents for the following
 - a) Earth work
 - b) Construction of a small house as per given drawing
 - c) RCC works
 - d) Pointing, plastering and flooring
 - e) White-washing, distempering and painting
 - f) Wood work including polishing
 - g) Sanitary and water supply installations
 - h) False ceiling, aluminum (glazed) partitioning
 - i) Tile flooring including base course
 - j) Construction of W.B.M/Concrete road
9. Exercises on preparation of comparative statements for item rate contract (02 periods)
10. Valuation (06 periods)
- a) Purpose of valuation, principles of valuation
 - b) Definition of various terms related to valuation like depreciation, sinking fund, salvage and scrap value, market value, fair rent, year's purchase etc.
 - c) Methods of valuation (i) replacement cost method (ii) rental return method

INSTRUCTIONAL STRATEGY

This is an applied engineering subject. Teachers are expected to provide working drawings for various Civil Engineering works and students be asked to calculate the quantities of materials required for execution of such works and use of relevant software for preparing estimates. Teachers should conceptualize making analysis of rates for different items of works. It will be advantageous if students are given valuation reports for reading.

RECOMMENDED BOOKS

1. Pasrija, HD, Arora, CL and S. Inderjit Singh, "Estimating, Costing and Valuation (Civil)", New Asian Publishers, Delhi,

2. Rangwala, S.C, Estimating and Costing”, Anand, Charotar Book Stall
3. Chakraborti, M, “Estimating, Costing and Specification in Civil Engineering”, Calcutta
4. Dutta, BN, “Estimating and Costing
5. Mahajan Sanjay, “Estimating and Costing” Satya Parkashan, Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	02	02
2	03	03
3	03	03
4	28	30
5	12	12
6	16	18
7	10	10
8	14	14
9	02	02
10	06	06
Total	96	100

5.5 REPAIR AND MAINTENANCE OF BUILDINGS

L T P

Period/Week 4 - 2

RATIONALE

One of the major concerns of a civil engineer is to take care of the building works, already constructed, in order to keep these buildings in utmost workable conditions. Usually it is being felt that the buildings deteriorate faster for want of care and proper maintenance. The buildings usually have a shabby appearance due to cracks, leakage from the roofs and sanitary/water supply fittings. Thus the need for teaching the subject in proper perspective has arisen making students aware of importance of maintenance of buildings.

DETAILED CONTENTS

1. Need for Maintenance (09 periods)
 - 1.1 Importance and significance of repair and maintenance of buildings
 - 1.2 Meaning of maintenance
 - 1.3 Objectives of maintenance
 - 1.4 Factors influencing the repair and maintenance
2. Agencies Causing Deterioration (Sources, Causes, Effects) (08 periods)
 - 2.1 Definition of deterioration/decay
 - 2.2 Factors causing deterioration, their classification
 - 2.2.1 Human factors causing deterioration
 - 2.2.2 Chemical factors causing deterioration
 - 2.2.3 Environmental conditions causing deterioration
 - 2.2.4 Miscellaneous factors
 - 2.3 Effects of various agencies of deterioration on various building materials i.e. bricks, timber, concrete, paints, metals, plastics, stones
3. Investigation and Diagnosis of Defects (08 periods)
 - 3.1 Systematic approach/procedure of investigation
 - 3.2 Sequence of detailed steps for diagnosis of building defects/problems
 - 3.3 List non-destructive and others tests on structural elements and materials to evaluate the condition of the building and study of three most commonly used tests
4. Defects and their root causes (09 periods)
 - 4.1 Define defects in buildings
 - 4.2 Classification of defects
 - 4.3 Main causes of building defects in various building elements
 - 4.3.1 Foundations, basements and DPC
 - 4.3.2 Walls
 - 4.3.3 Column and Beams
 - 4.3.4 Roof and Terraces
 - 4.3.5 Joinery

- 4.3.6 Decorative and protective finishes
- 4.3.7 Services
- 4.3.8 Defects caused by dampness

5. Materials for Repair, maintenance and protection (09 periods)

- 5.1 Compatibility aspects of repair materials
- 5.2 State application of following materials in repairs:
 - 5.2.1 Anti corrosion coatings
 - 5.2.2 Adhesives/bonding aids
 - 5.2.3 Repair mortars
 - 5.2.4 Curing compounds
 - 5.2.5 Joints sealants
 - 5.2.6 Waterproofing systems for roofs
 - 5.2.7 Protective coatings

