

12. STUDY AND EVALUATION SCHEME

THIRD SEMESTER

| Sr. No. | SUBJECTS | STUDY SCHEME | | Credits (C) L+P = C | MARKS IN EVALUATION SCHEME | | | | | | Total Marks of Internal & External |
|------------------------------------|--|--------------|-----------|------------------------|----------------------------|------------|------------|---------------------|------------|------------|------------------------------------|
| | | Periods/Week | | | INTERNAL ASSESSMENT | | | EXTERNAL ASSESSMENT | | | |
| | | L | P | | Th | Pr | Tot | Th | Pr | Tot | |
| 3.1 | Industrial/In-House Training - I | - | 2 | 0+1=1 | - | 40 | 40 | - | 60 | 60 | 100 |
| 3.2 | Concrete Technology | 2 | 2 | 2+1=3 | 40 | 40 | 80 | 60 | 60 | 120 | 200 |
| 3.3 | Structural Mechanics | 2 | 4 | 2+2=4 | 40 | 40 | 80 | 60 | 60 | 120 | 200 |
| 3.4 | Surveying-I | 2 | 6 | 2+3=5 | 40 | 40 | 80 | 60 | 60 | 120 | 200 |
| 3.5 | Building Construction | 2 | 4 | 2+2=4 | 40 | 40 | 80 | 60 | 60 | 120 | 200 |
| 3.6 | Fluid Mechanics | 2 | 2 | 2+1=3 | 40 | 40 | 80 | 60 | 60 | 120 | 200 |
| 3.7 | Multidisciplinary Elective (MOOCs ⁺ /Offline) | 2 | - | 2+0=2 | 40 | - | 40 | 60 | - | 60 | 100 |
| # Student Centered Activities(SCA) | | | 3 | - | - | - | - | - | - | - | - |
| Total | | 12 | 23 | 22 | 240 | 240 | 480 | 360 | 360 | 720 | 1200 |

+ Assessment of Multidisciplinary Elective through MOOCs shall be based on assignments out of 100 marks.

Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017 etc., games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

3.1 INDUSTRIAL / IN-HOUSE TRAINING-I

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RATIONALE

Industrial training / In – house training will help the students to understand the working environment of relevant industries. The student will learn to work in team to solve the industrial problems. It will also give exposure about the present and future requirements of the relevant industries. This training is very important for development of required competencies and skills for employment and start– ups.

COURSE OUTCOMES

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

- CO1: Understand the working environment of industries
- CO2: Take necessary safety precautions and measures.
- CO3: Learn about present and future requirement of industries.
- CO4: Work in team for solving industrial problems
- CO5: Develop competencies and skills required by relevant industries.
- CO6: Develop writing, speaking and presentations skills.

PRACTICAL EXERCISES

1. Report writing based on industrial training.
2. Preparation of Power Point Slides based on industrial training and presentation by the candidate.
3. Internal Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.
4. External Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.

GUIDELINES

Students will be evaluated based on Industrial training / In – house training report and their presentation using Power Point about the knowledge and skills gained during the training. The Head of the Department will depute faculty coordinators by assigning a group of students to each. The coordinators will mentor and guide the students in preparing the PPTs for final presentation.

The following performance parameters are to be considered for assessment of the students out of 100 marks:

| | Parameter | Weightage |
|-----|--|------------------|
| i | Industrial / In-house assessment of the candidate by the trainer | 40% |
| ii | Report Writing | 20% |
| iii | Power Point Presentation | 20% |
| iv | Viva-voce | 20% |

3.2 CONCRETE TECHNOLOGY

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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.

