

**FOURTH SEMESTER :**

| Sr. No.                            | SUBJECTS                                | STUDY SCHEME |           | Credits (C)<br>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        |                                    |
| 4.1                                | *English & Communication Skills – II    | 2            | 2         | 2+1=3                  | 40                         | 40         | 80         | 60                  | 60         | 120        | 200                                |
| 4.2                                | Surveying -II                           | 2            | 4         | 2+2=4                  | 40                         | 40         | 80         | 60                  | 60         | 120        | 200                                |
| 4.3                                | Water Supply & Waste Water Engineering  | 2            | 4         | 2+2=4                  | 40                         | 40         | 80         | 60                  | 60         | 120        | 200                                |
| 4.4                                | Soil Mechanics & Foundation Engineering | 3            | 2         | 3+1=4                  | 40                         | 40         | 80         | 60                  | 60         | 120        | 200                                |
| 4.5                                | Irrigation Engineering                  | 2            | -         | 2+0=2                  | 40                         | -          | 40         | 60                  | -          | 60         | 100                                |
| 4.6                                | Open Elective (MOOCs+/Offline)          | 2            | -         | 2+0=2                  | 40                         | -          | 40         | 60                  | -          | 60         | 100                                |
| 4.7                                | Minor Project                           | -            | 6         | 0+3=3                  | -                          | 40         | 40         | -                   | 60         | 60         | 100                                |
| # Student Centered Activities(SCA) |   | -            | 4         | -                      | -                          | -          | -          | -                   | -          | -          | -                                  |
| <b>Total</b>                       |   | <b>13</b>    | <b>22</b> | <b>22</b>              | <b>240</b>                 | <b>200</b> | <b>440</b> | <b>360</b>          | <b>300</b> | <b>660</b> | <b>1100</b>                        |

\* Common with other Diploma Courses

+ Assessment of Open 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.

**Industrial/In-house Training:** After 4<sup>th</sup> Semester, students shall undergo Summer Training of minimum 4 Weeks.

**Survey Camp** will be held after 4<sup>th</sup> Semester or in the beginning of 5<sup>th</sup> Semester for minimum 10 days in a sub mountainous area away from polytechnic preferably in camp conditions. Details are in 5<sup>th</sup> Semester.

## 4.1 ENGLISH AND COMMUNICATION SKILLS - II

|          |          |
|----------|----------|
| <b>L</b> | <b>P</b> |
| <b>2</b> | <b>2</b> |

### RATIONALE

Communication II moves a step further from Communication Skills I and is aimed at enhancing the linguistic competency of the students. Language as the most commonly used medium of self-expression remains indispensable in all spheres of human life – personal, social and professional. This course is intended to make fresh ground in teaching of Communicative English as per the requirements of National Skill Quality Framework.

### COURSE OUTCOMES

After undergoing this course, the learners will be able to:

- CO1: Communicate effectively with an increased confidence; read, write and speak in English language fluently.
- CO2: Comprehend special features of format and style of formal communication through various modes.
- CO3: Write a Report, Resume, make a Presentation, Participate in GDs and Face Interviews
- CO4: Illustrate use of communication to build a positive self-image through self-expression and develop more productive interpersonal relationships.

### DETAILED CONTENTS

#### UNIT I

##### Reading

- 1.1 All The World's A Stage – W. Shakespeare
- 1.2 Life Sketch of Dr. Abdul Kalam
- 1.3 The Portrait of a Lady - Khushwant Singh
- 1.4 The Doctor's Word by R K Narayan
- 1.5 Speech by Dr Kiran Bedi at IIM Indore 2007 Leadership Concepts
- 1.6 The Bet - by Anton Chekov

**UNIT II****Effective Communication Skills**

- 2.1 Modern means of Communication (Video Conferencing, e- mail, Teleconferencing)
- 2.2 Effective Communication Skills: 7 C's of Communication
- 2.3 Non-verbal Communication – Significance, Types and Techniques for Effective Communication
- 2.4 Barriers and Effectiveness in Listening Skills
- 2.5 Barriers and Effectiveness in Speaking Skills

**UNIT III****Professional Writing**

- 3.1 Correspondence: Enquiry letters, placing orders, complaint letters
- 3.2 Report Writing
- 3.3 Memos
- 3.4 Circulars
- 3.5 Press Release
- 3.6 Inspection Notes and tips for Note-taking
- 3.7 Corrigendum writing
- 3.8 Cover Letter
- 3.9 Drawing inferences