6. Remedial Measures for Building Defects (21 periods)

- 6.1 Preventive maintenance considerations
- 6.2 Surface preparation techniques for repair
- 6.3 Crack repair methods
 - 6.3.1 Epoxy injection
 - 6.3.2 Grooving and sealing
 - 6.3.3 Stitching
 - 6.3.4 Adding reinforcement and grouting
 - 6.3.5 Flexible sealing by sealant
- 6.4 Repair of surface defects of concrete
 - 6.4.1 Bug holes
 - 6.4.2 Form tie holes
 - 6.4.3 Honey comb and larger voids
- 6.5 Repair of corrosion in RCC elements
 - 6.5.1 Steps in repairing
 - 6.5.2 Prevention of corrosion in reinforcement
- 6.6 Material placement techniques with sketches
 - 6.6.1 Pneumatically applied (The gunite techniques)
 - 6.6.2 Open top placement
 - 6.6.3 Pouring from the top to repair bottom face
 - 6.6.4 Birds mouth
 - 6.6.5 Dry packing
 - 6.6.6 Form and pump
 - 6.6.7 Preplaced – aggregate concrete
 - 6.6.8 Trowel applied method
- 6.7 Repair of DPC against Rising Dampness
 - 6.7.1 Physical methods
 - 6.7.2 Electrical methods
 - 6.7.3 Chemical methods
- 6.8 Repair of walls
 - 6.8.1 Repair of mortar joints against leakage

- 6.8.2 Efflorescence removal
- 6.9 Waterproofing of wet areas and roofs
 - 6.9.1 Water proofing of wet areas
 - 6.9.2 Water proofing of flat RCC roofs
 - 6.9.3 Various water proofing systems and their characteristics
- 6.10 Repair of joints in buildings
 - 6.10.1 Types of sealing joints with different types of sealants
 - 6.10.2 Techniques for repair of joints
 - 6.10.3 Repair of overhead and underground water tanks

PRACTICAL EXERCISES

Identify the different defects in buildings and their remedies as per list given below. Building Maintenance/Different Remedies should be comprised with the technical support of teachers and labour support. For this purpose labour should be hired from open market at government rate on daily basis of expenditure regarding items required for maintenance should be procured from student funds of maintenance. For major maintenance, Expert Masons required, should also be hired. Building comprises the residential/non residential/hostel etc.

List of Defects

1. To Identify dampers on walls
2. Cracks on Roof level and on walls
3. Corrosion on iron window and door chaukhats
4. Decay of wooden structures
5. Cracks on R.C.C structures.
6. To perform the anti-termite treatment
7. Removal of damaged or decay plaster and guniting

INSTRUCTIONAL STRATEGY

This is very important course and efforts should be made to find damaged/defective work spots and students should be asked to think about rectifying/finding solution to the problem. Visits to work site, where repair and maintenance activities are in progress can be very useful to students. The students will also prepare a project report based upon the available water proofing materials, sealant, special concrete for repair and adhesives and other repair material available in the market.

RECOMMENDED BOOKS

1. Gahlot P.S. and Sanjay Sharma, "Building Defects and Maintenance Management", CBS Publishers, New Delhi
2. Nayak, BS, "Maintenance Engineering for Civil Engineers", Khanna Publishers, Delhi
3. Ransom, WH "Building Failures - Diagnosis and Avoidance", Publishing E and F.N. Span
4. Hutchinson, BD; et al, "Maintenance and Repair of Buildings", Published by Newness – Butterworth

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	09	13
2	08	13
3	08	13
4	09	13
5	09	13
6	21	35
Total	64	100

5.6 APPLICATIONS AND USES OF VARIOUS SOFTWARE IN CIVIL ENGINEERING

L T P
Periods/Week - - 6

RATIONALE

Computer applications plays a very vital role in present day life and more so, in the professional life of diploma engineer. In order to enable the students use the computers effectively in problem solving, this course offers applications of various computer softwares in civil engineering.

DETAILED CONTENTS

PRACTICAL EXERCISES

1. Introduction and use of AutoCAD for making 2D Drawings and develop plan, section and elevation of 2 rooms building..
2. Demonstration of various civil engineering softwares like STAAD-Pro, MS Project or Primavera Project Planner, Auto Civil, MX Road or any other equivalent software for above mentioned software

Note:

- i) The polytechnics may use any other software available with them for performing these exercises
- ii) If the above softwares are not available in the institution, the demonstration of the above said software should be arranged outside the institute.