COURSE OUTCOMES

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

- CO1: Conduct various tests on aggregate in laboratory to evaluate their characteristics
- CO2: Interpret the grading charts of different aggregates and evaluate fineness modulus of aggregates
- CO3: Evaluate workability and strength of concrete
- CO4: Recognise bleeding, segregation, harshness defects in fresh concrete
- CO5: Explain hydration process of cement, water to cement (w/s) ratio and analyze relationship between compressive strength and w/c ratio
- CO6: Conduct various destructive and non-destructive (NDT) test

DETAILED CONTENTS

UNIT I

1. Introduction to Concrete

- 1.1 Definition of concrete, properties of concrete. Advantages and disadvantages of concrete.

2. Ingredients of Concrete

- 2.1 Cement: Introduction only

- 2.2 Aggregates:

- 2.2.1 Classification of aggregates according to size and shape

- 2.2.2 Characteristics of aggregates: Particle size and shape, surface texture, specific gravity of aggregate; bulk density, water absorption, surface moisture, bulking of sand, deleterious materials soundness
- 2.2.3 Grading of aggregates: coarse aggregate, fine aggregate; All-in- aggregate; fineness modulus; interpretation of grading charts
- 2.3 Water: Water Quality requirements as per IS:456-2000

UNIT II

3. Water Cement Ratio

- 3.1 Hydration of cement principle of water-cement ratio, Duff Abram's Water-cement ratio law: Limitations of water-cement ratio law and its effects on strength of concrete

4. Properties of Concrete

- 4.1 Properties in plastic state: Workability, Segregation, Bleeding and Harshness
- 4.1.1 Factors affecting workability, Measurement of workability: slump test, compacting factor; Recommended slumps for placement in various conditions as per IS:456-2000/SP-23
- 4.2 Properties in hardened state: Strength, Durability, Impermeability, Dimensional changes.
- 4.3 Concrete mix design (Introduction only)
- 4.4 Introduction to Admixtures (chemicals and minerals) for improving performance of concrete

UNIT III

5. Concreting Operations

- 5.1 Storing of Cement:
- 5.1.1 Storing of cement in a warehouse
- 5.1.2 Storing of cement at site
- 5.1.3 Effect of storage on strength of cement
- 5.1.4 Determination of warehouse capacity for storage of Cement
- **5.2 Storing of Aggregate: Storing of aggregate at site
- **5.3 Batching (to be shown during site visit)
- 5.3.1 Batching of Cement
- 5.3.2 Batching of aggregate by:
- Volume, using gauge box (farma) selection of proper gauge box
 - Weight spring balances and batching machines
- 5.3.3 Measurement of water

****5.4 Mixing:**

- 5.4.1 Hand mixing
- 5.4.2 Machine mixing - types of mixers, capacities of mixers, choosing appropriate size of mixers, operation of mixers.
- 5.4.3 Maintenance and care of mixers

UNIT IV

- **6.1** Transportation of concrete: Transportation of concrete using: wheel barrows, transit mixers, chutes, belt conveyors, pumps, tower crane and hoists etc.
- **6.2** Placement of concrete: Checking of form work, shuttering and precautions to be taken during placement
- 6.3 Compaction:
 - 6.3.1 Hand compaction
 - 6.3.2 Machine compaction - types of vibrators, internal screed vibrators and form vibrators
 - 6.3.3 Selection of suitable vibrators for different situations
- 6.4 Finishing concrete slabs - screeding, floating and trowelling
- 6.5 Curing:
 - 6.5.1 Objective of curing, methods of curing like ponding, membrane curing, steam curing, chemical curing
 - 6.5.2 Duration for curing and removal of form work
- 6.6 Jointing: Location of construction joints, treatment of construction joints, expansion joints in buildings - their importance and location
- 6.7 Defects in concrete: Identification of defects and methods of removing defects.