**UNIT IV****Grammar and Vocabulary**

- 4.1 Prepositions
- 4.2 Conjunctions
- 4.3 Punctuation
- 4.4 Idioms and Phrases
- 4.5 Pairs of words (Words commonly misused and confused)
- 4.6 Translation of Administrative and Technical Terms in Hindi or Mother tongue

**UNIT V****Employability Skills**

- 5.1 Presentation Skills: How to prepare and deliver a good presentation
- 5.2 Telephone Etiquettes
- 5.3 Importance of developing employable and soft skills

- 5.4 Resume Writing: Definition, Kinds of Resume, Difference between Bio-data and Curriculum Vitae and Preparing a Resume for Job/ Internship
- 5.5 Group discussions: Concept and fundamentals of GD, and learning Group Dynamics.
- 5.6 Case Studies and Role Plays

### **PRACTICAL EXERCISES**

1. Reading Practice of the above lessons in the Lab Activity classes.
2. Comprehension exercises of unseen passages along with the given lessons.
3. Vocabulary enrichment and grammar exercises based on the above selective readings.
4. Situational Conversation: Requesting and responding to requests; Expressing sympathy and condolence.
5. Warning; Asking and giving information.
6. Getting and giving permission.
7. Asking for and giving opinions.
8. A small formal and informal speech.
9. Seminar.
10. Debate.
11. Unseen Comprehension Passages and vocabulary enhancement.
12. Interview Skills: Preparing for the Interview and guidelines for success in the Interview and significance of acceptable body-language during the Interview.
13. Written and Oral Drills will be undertaken in the class to facilitate a holistic linguistic competency among learners.
14. Participation in a GD, Functional and Non-functional roles in GD, Case studies and Role plays.
15. Presentations, using audio-visual aids (including power-point).
16. Telephonic interviews, face to face interviews.
17. Presentations as Mode of Communication: Persuasive Presentations using multi-media aids.

### **RECOMMENDED BOOKS**

1. J Sethi, Kamlesh Sadanand & DV Jindal, “Course in English Pronunciation”, PHI Learning Pvt. Ltd., New Delhi.
2. Wren and Martin, “High School English Grammar and Composition”.

3. NK Aggarwal and FT Wood, “English Grammar, Composition and Usage”, Macmillan Publishers India Ltd., New Delhi.
4. RC Sharma, and Krishna Mohan, “Business Correspondence & Report Writing”, (4<sup>th</sup> Edition), by Tata MC Graw Hills, New Delhi.
5. Varinder Kumar, Bodh Raj & NP Manocha, “Business Communication Skills”, Kalyani Publisher, New Delhi.
6. Kavita Tyagi & Padma Misra, “Professional Communication”, PHI Learning Pvt. Ltd., New Delhi.
7. Nira Konar, “Communication Skills for Professionals”, PHI Learning Pvt. Ltd., New Delhi.
8. Krishna Mohan & Meera Banerji, “Developing Communication Skills”, (2<sup>nd</sup> Edition), Macmillan Publishers India Ltd., New Delhi.
9. M. Ashraf Rizwi, “Effective Technical Communication”, Tata MC Graw Hills, New Delhi.
10. Andrea J Rutherford, “Basic Communication Skills for Technology”, Pearson Education, New Delhi.

### **INSTRUCTIONAL STRATEGY**

This is practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required communication skills in the students. Emphasis should be given on practicing of communication skills. This subject contains five unit of equal weightage.

## 4.2 SURVEYING – II

|          |          |
|----------|----------|
| <b>L</b> | <b>P</b> |
| <b>2</b> | <b>4</b> |

### 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.

### COURSE OUTCOMES

After undergoing the subject, students will be able to:

- CO1: Prolong a line with theodolite.
- CO2: Conduct closed traversing
- CO3: Measure horizontal and vertical angles.
- CO4: Set out simple circular curve
- CO5: Prepare maps for closed traverse and open traverse with Total Station
- CO6: Draw a contour plan of an area with Total station and DGPS
- CO7: Calculate earth work for a road with Total station and DGPS

### DETAILED CONTENTS

#### UNIT I

##### Electronic Digital Theodolite and Tachometric surveying

- 1.1 Concept/Difference of Transit Theodolite and Electronic Digital Theodolite
- 1.2 Temporary adjustments of an Electronic Digital Theodolite, Concept of transiting, swinging, face left, face right and changing face.
- 1.3 Prolonging a line (forward and backward)
- 1.4 Traversing by included angles and deflection angle method.