5.7 MINOR PROJECT WORK

L T P
Period/week - - 8

Minor project work aims at exposing the students to field practices, size and scale of operations and work culture at works sites. For this purpose, students during middle of course, are required to be sent at different work sites where some construction activities are in progress or some operations are going on. Depending on the interests of the students, they may be sent to following (or any other field project related to Civil Engineering):

- i) Building construction sites
- ii) Water treatment plant, Sewage treatment plant
- iii) Crusher plant, Cement Manufacturing Plant, Brick kiln
- iv) Highway construction site
- v) Material and Soil testing laboratory, Soil investigation projects
- vi) Hydel Power Project
- vii) Land surveying projects
- viii) Community development works
- ix) Constructional site like building, bridge, tunnel, canal lining, highway, railway track, irrigation works etc

As a minor project activity, each student is supposed to study the operations at site and prepare a detailed project report of the observations/processes seen by him/her and give seminar using computer aided presentation slides using photographs. These students should be guided by respective subject teachers. Each teacher may guide a group of 10 – 15 students. The teachers along with field supervisors will conduct performance assessment of students. Some of the projects are suggested below:

1. Survey of a village approach road, drawings of L-section and x-sections
2. Estimation of white washing and distempering in hostel building
3. Preparation of detailed estimate with drawings of septic tank for 30-40 users
4. Plumbing work and installation of PVC over-head water tank on a toilet block and then prepare report
5. Construction of different components of a building
6. Identification of water-supply fittings and replacement of defective fittings and then prepare report.
7. Construction of a pipe/slab culvert
8. Ferro-cement construction techniques

- a) Low cost housing
 - b) New construction materials
9. Study and preparation of models of hydraulic pumps.

A group of students not exceeding 5 may work on any one project. Each student will prepare the project report of the activities observed by him. They will study the whole process of the plant, and explain the same in their project report. Further they are required to present the Project Report of work done by them through seminar in the class for internal assessment. External examiner will ask the questions on the construction, working, processes observed by the students during their project work: Shortcomings in the works (site) and their remedial measures may be suggested by the students.

6.1 STEEL STRUCTURES DESIGN

	L	T	P
Period/Week	6	0	0

RATIONALE

This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise steel construction and fabrication. He may also be required to design simple structural elements, make changes in design depending upon availability of materials. This subject thus deals with elementary design principles as per BIS code of practice IS: 800

DETAILED CONTENTS THEORY

1. Structural Steel and Sections: (03 periods)
 - 1.1 Properties of structural steel as per IS Code
 - 1.2 Designation of structural steel sections as per IS handbook and IS:800-2007

2. Riveted Connections: (11 periods)

Types of rivets, permissible stresses in rivets, types of riveted joints, specifications for riveted joints as per IS 800. Failure of a riveted joint. Assumptions in the theory of riveted joints. Strength and efficiency of a riveted joint. Design of riveted joints for axially loaded members.

3. Welded connections: (07 periods)

Types of welds and welded joints, advantages and disadvantages of welded joints design of fillet and butt weld. Plug and slot welds (Descriptive No numerical on plug and slot welds)

4. Tension Members (17 periods)

Analysis and design of single and double angle section tension members and their rivetted and welded connections with gusset plate as per IS:800

5. Compression Members (17 periods)

Analysis and design of single and double angle sections compression members (struts) and their rivetted and welded connections with gusset plate as per BIS:800

6. Roof Trusses (07 periods)
Form of trusses, pitch of roof truss, spacing of trusses, spacing of purlins, connection between purlin and roof covering. Connection between purlin and principal rafter (no design, only concept)
7. Columns: (11 periods)
7.1 Concept of buckling of columns, effective length and slenderness ratio, permissible stresses in compression as per IS:800 for different end conditions. Analysis and Design of axially loaded single section steel column
8. Beams (11 periods)
Analysis and design of single section simply supported laterally restrained steel beams.
- 9 Fabrication and Erection of Steel Structures like trusses, columns and girders (06 periods)
- 10 Masonry structures – Design of brick column and wall foundations (06 periods)

Important Note:

Use of IS: 800 and Steel Tables are permitted in examination.

INSTRUCTIONAL STRATEGY

Teachers are expected to give simple problems for designing various steel structural members. For creating comprehension of the subject, teachers may prepare tutorial sheets, which may be given to the students for solving. It would be advantageous if students are taken at construction site to show fabrication and erection of steel structures. IS:800 may be referred along with code for relevant clauses

RECOMMENDED BOOKS

1. Duggal SK, "Design of Steel Structures" by Standard Publishers, Delhi
2. Birinder Singh, "Steel Structures Design and Drawing", Kaption Publishing House, Ludhiana
3. Ram Chandra, "Design of Steel Structures", Standard Publishers, Delhi
4. LS Negi, "Design of Steel Structure" Tata McGraw Hill, New Delhi
5. S Ramamurthan, "Design of Steel Structures",
6. Harbhajan Singh, "Design and Drawing of Steel Structures", Abhishek Publishing, Chandigarh
7. IS Code : 800-2007

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	03	03
2	11	12
3	07	08
4	17	17
5	17	17
6	07	08
7	11	12
8	11	13
9	06	05
10	06	05
Total	96	100

6.2 EARTHQUAKE RESISTANT BUILDING CONSTRUCTION

L T P
Periods/Week 4 -

RATIONAL

Diploma holders in civil engineering have to supervise construction of various earthquake resistant buildings. Therefore, the students should have requisite knowledge regarding terminology of earthquake and the precautions to be taken while constructing earthquake resistant buildings