UNIT V**7. Special Concretes (only features)**

- 7.1 Concreting under special conditions, difficulties, and precautions before, during and after concreting
 - 7.1.1 Cold weather concreting
 - 7.1.2 Under water concreting
 - 7.1.3 Hot weather concreting
- 7.2 Ready mix concrete
- 7.3 Fly ash concrete

8. Importance and methods of non-destructive tests (introduction only)

- 8.1. Rebound Hammer Test

8.2. Pulse Velocity method

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

PRACTICAL EXERCISES

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

RECOMMENDED BOOKS

1. KT Rao, A Kasundra and Khandekar, "Concrete Technology by Krishnamurthy, AA. Dhanpat Rai and Sons, Delhi.
2. BL Gupta and Amit Gupta, "Textbook of Concrete Technology", Standard Publishers Distributors, Delhi.
3. BL Handoo, LD Puri, and Sanjay Mahajan, "Concrete Technology", Satya Prakashan, New Delhi.
4. Hemant Sood, LN Mittal and PD Kulkarni, "Laboratory Manual on Concrete Technology" by; CBS Publishers, New Delhi.
5. Birinder Singh, "Concrete Technology", Kaption Publications, Ludhiana.
6. Dr. Hemant Sood, Module on "Special Concretes", NITTTR Chandigarh.

7. “Video programme on different experiments in ‘Concrete Technology’”, NITTTR, Chandigarh.
8. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

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 to make them confident in the preparation and testing of concrete. Teachers should also organize viva examination to develop understanding about concepts and principles involved. The experiments may also be demonstrated to students Periods through video programmes developed in the field of ‘concrete technology’ by NITTTR, Chandigarh. This subject contains five units of equal weightage.

3.3 STRUCTURAL MECHANICS

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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.

COURSE OUTCOMES

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

- CO1: Conduct different tests on mild steel
- CO2: Analyse and explain stress-strain diagram of mild and HYSD steel
- CO3: Calculate various forces used in design of structures
- CO4: Calculate shear force, bending moment for simply supported, cantilever and overhanging beams with concentrated and uniformly distributed loads
- CO5: Calculate moment of inertia, second moments of inertia, radius of gyration, section modulus for L, T, channel and I sections
- CO6: Calculate the bending stresses, moment of resistance of simply supported beams

DETAILED CONTENTS

UNIT I

1. Properties of Materials

- 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

- 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 due to axial load (two or three bars)
- 2.5 Stress-strain diagram for mild steel and HYSD steel, mechanical properties, factor of safety.
- 2.6 Temperature stresses and strains

UNIT II**3. Shear Force and Bending Moment**

- 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 and simply supported subjected to concentrated, uniformly distributed
- 3.5 Relationship between load, shear force and bending moment, point of maximum bending moment, and point of contraflexure.

UNIT III**4. Moment of Inertia**

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.

UNIT IV**5. Bending Stresses in Beams**

- 5.1 Concept of pure/simple bending
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- 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
- 5.5 Concept of shear stresses in beams, shear stress (introduction only)

6. Slope and Deflection

Determination of slope and deflection using Moment Area Theorem for simply supported beam for pointed load and U.D.L numerical problems. (no derivation,)

UNIT V

7. Columns

- 7.1 Theory of columns
- 7.2 Problem solving using Euler's and Rankine Formula

8. Analysis of Trusses

- 8.1 Concept of a perfect, redundant, and deficient frames
- 8.2 Assumptions and analysis of trusses by:
 - a) Method of joints
 - b) Method of sections

PRACTICAL EXERCISES

- 1. 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
- 2. Testing of HYSD Steel
- 3. Determination of Young's modulus of elasticity for steel wire with sear's apparatus
- 4. Determination of modulus of rupture of a concrete beam
- 5. Determination of maximum deflection and young's modulus of elasticity in simply supported beam with load at middle third point
- 6. Verification of forces in a framed structure

RECOMMENDED BOOKS

- 1. S Ramamrutham, "Strength of Materials", Dhanpat Rai and Sons, New Delhi.
- 2. Ram Chandra, "Applied Mechanics and Strength of Materials", Standard Publishers, Delhi.