- 1.5 Plotting a traverse; concept of coordinate and solution of omitted measurements (one side affected)
- 1.6 Errors in theodolite survey and precautions taken to minimize them
- 1.7 Height of objects with and without accessible bases
- 1.8 Concept, general principles of stadia tachometry and methods of tachometry and (with numerical problems)
- 1.9 Instruments to be used in tachometry

## UNIT II

### Curves: (Horizontal, Vertical and Transition Curve)

- 2.1 Definition and types of horizontal curve
  - \*\*2.1.1 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. (With numerical problems)
- 2.2 Transition Curve:
  - 2.2.1 Definition of transition curve
  - 2.2.2 Requirements of transition curve
  - 2.2.3 Length of transition curve for roads; by cubic parabola
  - 2.2.4 Need (centrifugal force and super elevation).
  - 2.2.5 Calculation of offsets for a transition curve
- 2.3 Definition and types of vertical curve
  - 2.3.1 Types of vertical curves
  - 2.3.2 Setting out of a vertical curve

## UNIT III

### Introduction of Advanced Surveying Equipment and Techniques.

- 3.1 Principle of EDM, its component parts and their functions
- 3.2 Uses of EDM
- 3.3 Distomat
- 3.4 Remote sensing system
- 3.5 Application of remote sensing system in civil engineering, land uses/land cover, mapping, and disaster management
- 3.6 GPS, DGPS and GIS applications and software used (introduction only)
- 3.7 Planimeter (Digital)
- 3.8 Introduction of Drones Survey

**UNIT IV****Total Station (TS)**

- 4.1 Concept and uses of TS
- 4.2 Uses of function keys, various parts of TS
- 4.3 Accessories used in TS survey
- 4.4 Applications of TS in various engineering area.
- 4.5 Temporary adjustments of TS
- 4.6 Measurement of horizontal angle, vertical angle distance and coordinates using Total station, Traversing, profile survey and contouring with TS
- 4.7 Errors in TS
- \*\*4.8 Layout of any building, school, college, factory etc. with total station showing topographic map also

**UNIT V****DGPS (Differential Global Positioning System)**

- 5.1 Concept of DGPS, various parts, applications and software used for DGPS
- 5.2 Comparison between DGPS and TS
- 5.3 Temporary adjustments of a DGPS
- 5.4 How does DGPS work
- 5.5 Errors in DGPS
- \*\*5.6 Periodic field visits to Survey of India and other government agencies.
- \*\*5.7 Layout of drain, canal, road with DGPS.
- \*\*5.8 Demarcation of roads, plots, commercial spaces and agricultural land etc. with DGPS

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

**PRACTICAL EXERCISES**

- I. Digital Theodolite:
  - i) Study of a transit vernier theodolite; temporary adjustments of theodolite
  - ii) Reading the Vernier and working out the least count, measurement of horizontal angles by repetition and reiteration methods
  - iii) Measurement of vertical angles and use of tachometric tables
  - iv) Measurement of magnetic bearing of a line
  - vi) Running a closed traverse with a theodolite (at least five sides) and its plotting
  - v) Height of objects with and without accessible bases



- II. Curves
- i) Setting out of a simple circular curve with given data by the following methods
    - a) Offsets from the chords produced by Digital Theodolite
    - b) One theodolite method
  - ii) Setting out of simple circular curve by tangential angles using a Digital Theodolite.
  - iii) Setting out of a transition curve by tangential offsets using a Digital Theodolite.
- III Total Station
- i) Temporary adjustments of a Total station
  - ii) Measurement of distance, horizontal angle and vertical angle.
  - iii) To plot an area with the help of Total Station
  - iv) Layout of any building, school, college, factory etc. with total station showing topographic map also  
(Draw at least one sheet using AutoCAD software)
- IV DGPS (Differential Global Positioning System)
- i) Computation of earth work and reservoir capacity with DGPS
  - ii) Layout of drain, canal, road with DGPS.
  - iii) Demarcation of roads, plots, commercial spaces and agricultural land etc. with DGPS  
(Draw at least one sheet using AutoCAD software)
  - iv) Periodic field visits to Survey of India and other government agencies.