DETAILED CONTENTS

1. Elements of Engineering Seismology (12 periods)
General features of tectonic of seismic regions. Causes of earthquakes, Seismic waves, earthquake size (magnitude and intensity), Epicentre, Seismograph, Classification of earthquakes, Seismic zoning map of India, Static and Dynamic Loading, Fundamental period.
2. Seismic Behaviour of Traditionally-Built Constructions of India (08 periods)
Performance of building during earthquakes and Mode of failure (Out-of-plane failure, in-plane failure, Diaphragm failure, Connection failure, Non-structural components failure)
3. Special construction method, tips and precautions to be observed while planning, designing and construction of earthquake resistant building. (10 periods)
4. Introduction to IS: 4326, IS: 13828, IS: 1893(Part 1), 154326 and IS: 13920 (latest edition) (08 periods)
5. Seismic Provision of Strengthening and Retrofitting Measures for Traditionally-Built Constructions, Brick and RCC Structures (10 periods)
6. Provision of reinforcement detailing in masonry and RC constructions (08 periods)
7. Disaster Management: Disaster rescue, psychology of rescue, rescue workers, rescue plan, rescue by steps, rescue equipment, safety in rescue operations, debris clearance and casualty management. (08 periods)

INSTRUCTIONAL STRATEGY

The student may be taken for visit to various building construction sites where precautions related to earthquake resistant construction are being taken so that the students may appreciate the importance of the subject.

RECOMMENDED BOOKS

1. Elements of Earthquake Engineering by Jai Krishana and AR Chandrasekaran; Sarita Parkashan, Meerut.
2. Manual Published by Earthquake Engineering department, IIT Roorkee / IIT Kanpur
3. IS 13920, IS: 13827, IS: 13828, IS 1893, IS 4326 (latest edition)
4. Singh, Harbhajan “ Earthquake Resistant Building Construction” Abhishek Publishers, Chandigarh

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	12	19
2	08	15
3	10	17
4	08	10
5	10	19
6	08	08
7	08	12
Total	64	100

6.3 CONSTRUCTION MANAGEMENT AND ACCOUNTS AND ENTREPRENEURSHIP DEVELOPMENT

L T P
Periods/Week 6 - -

RATIONALE

This is an applied civil engineering subject. The subject aims at imparting basic knowledge about construction planning and management, site organisation, construction labour, control of work progress, inspection and quality control, accidents and safety and accounts.

DETAILED CONTENTS THEORY

CONSTRUCTION MANAGEMENT:

1. Introduction: (06 periods)
 - 1.1 Significance of construction management
 - 1.2 Main objectives of construction management and overview of the subject
 - 1.3 Functions of construction management, planning, organising, staffing, directing, controlling and coordinating, meaning of each of these with respect to construction job.
 - 1.4 Classification of construction into light, heavy and industrial construction
 - 1.5 Stages in construction from conception to completion
 - 1.6 The construction team: owner, engineer, architect and contractors, their functions and inter-relationship

2. Construction Planning: (12 periods)
 - 2.1 Importance of construction planning
 - 2.2 Stages of construction planning
 - Pre-tender stage
 - Contract stage
 - 2.3 Scheduling construction works by bar charts
 - Definition of activity, identification of activities
 - Preparation of bar charts for simple construction work

- Preparation of schedules for labour, materials, machinery and finances for small works
 - Limitations of bar charts
- 2.4 Scheduling by network techniques
- Introduction to network techniques; PERT and CPM, differences between PERT and CPM terminology
3. Organization: (06 periods)
- 3.1 Types of organizations: Line, line and staff, functional and their characteristics
4. Site Organization: (06 periods)
- 4.1 Principle of storing and stacking materials at site
- 4.2 Location of equipment
- 4.3 Preparation of actual job layout for a building
- 4.4 Organizing labour at site
5. Construction Labour: (08 periods)
- 5.1 Conditions of construction workers in India, wages paid to workers
- 5.2 Important provisions of the following Acts:
- Labour Welfare Fund Act 1936 (as amended)
 - Payment of Wages Act 1936 (as amended)
 - Minimum Wages Act 1948 (as amended)
6. Control of Progress: (04 periods)
- 6.1 Methods of recording progress
- 6.2 Analysis of progress
- 6.3 Taking corrective actions keeping head office informed
- 6.4 Cost time optimization for simple jobs - Direct and indirect cost, variation with time, cost optimization

7. Inspection and Quality Control: (08periods)

- 7.1 Need for inspection and quality control
- 7.2 Principles of inspection
- 7.3 Stages of inspection and quality control for
 - Earth work
 - Masonry
 - RCC
 - Sanitary and water supply services