3. BC Punmia, "Strength of Materials", Standard Publishers, Delhi.
4. Sadhu Singh, "Strengths of Materials", Standard Publishers, New Delhi.
5. Birinder Singh, "Structural Mechanics", Kaption Publishers, Ludhiana.
6. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. <http://swayam.gov.in>

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. This subject contains five units of equal weightage.

3.4 SURVEYING - I

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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.

COURSE OUTCOMES

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

CO1: Prepare maps for closed traverse and open traverse with survey instruments

CO2: Measure bearing of line

CO3: Perform leveling with digital level

CO4: Perform temporary adjustments of leveling instruments

CO5: Draw a contour plan of an area.

DETAILED CONTENTS

UNIT I

Introduction and Basic Concepts

- 1.1 Definition and Purpose of Surveying
- 1.2 Primary Division of Surveying
- 1.3 Basic principles of surveying
- 1.4 Measurements-linear and angular
- 1.5 Units of measurements

- 1.6 Instruments used for taking these measurements
- 1.7 Classification of surveying

UNIT-II

Chain and Compass Surveying

- 2.1 Purpose and principles of chain surveying
- 2.2 Operations in Chain Surveying (Ranging, Measurement, Offsetting)
- 2.3 Purpose of compass surveying
- 2.4 Use of prismatic compass: Setting and taking observations
- 2.5 Concept of following with simple numerical problems:
 - a) Meridian - Magnetic and true, Arbitrary
 - b) Bearing - Magnetic, True and Arbitrary
 - c) Whole circle bearing and reduced bearing
 - d) Fore and back bearing
 - e) Magnetic dip and declination
- 2.6 Local attraction – Problems, causes, detection, errors and corrections,

UNIT-III

Levelling

- 3.1 Definition and Purpose of levelling
- 3.2 Various technical terms used in levelling (level surface, horizontal surface, vertical surface, datum, reduced level, bench marks, line of collimation, axis of the bubble tube, axis of the telescope and vertical axis)
- 3.3 Identification of various parts of Auto level, leveling staff types, uses and least count of leveling staff
- 3.4 Temporary adjustment and permanent adjustment of Auto level
- 3.5 Concept of back sight, foresight, intermediate sight, change point, to determine reduce levels
- 3.6 Level book and reduction of levels by
 - 3.7.1 Height of collimation method and
 - 3.7.2 Rise and fall method (Numerical problems)
- 3.7 Methods of Levelling (Simple levelling, differential levelling, fly levelling, check leveling and profile levelling (L-section and X-section) only (Numerical problems)
- 3.8 Problem on reduction of levels, Errors in levelling

UNIT-IV**Plane Table Surveying**

- 4.1 Introduction and Definition of plane table surveying
- 4.2 Advantages & Disadvantages of plane table surveying
- 4.3 Equipment used in plane table survey
- 4.4 Setting of a plane table:
 - (a) Centering
 - (b) Levelling
 - (c) Orientation
- 4.5 Methods of plane table surveying
 - (a) Radiation,
 - (b) Traversing
- 4.6 Errors in plane table survey

UNIT-V**Contouring**

- 5.1 Definition and Purpose of contours
- 5.2 Contour interval and horizontal equivalent
- 5.3 Factors effecting contour interval
- 5.4 Characteristics of contours
- 5.5 Methods of contouring: Direct and indirect
- 5.6 Use of stadia measurements in contour survey
- 5.7 Interpolation of contours; use of contour map
- 5.8 Drawing cross section from a contour map; marking alignment of a road, railway line and a canal on a contour map

PRACTICAL EXERCISES

- I Demonstration of chain surveying
- 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 Auto level and levelling staff
 - b) Temporary adjustments of Auto 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 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.
- VI Contouring:
 - i) Preparing a contour plan by radial line method by the use of a Auto level.
 - ii) Preparing a contour plan by method of squares
 - iii) Preparing a contour plan of a Road/Railway track/Canal by taking cross sections.
 - iv) Computation of earth work and reservoir capacity from a contour map

RECOMMENDED BOOKS

1. CL Kochar, "A Text Book of Surveying", Katson Publishing House, Ludhiana.
2. TP Kanetkar and SV Kulkarni, "Surveying and Leveling", AVG Parkashan, Poona.
3. Sanjay Mahajan, "Surveying –I", Tech. Publication, Delhi.
4. BC Punmia, "Surveying and Leveling", Standard Publishers Distributors, Delhi.
5. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. <http://swayam.gov.in>

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 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. This subject contains five units of equal weightage.