### RECOMMENDED BOOKS

1. SK Hussain, and MS Nagraj, "Text Book of Surveying", S Chand and Co Ltd., New Delhi.
2. RS Deshpande, "A Text Book Surveying and Levelling", United Book Corporation, Pune.
3. CL Kocher, "A Text Book of Surveying", Katson Publishing House Ludhiana.
4. TP Kanetkar, and SV Kulkarni, "Surveying and Leveling-Vol.2", AVG Prakashan, Pune.
5. BC Punima, "Surveying and Leveling", Standard Publishers Distributors, Delhi.
6. Sanjay Mahajan, "Surveying-II", Satya Prakashan, Delhi.

## **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 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. Extract data from Total Station and DGPS all civil engineering students train to use AutoCAD software. If a student aspires to be successful in the civil engineering, design, field surveyor etc. then AutoCAD may be an essential tool to learn. This subject contains five units of equal weightage.

## 4.3 WATER SUPPLY AND WASTE WATER ENGINEERING

|          |          |
|----------|----------|
| <b>L</b> | <b>P</b> |
| <b>2</b> | <b>4</b> |

### 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 specialized operations.

### COURSE OUTCOMES

After undergoing the subject, students will be able to:

- CO1: Calculate the water requirement for a particular population
- CO2: Check and improve the quality of water by giving required treatment to water
- CO3: Calculate the size of different pipes to carry water
- CO4: Lay the network of pipes for water supply as well as sewerage in a building
- CO5: Supervise the water supply and waste water schemes

### DETAILED CONTENTS

#### A. WATER SUPPLY

##### UNIT I

##### Quantity and Quality of Water

- 1.1 Necessity and brief description of planned water supply system.
- 1.2 Sources of water – surface/sub-surface sources (only description)
- 1.3 Water requirement, Per capita demand, Factors affecting per capita demand
- 1.4 Rate of demand and variation in rate of demand
- 1.5 Design Period, Factors governing the design period, Design period values for different components of a water supply scheme
- 1.6 Population forecasting methods (with Numerical Problems)
- 1.7 Physical, Chemical and bacteriological tests and their significance

- 1.8 Standard of potable water as per Indian Standard, water meter

## **UNIT II**

### **Water Treatment**

- \*\*2.1 Sedimentation - Purpose, Types of sedimentation tanks
- \*\*2.2 Coagulation / Flocculation - usual coagulation and their feeding
- \*\*2.3 Filtration - Slow and Rapid sand filters, their significance and suitability
- 2.4 Necessity of disinfection of water, forms of chlorination, break point chlorine, residual chlorine, application of chlorine.
- 2.5 Miscellaneous Treatments – Aeration, Aquaguard, Reverse Osmosis System

## **UNIT III**

### **Water Distribution System**

- 3.1 Requirement of a good water distribution system
- 3.2 Layout of distribution networks
- 3.3 Methods of distribution
- 3.4 Distribution reservoirs – their functions and types
- 3.5 Storage capacity of distribution reservoirs
- 3.6 Stand Pipes

## **B. WASTE WATER ENGINEERING**

### **UNIT IV**

#### **Waste Water Disposal**

- 4.1 Sanitation – Purpose and necessity of sanitation
- 4.2 Components of sewerage system - Manhole
- 4.3 Types of sewage and types of sewerage system
- 4.4 Properties of sewage and IS standards for analysis of sewage
- 4.5 Physical, chemical and bacteriological parameters of sewage
- 4.6 Sewage disposal methods - Disposal by dilution and land treatment
- 4.7 Self-purification of stream, Nuisance due to disposal

### **UNIT V**

#### **Sewage Treatment**

- 5.1 Primary and secondary treatment
- 5.2 Screens, Grit chambers, Skimming tanks
- 5.3 Plain sedimentation tanks

- 5.4 Filtration, Trickling filter
- 5.5 Sludge treatment and disposal
- 5.7 Oxidation Ponds (Visit to a sewage treatment plant)