8. Accidents and Safety in Construction: (10 periods)

- 8.1 Accidents – causes and remedies
- 8.2 Safety measures for
 - Excavation work
 - Drilling and blasting
 - Hot bituminous works
 - Scaffolding, ladders, form work
 - Demolitions
- 8.3 Safety campaign and safety devices

ACCOUNTS

9. Public Work Accounts: (20 periods)

Introduction, technical sanction, administrative approval, allotment of funds, re-appropriation of funds bill, contractor ledger, measurement book running and final account bills complete, preparation of bill of quantities (BOQ), completion certificate & report, hand receipt, acquittance roll. Muster Roll labour, casual labour roll-duties and responsibility of different cadres, budget-stores, returns, account of stock, misc. P.W. advances T & P – verification, survey report, road metal material charged direct to works, account - expenditure & revenue head, remittance and deposit head, definition of cash, precaution in custody of cash book, imprest account, temporary advance, treasury challan, preparation of final bills. Students must learn to prepare accounts register, stock register.

10. Entrepreneurship Development (14 periods)

10.1 Introduction

Entrepreneur-entrepreneurship, its meaning & importance. Qualities of an entrepreneur. Entrepreneur Motivation Training

10.2 Financing Agencies:

Financing agencies for land, infra structure, machinery, raw material, import of raw material and machinery. Role and function of Govt. department connected with the development of industries/business ventures in the State.

10.3 Industrial Legislation and taxes:

Industrial and labour laws, production tax, local tax, sales tax, excise duty and income tax.

10.4 Project Report:

Component of project report – Land building, electricity, water, equipment and other utilities. Materials, its availability, cost, labour availability and wage rates. Project report preparation, provisional registration and plan of acquiring finance from proper source (financing agencies).

INSTRUCTIONAL STRATEGY

This is highly practice-based course and efforts should be made to relate process of teaching with direct experiences at work sites. Participation of students should be encouraged in imparting knowledge about this subject. To achieve this objective the students should be taken to different work sites for clear conception of particular topics, such as site organization, inspection of works at various stages of construction and working of earth moving equipment

RECOMMENDED BOOKS

1. Harpal Singh, "Construction Management and Accounts", Tata McGraw Hill Publishing Company., New Delhi
2. Peurifoy, RL, "Construction Planning, Equipment and Methods", McGraw Hill, Tokyo
3. Singh, Harbhajan “ Construction Project Management” Abhishek Publishers, Chandigarh
4. Verma, Mahesh; "Construction Equipment and its Planning and Application
5. Dharwadker, PP; "Management in Construction Industry", , Oxford and IBH Publishing Company, New Delhi
6. Gahlot PS; Dhir, BM; "Construction Planning and Management", Wiley Eastern Limited, New Delhi
7. Softwares :
 - (a) MS Project – Microsoft USA
 - (b) Primavera

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	06
2	12	12
3	06	06
4	06	06
5	10	08
6	04	04
7	08	08
8	10	11
9	20	22
10	14	17
Total	96	100

6.4 ADVANCED CONSTRUCTION TECHNOLOGY

	L	T	P
Periods/ Week	4	-	-

RATIONALE

This is an applied technology subject. In this subject, knowledge regarding earth work, construction of high rise buildings and precast and pre stressed concreting operations and piles has been given.

DETAILED CONTENTS

1. Earth Work (20 Periods)
 - 1.1 Excavation in ordinary and hard soils, excavation in soft and hard rock, blasting techniques excavation in weak soils
 - 1.2 Side slopes of excavation; minimum working space at bottom, shoring strutting
 - 1.3 Dewatering technique – pumping and well points
 - 1.4 Disposal of spoil and balancing
 - 1.5 Safety aspects
 - 1.6 Embankments, compaction of earth fills, protection and drainage of embankments

2. High Rise Construction (12 Periods)
 - 2.1 Construction techniques for high rise buildings
 - 2.2 Construction techniques for chimneys and cooling towers

3. Precast and Prestressed Concrete Construction (20 Periods)
 - 3.1 Introduction of prestressed concrete, general theory. Linear post tensioning – general, post tensioning advantages to the design engineer and the contractor
 - 3.2 Linear post tensioning system, high strength post tensioned stands, parallel lay wire, high strength alloy steel bars
 - 3.3 Techniques of post tensioning – general, special requirements for forming and false work, ducts or tendons, concreting, stressing procedure, grouting, protecting anchorage from corrosion
 - 3.4 Pretensioning - general, pretensioning yards set up, forms for pretensioned structural elements, special techniques of pretensioning

- 3.5 Materials of prestressing – cement, aggregates concrete, admixtures, vibration, curing, light weight aggregates, high strength steel bars, high strength stand, stress relaxation, galvanization. Codes specifications and inspection, manufacturers of prestressing equipment, specifications, sizes and costs
4. Piles (12 Periods)
Piles; basic piling methods for various types of piles, methods of pile driving, non – displacement piles, problems in pile construction, pile testing

Note: To visit high rise buildings and flyovers construction site and their report writing

INSTRUCTIONAL STRATEGY

The subject shall consist of visits by the students to various construction sites where they shall see the heavy construction works. They shall also contact the representatives of the manufacturers of various construction equipment and collect information from practical demonstration, discussions and technical information received from the firms.