3.5 BUILDING CONSTRUCTION

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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.

COURSE OUTCOMES

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

- CO1: Explain different types of walls, scaffolding, shoring, underpinning and their constructional methodology
- CO2: Carry out the construction of brick wall.
- CO3: Supervise rubble and ashlar types of stone masonry construction
- CO4: Select different types of doors, windows, floors and stairs cases in building
- CO5: Recognize different parts of roof trusses and drainage system of roofs
- CO6: Evaluate the possible reason of dampness at various level in building and remedial means

DETAILED CONTENTS

UNIT I

1. Foundation

- 1.1 Introduction: Definition of a building, Different parts of a building, classification of buildings
- 1.2 Types of foundation – Shallow foundation (thumb rules for depth and width of foundation) and Deep foundation

- 1.3 Excavation of foundation – Trenches, Shoring, Underpinning, Timbering and De-watering
- 2. Walls**
- 2.1 Classification of walls based on load - Load bearing, non-load bearing, retaining walls
- 2.2 Classification of walls as per materials of construction
- 2.3 Partition walls: Constructional details, suitability and uses of brick and wooden partition walls
- 2.4 Scaffolding, construction details and suitability of mason's brick layers and tubular scaffolding.

UNIT II

3. Masonry Work

- 3.1 Glossary of terms used in brick masonry - Header, Stretcher, Queen closer, King closer etc.
- 3.2 Brick Masonry Bonds – English and Flemish Bonds
- 3.3 Construction of brick walls – New wall Construction, Methods of bonding new brick work with old (Toothing and Raking Methods)
- 3.4 Mortars: types, selection of mortar and its preparation

4. Arches and Lintels

- 4.1 Glossary of terms used in arches -Intrados, Extrados, Crown, Key stone etc.
- 4.2 Types of Arches – Semi-circular, Segmental and Parabolic arches
- 4.3 Lintels – Cast-in-situ and pre-cast lintels

UNIT III

5 Doors and Windows

- 5.1 Glossary of terms used – Door Frame, Door Shutter, Hold fast, Horns, Jamb, Reveal, Soffit, Styles, Rails: Top, Bottom and Lock rails etc.
- 5.2 Doors and window frames – Materials and Sections, Fixtures and Fasteners
- 5.3 Doors – Framed and Panelled door, Glazed or sash door, Flush door, Sliding door, Rolling steel shutter doors
- 5.4 Windows – Fixed window, Sliding window, Glazed or sash window, Corner window
- 5.5 Ventilators

6. Damp Proofing and Water Proofing

- 6.1 Dampness and its ill effects in buildings
- 6.2 Sources of dampness in building
- 6.3 Damp proofing of basement, Plinth and walls, Kitchen, Washroom, Roof

UNIT IV**7. Floors**

- 7.1 Glossary of terms used – Floor finish, Topping, Under layer, Base course, Rubble filling and their purpose
- 7.2 Types of floor finishes – Concrete flooring, Ceramic tile flooring, Stone (marble and kota) flooring, Wooden flooring
- 7.3 Special emphasis on level / slope / reverse slope in bathrooms, toilets, kitchen, balcony

8. Roofs

- 8.1 Types of roofs, concept of flat and pitched roofs
- 8.2 Glossary of terms for pitched roofs – Batten, Eaves, Facia board, Gable, Hip, Lap, Purlin, Rafter, Rag bolt, Ridge, Rain water gutter, Anchoring bolts
- 8.3 False ceilings – Gypsum false ceiling, POP false Ceiling, PVC false ceiling, Wooden false ceiling, Cellotex false ceiling