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

### **PRACTICAL EXERCISES**

- 1) To determine turbidity of water sample
- 2) To determine dissolved oxygen of given sample
- 3) To determine pH value of water
- 4) To perform jar test for coagulation
- 5) To determine BOD of given sample
- 6) To determine residual chlorine in water
- 7) To determine conductivity of water and total dissolved solids
- 8) To study the installation of following:
  - a) Water meter
  - b) Connection of water supply of building with main
  - c) Pipe valves and bends
  - d) Water supply and sanitary fittings
- 9) To study and demonstrate the joining / threading of GI Pipes, CI Pipes, SWG pipes, PVC pipes and copper pipes.
- 10) To demonstrate the laying of SWG pipes for sewers
- 11) Study of water purifying process by visiting a field lab.
- 12) To study the installation and working of water cooler available in Institution
- 13) To study the installation and working of Reverse Osmosis System available in Institution
- 14) To study the working of Rain Water Harvesting System
- 15) To demonstrate the drainage of roof top rain water of Institutional building
- 16) Prepare a report of a field visit to sewage treatment plant
- 17) Undertake a field visit to water treatment plant and prepare a report.

### **RECOMMENDED BOOKS**

- 1. KN Duggal, "Elements of Public Health Engineering"; S. Chand and Co. New Delhi.
- 2. SC Rangwala, "Water Supply and Sanitary Engineering", Charotar Book Stall, Anand.
- 3. SR Kshirsagar, "Water Supply Engineering", Roorkee Publishing House, Roorkee.
- 4. SR Kshirsagar, "Sewage and Sewage Treatment", Roorkee Publishing House, Roorkee.

5. GS Birdie, “Water Supply and Sanitary Engineering”, Dhanpat Rai and Sons, Delhi.
6. Santosh Kumar Garg, “Water Supply Engineering”, Khanna Publishers, Delhi.
7. Santosh Kumar Garg, “Sewage and Waste Water Disposal Engineering”, Khanna Publishers, Delhi.
8. Ajay K Duggal, and Sanjay Sharma, “A Laboratory Manual in Public Health Engineering”, Galgotia Publications, 2006, New Delhi.
9. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

### **SUGGESTED WEBSITES**

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

### **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. This subject contains five units of equal weightage.

## 4.4 SOIL MECHANICS AND FOUNDATION ENGINEERING

|          |          |
|----------|----------|
| <b>L</b> | <b>P</b> |
| <b>3</b> | <b>2</b> |

### RATIONALE

Civil Engineering diploma engineers are required to supervise the construction of roads, pavements, dams, embankments, and other Civil Engineering structures. As such the knowledge of basic soil engineering is the pre-requisite for these engineers for effective discharge of their duties. 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.

### COURSE OUTCOMES

After undergoing the subject, students will be able to:

- CO1: Identify and classify various types of soils
- CO2: Select particular type of foundation according to loading of structure
- CO3: Determine shear strength of soil
- CO4: Carry out compaction of soils as per density
- CO5: Calculate bearing capacity of soil
- CO6: Calculate liquid limit and plastic limit of soil
- CO7: Perform various tests of the soil

### DETAILED CONTENTS

#### UNIT I

##### 1. Introduction

- 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 Punjab, 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**

- 2.1 Constituents of soil and representation by a phase diagram
- 2.2 Definitions of void ratio, porosity, degree of saturation, water content, specific gravity, unit weight, bulk density/bulk unit weight, dry unit weight, saturated unit weight and submerged unit weight of soil grains.

**UNIT II****3. Classification and Identification of Soils**

- 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

**4. Flow of Water Through Soils**

- 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

**UNIT III****5. Effective Stress: (Concept only)**

- 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**

- 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 Meaning of total settlement, uniform settlement, and differential settlement; rate of settlement and their effects.
- 6.3 Settlement due to construction operations and lowering of water table
- 6.4 Tolerable settlement for different structures as per BIS

#### **UNIT IV**

##### **7. Shear Strength of Soil**

- 7.1. Concept and Significance of shear strength
- 7.2 Factors contributing to shear strength of cohesive and cohesion less soils, Coulomb's law

##### **8. Compaction**

- 8.1 Definition and necessity of compaction
- 8.2 Laboratory compaction test (standard and modified proctor test as per IS) 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

##### **9. Soil Exploration**

- 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

#### **UNIT V**

##### **10 Bearing Capacity of soil**

- 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 Factors affecting bearing capacity.
- 10.4 Improvement of bearing capacity by sand drain method, compaction, use of geo-synthetics.