RECOMMENDED BOOKS

1. Gupta, Sushil Kumar, Singla, DR. and Juneja BM, “A Text Book of Building Construction”; Ludhiana Katson Publishing House.
2. Deshpande, RS and Vartak, GV; “A Text Book of Building Construction”; Poona United Book Corporation.
3. Kulkarni, GJ; “A Text Book of Building Construction”; Ahmedabad Book Depot.
4. Arora, SP and Bindra, SP; “A Text Book of Building Construction”; New Delhi Dhanpt Rai and Sons.
5. Sharma, SK and Kaul, BK; “A Text Book of Building Construction”; Delhi, S Chand and Corporation
6. Sushil Kumar; “Building Construction”; Delhi Standard Publishers Distributors.
7. Moorthy, NKR; “A Text Book of Building Construction”; Poona, Engineering Book Publishing Corporation
8. N.Krishna Raju, “Prestressed Concrete”, Tata McGraw Hills, New Delhi
9. P Dayaratnam, “Prestressed Concrete”, “Laxmi Publication, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	20	30
2	12	20
3	20	30
4	12	20
Total	64	100

6.5 ENVIRONMENTAL POLLUTION CONTROL

L T P
Periods/Week 4 - -

RATIONALE

Civil Engineering diploma holders must have the knowledge of different types of environmental aspects related to development activities so that they may help in maintaining the ecological balance and control pollution. They should also be aware of the related environmental laws for effectively combating environmental pollution. The class room instructions should be supplemented by field visits to show the pollution caused by urbanization and the combatment measures being adopted at site. Extension lectures by experts may be encouraged.

DETAILED CONTENTS

1. Study of Importance of Environmental Engineering (04 periods)
Importance of clean environment, control of environmental pollution with respect to air, land and water. Conservation of natural resources, environmental education and awareness, sustainable development.
2. Water Pollution (06 periods)
Causes of pollution in surface and underground water eutrophication of lakes and its preventing measure; BIS standards for water quality.
3. Air Pollution (09 periods)
Definition, principal air pollutants, atmospheric parameters influencing air pollution, types of air contaminants and their sources, effects of air pollution on human beings, plants, animals, automobile pollution, BIS ambient air quality standards and measures to combat air pollution
4. Noise Pollution (05 periods)
Definition, unit of measurement of noise, sources and effects of noise pollution and control of noise pollution
5. Effects of mining, blasting and deforestation (04 periods)
Ill effects of mining, blasting and deforestation on the environment human life and wild life.

6. Land Use (08 periods)
Effect of land use on environmental quality, land use and natural disasters,(land slides etc) soil degradation problems - erosion, water logging, soil pollution etc.
7. Environmental Impact Assessment (08 periods)
Definition and requirements, environmental impact assessment. Flow chart of environmental impact assessment methodology. Describe the need and importance of EIA.
8. Legislation to Control Environmental Pollution (idea) (05 periods)
Indian legislative acts for water, land and air pollution control – provisions, scope and implementation
9. Global Issues of Environmental Engineering (07 periods)
Global warming, ozone depletion, acid rain, oil pollution; radiation hazards and their control, concept of clean technology and carbon credits.
10. Renewable Source of Energy (08 periods)
Role of non-conventional sources of energy (biogas, solar, wind etc) in environmental protection. Conservation of energy resources like coal, oil etc., alternative fuels, bio-diesel etc.

INSTRUCTIONAL STRATEGY

Students should be encouraged to undertake project work related to environmental problems. They should visit industrial effluent treatment plant, water treatment plant and environmental engineering laboratory and study the impact of utilization of reclaimed by products

RECOMMENDED BOOKS

1. Deswal DS and Deswal SS “Environmental Engineering” Dhanpat Rai and Company (P) Ltd., Delhi
2. Odum EP, “Fundamentals of Ecology”, Amarind Publication Co., Delhi
3. Dhamija SK “Environmental Engineering and Management ; SK Kataria and Sons, Delhi

4. De AK, "Engineers Chemistry", New Age Publication, Delhi
5. Kendeigh SC, "Ecology", Prentice Hall of India, Delhi
6. Khitoliya, RK, "Environmental Pollution", S Chand & Co. Ltd., New Delhi
7. Bhatia, HS, "A text book of Environmental Pollution and Control", Galgotia. Publishers, Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	04
2	06	10
3	09	16
4	05	08
5	04	06
6	08	12
7	08	12
8	05	08
9	07	12
10	08	12
Total	64	100

6.6 STRUCTURAL DRAWINGS

L T P
Periods/Week - - 8

RATIONALE

Diploma holders in Civil Engineering are required to supervise the construction of RC and steel structures. Thus one should be able to read and interpret structural drawings of RC and steel structures. The competence to read and interpret structural drawings is best learnt by being able to draw these drawings. Hence there is a need to have a subject devoted to preparation of structural drawings.