UNIT V**9. Stairs**

- 9.1 Glossary of terms used in stairs: Landing, Stringer, Newel, Baluster, Riser, Tread, Width of staircase, Hand-rail, Nosing
- 9.2 Types of stairs on the basis of materials used: RCC and Steel stairs
- 9.3 Various types of layout – Straight flight, Dog legged, Quarter turn, Half turn
- 9.4 Ramps and Elevators – Excavation and construction
- 9.5 Escalators pits and landings – Excavation and construction

10. Surface Finishes

- 10.1 Plastering – Plain plaster, Stone cladding and Tile work
- 10.2 Pointing – Different types of pointing and their methods
- 10.3 Painting – Preparation of surface, Primer coat and application of paints on wooden, steel and plastered wall surfaces
- 10.4 Selection of appropriate paints/finishes for interior and exterior surfaces

PRACTICAL EXERCISES

- 1. Demonstration of tools and plants used in building construction
- 2. To prepare Layout of a building: 2BHK with front verandah
- 3. To construct brick bonds (English Bond) in One, One & half and Two brick thick:
 - (a) Walls for L, T and Cross Junction
 - (b) Columns

4. To construct brick bonds (Flemish Bond) in One, One & half and Two brick thick:
 - (a) Walls for L, T and Cross Junction
 - (b) Columns
5. Demonstration of “Timbering of Excavated Trenching” through a model and visit at construction site
6. Demonstration of “Laying Damp Proof Courses” through a model and visit at construction site
7. Demonstration of “Construction of Masonry Walls” through a model and visit at construction site
8. Demonstration of “Brick Layers Scaffolding” through a model and visit at construction site
9. Demonstration of “Steel Scaffolding” through a model and visit at construction site
10. Demonstration of “Laying of Vitrified Tile Flooring” through visit at construction site
11. Demonstration of “Plastering and Pointing Exercise” through visit at construction site
12. Demonstration of “Constructing RCC work – Foundations, Columns, Beams and Slabs” through visit at construction site
13. Demonstration of “Pre-construction and post construction termite treatment of building and woodwork” through visit at construction site
14. Demonstration of “False Ceiling” through visit at construction site
15. Demonstration of “Interlocking Tiles” through visit at construction site

RECOMMENDED BOOKS

1. SC Rangwala, "Building Construction", Charotar Book Stall, Anand.
2. GJ Kulkarni, "A Text Book of Building Construction", Ahmedabad Book Depot.
3. SP Arora, and SP Bindra, "A Text Book of Building Construction", Dhanpat Rai and Sons, New Delhi.
4. Sushil Kumar, "Building Construction", Standard Publishers Distributors, Delhi.
5. SP – 62 “Hand Book of BIS”.
6. B.I.S. – 6313 Part 1, 2, 3
7. National Building Code
8. PN Khanna, “Handbook of Civil Engineering”.
9. Video films on Damp proofing, water proofing, surface finishes
10. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR

SUGGESTED WEBSITES

1. <http://swayam.gov.in>

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. This subject contains five units of equal weightage.

3.6 FLUID MECHANICS

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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.

COURSE OUTCOMES

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

- CO1: Calculate the pressure exerted by fluids on the walls of containers.
- CO2: Calculate discharge through pipes, irrigation channels, water supply pipe lines.
- CO3: Use different flow measurement devices like Venturimeter, Orificemeter, Notches and Weir.
- CO4: Calculate size of the pipe for carrying a particular discharge.
- CO5: Differentiate between different types of water pumps used in the field.
- CO6: Measure the loss of head in pipes and channels.