**11. Foundation Engineering**

- 11.1 Concept of shallow and deep foundation.
- 11.2 types of shallow foundations: combined, isolated, strip, mat, and their suitability.
- 11.3 Factors affecting the depth of shallow foundations, deep foundations,
- 11.4 type of piles and their suitability; pile classification based on 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 and maximum dry density
- 8. Direct Shear Test
- 9. Permeability Test
- 10. Demonstration of Unconfined Compression Test
  - a) Specimen preparation
  - b) Conducting the test
  - c) Plotting the graph
  - d) Interpretation of results and finding/bearing capacity
- 11. Demonstration of Vane shear Test

### RECOMMENDED BOOKS

1. BC Punmia, "Soil Mechanics and Foundations", Standard Publishers, Delhi.
2. Bharat Singh and Shamsheer Prakash, "Soil Mechanics and Foundations Engineering", Nem Chand and Bros, Roorkee.
3. AK.Duggal, TR. Ramana, S Krishnamurthy, "Soil Sampling and Testing - A Laboratory Manual", Galgotia Publications, Delhi.
4. BIS Codes IS 6403 (latest edition) and IS 1498 (latest edition).
5. "Shallow Foundations" by NITTTR, Chandigarh.
6. Vinod Kumar, "Video films on Geo-technical Laboratory Practices", NITTTR, Chandigarh.
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**

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. This subject contains five units of equal weightage.

## 4.5 IRRIGATION ENGINEERING

|          |          |
|----------|----------|
| <b>L</b> | <b>P</b> |
| <b>2</b> | <b>-</b> |

### 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 tube wells. 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.

### COURSE OUTCOMES

After undergoing the subject, students will be able to:

- CO1: Recognise different crops and their water requirements
- CO2: Supervise maintenance and construction work of canal head works and cross Regulators
- CO3: Supervise constructions of various river training works
- CO4: Monitor installation of water harvesting techniques

### DETAILED CONTENTS

#### UNIT I

- 1. Introduction: Irrigation Engineering, Hydrological Cycle, Run-off and Catchment Area**
  - 1.1 Definition and necessity of irrigation
  - 1.2 Major, medium and minor irrigation projects
  - 1.3 Hydrology and hydrological cycle
  - 1.4 Rain-gauges – automatic and non-automatic (Symons rain gauge)
  - 1.5 Methods of estimating average rainfall (Arithmetic system)
  - 1.6 Runoff and Factors affecting runoff, Catchment area
  - 1.7 Hydrograph and basic concept of unit hydrograph.

**UNIT II****2. Water Requirement of Crops**

- 2.1 Principal crops in India and their water requirements
- 2.2 Crop seasons – Kharif and Rabi
- 2.3 Crop period, base period, Duty, Delta and their relationship.
- 2.4 Gross commanded area (GCA), culturable commanded area (CCA), Intensity of Irrigation, Irrigable area

**3. Methods of Irrigation**

- 3.1 Flow irrigation – Definition and its types (only description)
- 3.2 Lift Irrigation – Tube well, Types of tube wells (only description)
- 3.3 Explanation of terms: water table, radius of influence, depression head, cone of depression, confined and unconfined aquifers, advantages and disadvantages of tube well irrigation.
- 3.4 Sprinkler irrigation- Conditions favourable, Types and component parts, advantages and disadvantages of sprinkler irrigation.
- 3.5 Drip irrigation- layout, component parts, advantages and disadvantages of drip irrigation.

**UNIT III****4. Canals, Canal Head Works, Regulatory Works and Cross Drainage Works**

- 4.1 Definition and Classification of canal. (Visit to a Canal)
- \*\*4.2 Appurtenances of a canal and their functions.
- 4.3 Various types of canal lining - their related advantages and disadvantages,
- 4.4 Canal breaches and their control.
- 4.5 Maintenance of lined and unlined canals
- 4.6 Definition, objectives and general layout of different parts of head works.
- 4.7 Difference between weir and barrage
- \*\*4.8 Definition and necessity of Cross Drainage Works (Visit to a Cross Drainage Works)
- \*\*4.9 Concept of Aqueduct, super passage, level crossing, inlet and outlet.