DETAILED CONTENTS

PART A

Drawing Exercises

1. RC Structures:

Reinforcement details from the given data for the following structural elements with bar bending schedules

- (i) Drawing No. 1: RC Slabs - One way slab and Two way slab.
- (ii) Drawing No.2 : Beams - Singly and doubly reinforced rectangular beams and Cantilever beam (All beams with vertical stirrups)
- (iii) Drawing No.3 : Columns and Footings – Square, Rectangular and Circular Columns with lateral ties and their isolated sloped column footings.
- (iv) Drawing No. 4 : Portal Frame – Three bay two storey RC portal frame with blow up of column beam junctions.
- (v) Drawing No.5: Dog legged stairs for single storey building
- (vi) Drawing No.6 : Draw atleast one sheet using CAD software

PART B

2. Steel Structures:

Structural drawing from given data for following steel structural elements.

- (i) Drawing No. 1: Roof Truss – Drawing of Fink Roof Truss with details of joints, fixing details of purlins and roof sheets.
- (ii) Drawing No.2 : Column and Column Bases - Drawing of splicing of steel columns. Drawings of slab base, gusseted base and grillage base for single section steel columns.

(iii) Drawing No.3 : Column Beam Connections

(a) Sealed and Framed Beam to Beam Connections

(b) Sealed and Framed beam o Column Connections

(iv) Drawing No. 4 : Plate Girder

Plan and Elevation of Plate Girder with details at supports and connection of stiffness, flange angles and cover plate with web highlighting curtailment of plates.

(v) Drawing No. 5 : Draw atleast one sheet using CAD software

RECOMMENDED BOOKS

1. Loyal JS “Civil Engineering Drawing”, Satya Parkashan, New Delhi
2. Chandel RP “ Civil Engineering Drawings”
3. Kumar; NS “ Civil Engineering Drawing “ IPH, New Delhi
4. Malik RS and Meo GA, “Civil Engineering Drawing” Asian Publishing House, New Delhi
5. Singh, Birinder “RCC Design and Drawing” Kaption Publishing House, New Delhi.
6. Singh, Birinder “Steel Structures Design and Drawing”, Kaption Publishing House, New Delhi
7. Singh, Harbhajan, “Structural Drawings”, Abhishek Publishers, Chandigarh
8. B.V. Sikka, Civil Engineering Drawing.

6.7 MAJOR PROJECT WORK (INDUSTRY/FIELD ORIENTED - PRACTICE BASED)

L T P
- - 8

As far as possible students should be given live project problems with a view to :

- i) Develop understanding regarding the size and scale of operations and nature of field work in which students are going to play their role after completing the courses of study.
- ii) Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- iii) Provide first hand experience to develop confidence amongst the students to enable them to use and apply classroom based knowledge and skills to solve practical problems of the world of work.
- iv) Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

For the fulfillment of above objectives, polytechnics may establish close linkage with 8-10 relevant organization for providing such an experience. It is necessary that each organization is visited well in advance by respective teachers and activities to be performed by students are well defined. The chosen activities should be such which are of curricular interest to students and of professional value to industrial/field organizations. Each teacher is expected to supervise and guide 5 - 6 students.

Effort should be made to identify actual field problems to be given as project work to the students. Project selected should not be too complex which is beyond the comprehension level of the students. The placement of the students for such a practical cum project work should match with the competency profile and interest of students. Students may be assessed both by industry and polytechnic faculty. The suggested performance criteria is given below:

a)	Punctuality and regularity	10
b)	Initiative in learning/working at site	10
c)	Level/proficiency of practical skills acquired	10
d)	Sense of responsibility	10
e)	Self expression/Communication skills	10
f)	Interpersonal skills	10
g)	Report writing skills	20
h)	Viva voce	20

Some of suggested projects are given below: These are only guidelines, teacher may take any project related to Civil Engineering depending upon the availability of projects. Preference should be given to practical oriented projects.