DETAILED CONTENTS

UNIT I

1. Properties of Fluids

- 1.1 Introduction: Fluid Mechanics, Hydrostatics, Hydrodynamics, Hydraulics
- 1.2 Density or Mass Density, Specific Weight or Weight Density, Specific Volume, Specific Gravity
- 1.3 Viscosity: Units of viscosity, Kinematic Viscosity, Newton's Law of viscosity, Variation of viscosity with temperature.
- 1.4 Types of Fluids: Ideal, Real, Newtonian, Non-Newtonian and ideal Plastic fluids.
- 1.5 Compressibility, Bulk Modulus, Surface Tension, Capillarity, Vapour Pressure and Cavitation

2. Pressure and its Measurement

- 2.1 Pascal's Law, Fluid pressure at a point and Pressure variation in a fluid at rest.
- 2.2 Types of Pressure: Absolute Pressure, Gauge Pressure, Vacuum Pressure and Atmospheric Pressure
- 2.3 Measurement of Pressure: Simple and Differential Manometer (with Numerical Problems)

UNIT II**3. Hydrostatic Force on Surfaces**

- 3.1 Total Pressure and Centre of Pressure
- 3.2 Vertical, Horizontal Plane surfaces (Rectangular and Trapezoidal) submerged in liquid (No derivation - Simple Numerical Problems)

4. Buoyancy and Floatation

- 4.1 Buoyancy and Centre of Buoyancy
- 4.2 Meta-centre and Meta-centric Height
- 4.3 Analytic Method for Meta-centric Height (Concept only – Simple Numerical Problems)
- 4.4 Conditions of equilibrium of a floating and sub-merged bodies (Concept only)

UNIT III**5. Flow of Fluids**

- 5.1 Types of Flow: Steady and Unsteady Flow, Uniform and Non-Uniform Flow, Laminar and Turbulent Flow, Compressible and Incompressible Flow
- 5.2 Discharge and Continuity Equation (No derivation - Simple Numerical Problems)
- 5.3 Types of hydraulic energy: Potential energy, kinetic energy, pressure energy
- 5.4 Bernoulli's Theorem: Statement and Description (without Proof of Theorem - Simple Numerical Problems)

6. Flow Measurements

- 6.1 Venturimeter and Orificemeter (without Proof)
- 6.2 Pitot-tube and Current meter
- 6.3 Orifices, Hydraulic Co-Efficient (C_v , C_c and C_d) and their relationship
- 6.4 Discharge over a Rectangular and Trapezoidal Notch (No Derivation)
- 6.5 Discharge over a Rectangular and Trapezoidal Weir (No Derivation)

UNIT IV**7. Flow Through Pipes**

- 7.1 Reynold's number, laminar and turbulent flow - explained through Reynold's experiment
- 7.2 Loss of Energy in Pipes: Major and Minor Energy Losses (No derivation of formula)
- 7.3 Loss of Energy in Pipes: Simple Numerical Problems
- 7.4 Hydraulic gradient line and total energy line
- 7.5 Pipes in series and parallel: Simple Numerical Problems

8. Dimensional Homogeneity

- 8.1 Secondary and Derived Quantities
- 8.2 Dimensional Homogeneity
- 8.3 Dimensional Numbers: Reynold's Number, Froude's Number, Euler's Number, Weber's Number, Mach's Number (Only concept)

UNIT V**9. Flow in Open Channel**

- 9.1 Definition and classification of flow in open channels
- 9.2 Discharge through open channel by Chezy's formula
- 9.3 Most economical section of channels (No Derivation - Simple Numerical Problems)
 - i) Rectangular Channel Section
 - ii) Trapezoidal Channel Section

10. Hydraulic Pumps

Reciprocating Pump, Centrifugal Pump, Differences between Reciprocating Pump and Centrifugal Pump (No Derivations and Numerical)

PRACTICAL EXERCISES

- 1. To verify Bernoulli's Theorem
 - 2. To find out Venturimeter Coefficient
 - 3. 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
 - 4. To perform Reynold's experiment
 - 5. To verify loss of head in pipe flow due to
 - a. Sudden enlargement
 - b. Sudden contraction
 - c. Sudden bend
 - 6. Demonstration of use of current meter and pitot tube
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7. To determine coefficient of discharge of a rectangular notch and triangular notch.