**UNIT IV****5. Dams and hydraulic Structures**

- 5.1 Dam and its Classification
- \*\*5.2 Earth dams - types, causes of failure; cross-section of zoned earth dam, method of construction,
- \*\*5.3 Gravity dams – types, cross-sections of a dam, method of construction
- 5.4 Concept of spillways and energy dissipators

## 5.5 Concept of Canal Falls, Outlets and Escapes

### UNIT V

#### 6. River Training Works

- 6.1 Definition, function of river training works.
- 6.2 Types of river training- Embankments or levees.
- 6.3 Concept of Guide bank, Groynes or spurs, Pitched island, Cut-off

#### 7. Water Logging and Drainage and Ground Water Re-charge

- 7.1 Definition of water logging – its causes and effects.
- 7.2 Detection, prevention and remedies
- 7.3 Surface and sub-surface drains and their layout (only description)
- 7.4 Water Harvesting Techniques: Need and requirement.
- 7.5 Various methods of rain water harvesting.

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

### RECOMMENDED BOOKS

1. Santosh Kumar Garg, “Irrigation Engineering and Hydraulics Structures”, Khanna Publishers, Delhi.
2. BC Punmia, and Brij Bansi Lal Pande, “Irrigation and Water Power Engineering”, Standard Publishers Distributors, Delhi.
3. SR Saharsabudhe, “Irrigation Engineering and Hydraulic Structures”.
4. BIS Codes.
5. Central Ground Water Board and Central Water Commission Guidelines and Reference Books.
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

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. This subject contains five units of equal weightage.

## 4.6 OPEN ELECTIVE

|          |          |
|----------|----------|
| <b>L</b> | <b>P</b> |
| <b>2</b> | <b>-</b> |

### RATIONALE

Open electives are very important and play major role in implementation of National Education Policy. These subjects provide greater autonomy to the students in the curriculum, giving them the opportunity to customize it to reflect their passions and interests. The system of open electives also encourages cross learning, as students pick and choose subjects from the different streams.

### COURSE OUTCOMES

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

CO1: State the basic concepts and principles about the subject of interest.

CO2: Perform in a better way in the professional world.

CO3: Select and learn the subject related to own interest.

CO4: Explore latest developments in the field of interest.

CO5: Develop the habit of self-learning through online courses.

### LIST OF OPEN ELECTIVES

**(The list is indicative and not exhaustive)**

1. Computer Application in Business
2. Introduction to NGO Management
3. Basics of Event Management
4. Event Planning
5. Administrative Law
6. Introduction to Advertising
7. Moodle Learning Management System
8. Linux Operating System
9. E-Commerce Technologies
10. NCC
11. Marketing and Sales
12. Graphics and Animations



13. Digital Marketing
14. Human Resource Management
15. Supply Chain Management
16. TQM

## **GUIDELINES**

Open Elective shall be offered preferably in online mode. Online mode open elective shall preferably be through Massive Open Online Courses (MOOCs) from Swayam, NPTEL, Upgrad, Udemy, Khan Academy or any other online portal to promote self-learning. A flexible basket of large number of open electives is suggested which can be modified depending upon the availability of courses at suggested portals and requirements. For online open 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 open 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 open 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 open elective shall be internal and external. The offline open 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.

## **NOTE**

The students enrolled under NCC will compulsorily undertake NCC as an open elective subject.

## SUGGESTED WEBSITES

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

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## 4.7 MINOR PROJECT

**L    P**  
**-    6**

### RATIONALE

Minor project work will help in developing the relevant skills among the students as per National Skill Qualification Framework. It aims at exposing the students to the present and future needs of various relevant industries. It is expected from the students to get acquainted with desired attributes for industrial environment. For this purpose, students are required to be involved in Minor Project Work in different establishments.

### COURSE OUTCOMES

After undergoing this course, the students will be able to:

- CO1: Define the problem statement of the minor project according to the need of industry.
- CO2: Work as a team member for successful completion of minor project.
- CO3: Write the minor project report effectively.
- CO4: Present the minor project report using PPT.

### GUIDELINES

Depending upon the interest of the students, they can develop minor projects as per present and future demand of the industry. The supervisors may guide the students to identify their minor project work and chalk out their plan of action well in advance. 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/activities. The supervisor may create a group of 4-5 students as per their interest to work as a team for successful completion of the minor project.

The supervisor shall evaluate the students along with one external expert by considering the following parameters:

|     | <b>Parameter</b>                               | <b>Weightage</b> |
|-----|--|------------------|
| i   | Defining problem statement, focus and approach | 20%              |
| ii  | Innovation / creativity                        | 20%              |
| iii | Report Writing                                 | 20%              |
| iv  | Power Point Presentation                       | 20%              |
| v   | Viva - voce                                    | 20%              |