According to the need of the polytechnic, the following major projects are suggested:

1. Construction of a small concrete road consisting of following activities
 - Survey and preparation of site plan
 - Preparation of drawings i.e. L-Section and X-Section
 - Estimating earth work
 - Preparation of sub grade with stone ballast
 - Laying of concrete
 - Testing of slump, casting of cubes and testing
 - Material estimating and costing with specifications
 - Technical report writing
2. Water Supply system for a one or two villages
 - Surveying
 - Design of water requirements and water distribution system
 - Preparation of drawing of overhead tank
 - Material estimating and costing
 - Specifications
 - Technical report writing
3. Construction of seating benches in polytechnic campus
4. Welding of angle iron and Expanded metal jali to prepare fencing in polytechnic campus
5. Construction of toilets and baths for a shopping complex in a township
6. Construction of bridal path 4 kms long
7. Construction of shopping complex by detailing of RCC drawings, estimating and costing of material
8. Rainwater harvesting
 - Assessment of catchment's area
 - Intensity of rainfall
 - Collection of water
 - Soak pit design
 - Supply of water
 - Monitoring during rainy season
9. Design and construction of septic tank with soak pit for 100 users
10. Preparing plumbing detailed drawings of a two storey building and material estimate and costing
11. Planning and design of sports stadium in a township or cluster of villages

12. Design of small residential building including structural members, specifications, estimating and costing of materials, report writing and municipal drawings for water supply and sewerage system
13. Concrete Mix Design
14. Construction of concrete cubes by mixing appropriate quantity of fly ash with fibres
 - (i) the fibres like polypropylene, carbon, steel etc. can be used
 - (ii) students will show the comparison between concrete mixed with fibres versus the quality controlled concrete.
15. Estimation and designing of Highway Road
 - (i) Reconnaissance survey of proposed road
 - (ii) To take L - section and cross sections
 - (iii) Fixing of grades
 - (iv) Estimation of cutting and filling of earth mass
 - (v) Plane tabling survey of proposed road
 - (vi) Estimation of proposed road
16. Designing a small height gravity dam
 - (i) Constructing of catchment area
 - (ii) Calculating the reservoir capacity
 - (iii) Designing of gravity dam by taking into account various forces
17. Designing of ferro-cement water tank and toilet. Testing of the ferro-cement products in civil engineering labs.

Note: The projects undertaken should be field oriented

6.8 SURVEY CAMP

10 Days Duration

Purpose

- a) Making the students conversant with the camp life
- b) Providing an opportunity to the students to develop team spirit
- c) Training the students to communicate with the local population
- d) To impart intensive training in the use of all surveying instruments viz. Theodolite , Dumpy level, Compass, tachometer etc.
- e) To train the students to appreciate practical difficulties in surveying on the field
- f). To train the students for self management

Task:

Preparation of topographical plan of a given area. The survey camp will be organized for a duration of 10 days time span.

The students may be assigned an undulated area of about 1.5 to 2.00 sq.km. with level difference of 15m consisting of good number of physical features such as buildings, roads, bridges, culverts, railway tracks, electric lines etc. They are required to prepare the topographic map of above areas showing various features along with contours using a suitable contour intervals. They will mark a road alignment of given gradient connecting any two stations on the map consisting some horizontal and vertical curves and will prepare estimate of earthwork and submit the detailed technical report indicating therein practical difficulties faced during surveying for the features like ridge, line, valley lines, saddle cliffs etc.

The students should be divided in the groups consisting of 5-7 in numbers. They are required to submit the Report of work done, during survey camp, which will be dully examined, while awarding the internal assessment.

6.9 EMPLOYABLE SKILLS

L T P
Periods per week - - 4

RATIONALE

Diploma holders are required to not only possess subject related knowledge but also soft skills to get good jobs and to rise steadily at their workshop. This subject is included to develop employability skills amongst the students

DETAILED CONTENTS

1. Industrial Scenario Engineering Education and expectations of competences from an engineer by employer (04 period)
2. Personality types, characteristic and features for a successful engineer (04 period)
3. Professional Engineer desirable values and ethics and their development. Relation between engineering profession, society and environment (04 period)
4. Managing project (16 period)
 - Leadership
 - Motivation
 - Time management
 - Resource management
 - Computer Software
 - Interpersonal relationship
 - Engineer economics and fundamentals
5. Effective Communication (08 period)
 - Listening
 - Speaking
 - Writing
 - Presentation Technique/Seminar
 - Group discussion
6. Preparing for Employment (08 period)
 - Searching for job/job hunting
 - Resume Writing
 - Interview technique in personal interview telephonic interview, panel interview, group interview, video conference
7. Managing Self (06 period)
 - Managers body, mind, emotion and spirit
 - Stress Management
 - Conflict resolution

8. Continuing professional development (04 period)
 - Organising learning and knowledge
 - Use of computer for organising knowledge resource
9. Creativity, Innovation and Intellectual property right (06 period)
 - Concept and need in present time for an engineer
10. Basic rules, laws and norms to be adhered by engineers during their working (04 period)