RECOMMENDED BOOKS

1. Jagdish Lal, "Fluid Mechanics and Hydraulics", Delhi Metropolitan Book Co. Pvt Ltd.
2. PN Modi, and SM Seth, "Hydraulics and Fluid Mechanics"; Delhi Standard Publishers Distributors.
3. RS Khurmi, "Hydraulics and Hydraulics Machines", S Chand and Co., Delhi.
4. MP Poonia, and OP Jakhar, "Laboratory Manual for Fluid Mechanics", Standard Publishers Distributors, Delhi.
5. Birinder Singh, "Fluid Mechanics", Kaption Publishing, New Delhi.
6. A.S Sarao, "Fluid Mechanics", Tech. India Publication, New Delhi.
- 7 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. <http://swayam.gov.in>

INSTRUCTIONAL STRATEGY

Fluid Mechanics 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. This subject contains five units of equal weightage.

3.7 MULTIDISCIPLINARY ELECTIVE

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RATIONALE

Multidisciplinary electives are very important and play major role in implementation of National Education Policy. Multidisciplinary is a subject which is useful for two or more disciplines in which students are asked to understand the concept of multidisciplinary or interdisciplinary. It will help the students to gain an arsenal of skills that are easily transferable across work environments.

COURSE OUTCOMES

At the end of the open elective, the students will be able to:

- CO1: Apply critical thinking problem solving.
- CO2: Demonstrate self and time management.
- CO3: Display analytical and research abilities.
- CO4: Integrate multiple knowledge domains.
- CO5: Enhance the scope and depth of learning.

LIST OF MULTIDISCIPLINARY ELECTIVES

(The list is indicative and not exhaustive)

1. Introduction to Internet of Things
2. Introduction to Robotics
3. Introduction to Embedded System Design
4. Fundamentals of Artificial Intelligence
5. Digital Image Processing
6. Introduction to Machine Learning
7. Fundamentals of Artificial Intelligence
8. The Joy of Computing Using Python
9. Cloud Computing
10. Introduction to Industry 4.0
11. Industrial Internet of Things

12. Object Oriented System Development using UML, Java and Patterns

GUIDELINES

Multidisciplinary Elective shall be offered preferably in online mode. Online mode multidisciplinary elective shall preferably be through Massive Open Online Courses (MOOCs) from Swayam, NPTEL, Upgrad, Udemy, KhanAcademy or any other online portal to promote self-learning. A flexible basket of large number of multidisciplinary electives is suggested which can be modified depending upon the availability of courses at suggested portals and requirements. For online multidisciplinary electives, department coordinators shall be assigned to monitor and guide the group of students for selection of minimum 20 hours duration online course of their choice. For offline multidisciplinary electives, a suitable relevant subject shall be offered by the respective department to the students with minimum 40% of the total class strength as per present and future requirements.

Assessment of MOOCs multidisciplinary elective shall be based on continuous evaluation by the respective coordinator. The coordinator shall consider the submitted assignments by the students from time to time during the conduct of MOOCs. The MOOCs assessment shall be conducted by the coordinator along with one external expert by considering submitted assignments out of 100 marks.

In case, no suitable open elective is available online, only then the course may be conducted in offline mode. The assessment of offline multidisciplinary elective shall be internal and external. The offline multidisciplinary elective internal assessment of 40 marks shall be based on internal sessional tests, assignments etc. and external assessment of 60 marks shall be based on external examination at institute level.

SUGGESTED WEBSITES

1. <https://swayam.gov.in/>
2. <https://www.udemy.com/>
3. <https://www.upgrad.com/>
4. <https://www.khanacademy.org/>