3.1 FLUID MECHANICS

L	T	P
3	-	2

RATIONALE

Subject of Hydraulics 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: (01 hrs)

   1.1 Fluids: Real and ideal fluids

   1.2 Fluid Mechanics, Hydrostatics, Hydrodynamics, Hydraulics

2. Properties of Fluids (definition only) (03 hrs)

   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: (08 hrs)

   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: (05 hrs)

   4.1 Atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure.

   4.2 Piezometer, simple manometer and differential manometer, Bourden gauge and dead weight pressure gauge.

5. Fundamentals of Fluid Flow: (06 hrs)

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

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) (06 hrs)

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: (08 hrs)

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 Hydraulic gradient line and total energy line

7.5 Flow from one reservoir to another through a long pipe of uniform cross section (simple problems)

7.6 Pipes in series and parallel

7.7 Water hammer phenomenon and its effects (only definition and description)

8. Flow through open channels: (09 hrs)

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: (02 hrs)

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 Bernoullis 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 experiement

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 Hyraulics" 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 (Hrs)	Marks Allotted (%)
1	01	01
2	03	05
3	08	16
4	05	10
5	06	13
6	06	13
7	08	18
8	09	20
9	02	04
Total	**48**	**100**

3.2 STRUCTURAL MECHANICS

L	T	P
4	-	2

RATIONALE

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

DETAILED CONTENTS

THEORY:

1. Properties of Materials (02 hrs)

    1.1 Classification of materials, elastic materials, plastic materials, ductile materials, brittle materials.

    1.2 Introduction to tensile test, compressive test, impact test, fatigue test, torsion test on metals.

2. Simple Stresses and Strains: (12 hrs)

    2.1 Concept of stress, normal and shear stresses,

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

    2.3 Hooke's law, modulii of elasticity and rigidity, Bulk modulus of elasticity, relationship between the elastic constants.

    2.4 Stresses and strains in bars subjected to tension and compression. Extension of uniform bar under its own weight, stress produced in compound bars (two or three) due to axial load.

    2.5 Stress-strain diagram for mild steel and HYSD steel, mechanical properties, factor of safety.

    2.6 Temperature stresses and strains

3. Shear Force and Bending Moment: (16 hrs)

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. Moment of Inertia: (04 hrs)

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.

5. Bending Stresses in Beams: (06 hrs)

5.1 Concept of pure/simple bending

5.2 Assumptions made in the theory of simple bending, derivation and application of bending equation to circular cross-section, I section, T&L sections only

5.3. Moment of resistance

5.4 Calculations of bending stresses in simply supported beam

6. Combined Direct and Bending Stresses: (06 hrs)

6.1. Concentric and eccentric loads single axis eccentricity only
6.2. Effect of eccentric load on the section stresses due to eccentric loads, Numerical in the case of short columns.
6.3. Simple problems on stability of masonry dams and retaining walls

7. Shear Stresses in Beams (04 hrs)

7.1 Concept of shear stresses in beams, shear stress distribution in rectangular, circular I, T, L sections (Formula to be stated, no derivation)

8. Slope and Deflection: (04 hrs)

Necessity for determination of slope and deflection
Moment area theorem (no derivation, numerical problems)

9. Columns: (04 hrs)

9.1 Theory of columns
9.2 Eulers and Rankine Formula (No derivation)

10. Analysis of Trusses: (06 hrs)

10.1 Concept of a perfect, redundant and deficient frames
10.2 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) Ramamrutham, S., "Strength of Materials", Dhanpat Rai and Sons., New Delhi

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

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

iv) Prasad VS " Structural mechanics Galgotia publications Pvt Ltd, Delhi

v) Sadhu Singh "Strengths of Materials" Standard Publishers, New Delhi

vi) Singh Birinder "Structural Mechanics" Kaption Publishers, Ludhiana

vii) Singh Harbhajan, " Structural Mechanics" ., Abhishek Publishers, Chandigarh

viii) Singh Harbhajan, "Design of Masonry and Timber Structures" Abhishek Publishers, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	04
2	12	17
3	16	27
4	04	04
5	06	10
6	06	10
7	04	06
8	04	06
9	04	06
10	06	10
Total	**64**	**100**

3.3 SURVEYING - I

L	T	P
2	-	5

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: (02 hrs)

    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: (03 hrs)

    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: (07 hrs)

    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: (10 hrs)

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 (10 hrs)

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)

V. Layout of Buildings (from given drawing of two room residential building) by use of surveying instruments.

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 Trignometrical Survey(GTS), Dehradun.

RECOMMENDED BOOKS

1. Hussain, SK and Nagraj, MS; "Text Book of Surveying"; New Delhi, S Chand and Co Ltd.

2. Deshpande, RS; "A Text Book Surveying and Levelling"; Poona, United Book Corporation

3. Kocher, CL; "A Text Book of Surveying"; Ludhiana, Katson Publishing House

4. Kanetkar,TP and Kulkarni, SV., "Surveying and Leveling", Poona, AVG Parkashan

5. Kanetkar, TP; and Kulkarni, SV; "Surveying and Leveling" Poona, AVG Prakashan

6. Mahajan, Sanjay “Surveying -I”, Tech. Publication, Delhi

7. Punmia, BC; "Surveying and Leveling", Delhi Standard Publishers Distributors.

8. Shahai, PB; "A Text Book of Surveying", Oxford and IBH Publishing Co.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	07
2	03	09
3	07	24
4	10	30
5	10	30
Total	**32**	**100**

3.4 CONSTRUCTION MATERIALS

L T P
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 hrs)

    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 , startified 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 hrs)

    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 hrs)

**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 hrs)

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 hrs)

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 hrs)

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 hrs)

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: (10hrs)

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, "Constrution 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 (Hrs)	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
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 hr)

    1.1 Definition of a building, classification of buildings based on occupancy
    1.2 Different parts of a building

2. Foundations: (06 hrs)

    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 hrs)

    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 hrs)

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 hrs)

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 hrs)

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 alumininium 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 hrs)

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 hrs)

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 hrs)

9.1 Types of roofs, concept of flat, pitched and arched roofs
9.2 Glossary of terms for pitched roofs - batten, eaves, facia 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 hrs)

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 hrs)

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 hrs)

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 hrs)

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 Introduction to National Building code.

14 Building Services (05 hrs)

Introduction to fire fighting systems, Ducting for Air-conditioning, service lines for cable telephone, and electrical wiring , garbage disposal systems. Water supply system (internal and external).

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

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 (Hrs)	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 CIVIL ENGINEERING DRAWING - I

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 atleast 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 (a) (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. 7 (b)

Draw detailed plan, elevation and section of:

(i) Single flight R.C.C. stair case
(ii) Dog legged wooden stair case

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 atleast one sheet using CAD software

Drawing No. 11 (one sheet)

Drawing details of damp proofing arrangement of roofs and walls as per BIS Code. Show the rain water drainage arrangement also.

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