

**FIFTH SEMESTER (CIVIL ENGINEERING)**

| SR. NO.   | SUBJECTS  | STUDY SCHEME Hrs/Week |    | MARKS IN EVALUATION SCHEME |     |     |                     |     |     |     |     | Total Marks of Int. & Ext. |
|---|---|-----------------------|----|----------------------------|-----|-----|---------------------|-----|-----|-----|-----|----------------------------|
|   |   |                       |    | INTERNAL ASSESSMENT        |     |     | EXTERNAL ASSESSMENT |     |     |     |     |                            |
|   |   |                       |    | Th                         | Pr  | Tot | Th                  | Hrs | Pr  | Hrs | Tot |                            |
| 5.1   | Reinforced Concrete Design                      | 5                     | -  | 25                         |     | 25  | 100                 | 3   | -   | -   | 100 | 125                        |
| 5.2   | Highway Engineering                             | 5                     | 2  | 15                         | 10  | 25  | 100                 | 3   | 50  | 3   | 150 | 175                        |
| 5.3   | Survey Camp                                     | -                     | -  | -                          | 50  | 50  | -                   | -   | 50  | 3   | 50  | 100                        |
| 5.4   | Computer Applications in Civil Engineering      | -                     | 6  | -                          | 50  | 50  | -                   | -   | 100 | 3   | 100 | 150                        |
| 5.5   | Railways, Bridges and Tunnels                   | 5                     | -  | 25                         | -   | 25  | 100                 | 3   | -   | -   | 100 | 125                        |
| 5.6   | Soil and Foundation Engineering                 | 4                     | 2  | 15                         | 10  | 25  | 100                 | 3   | 50  | 3   | 150 | 175                        |
| 5.7*  | Generic Skills and Entrepreneurship Development | 3                     | -  | 25                         | -   | 25  | 100                 | 3   | -   | -   | 100 | 125                        |
| 5.8   | Minor Project Work (Industry oriented)          | -                     | 4  | -                          | 50  | 50  | -                   | -   | 100 | 3   | 100 | 150                        |
| # Student Centred Activities including Personality Development Awareness Camp |   | -                     | 4  | -                          | 25  | 25  | -                   | -   | -   | -   | -   | 25                         |
| Total   |   | 22                    | 18 | 105                        | 195 | 300 | 500                 | -   | 350 | -   | 850 | 1150                       |

\* Common with other diploma programmes

Note: Survey camp will be held either after fourth semester or in the beginning of 5<sup>th</sup> semester for minimum 15 days in a sub mountainous area away from polytechnic preferably in camp conditions.

# SCA will comprise of co-curricular activities like extension lectures, library studies, games, hobby clubs e.g. photography, painting, singing, seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, Civil Defence/Disaster Management activities etc..

## 5.1 REINFORCED CONCRETE DESIGN

**L T P**  
**5 - -**

### RATIONALE

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

### DETAILED CONTENTS

- |    |  |          |
|----|--|----------|
| 1. | Introduction   | (02 hrs) |
|    | 1.1 Concept of Reinforced Cement Concrete (RCC)  |          |
|    | 1.2 Reinforcement Materials:   |          |
|    | - Suitability of steel as reinforcing material   |          |
|    | - Properties of mild steel and HYSD steel  |          |
|    | 1.3. Loading on structures as per IS: 875  |          |
| 2. | Introduction to following methods of RCC design  | (02 hrs) |
|    | 2.1 Working stress method  |          |
|    | 2.2 Limit state method   |          |
| 3. | Shear and Development Length   | (04 hrs) |
|    | 3.1 Shear as per IS:456-2000 by working stress method  |          |
|    | i) Shear strength of concrete without shear reinforcement  |          |
|    | ii) Maximum shear stress   |          |
|    | iii) Shear reinforcement   |          |
| 4. | Singly Reinforced Beam (Working stress method)   | (08 hrs) |
|    | 4.1 Basic assumptions and stress strain curve, neutral axis, balanced, under-reinforcement and over reinforced beams, Moment of resistance for singly reinforced beam. |          |
|    | 4.2 Design of singly reinforced beam including sketches showing reinforcement details.   |          |

5. Concept of Limit State Method (08 hrs)
- 5.1 Definitions and assumptions made in limit state of collapse (flexure)
  - 5.2 Partial factor of safety for materials
  - 5.3 Partial factor of safety for loads
  - 5.4 Design loads
  - 5.5 Stress block, parameters
6. Singly Reinforced beam (10 hrs)
- Theory and design of singly reinforced beam by Limit State Method
7. Doubly Reinforced Beams (09 hrs)
- Theory and design of simply supported doubly reinforced rectangular beam by Limit State Method
8. Behaviour of T beam, inverted T beam, isolated T beam and 'L' beams (No Numericals) (04 hrs)
9. One Way Slab (10 hrs)
- Theory and design of simply supported one way slab including sketches showing reinforcement details (plan and section) by Limit State Method..
10. Two Way Slab (10 hrs)
- Theory and design of two-way simply supported slab with corners free to lift, no provisions for torsional reinforcement by Limit State Method including sketches showing reinforcement details (plan and two sections)
11. Axially Loaded Column (10 hrs)
- 11.1 Definition and classification of columns
  - 11.2. Effective length of column,
  - 11.3. Specifications for longitudinal and lateral reinforcement
  - 11.4. Design of axially loaded square, rectangular and circular short columns by Limit State Method including sketching of reinforcement (sectional elevation and plan)
12. Prestressed Concrete (03 hrs)
- 12.1. Concept of pre-stressed concrete
  - 12.2. Methods of pre-stressing : pre-tensioning and post tensioning
  - 12.3. Advantages and disadvantages of prestressing
  - 12.4. Losses in pre-stress

**Important Note:**

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

**INSTRUCTIONAL STRATEGY**

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

**RECOMMENDED BOOKS**

1. Punmia, BC; "Reinforced Concrete Structure Vol I", Standard Publishers, Delhi
2. Ramamurtham, S; "Design and Testing of Reinforced Structures", Dhanpat Rai and Sons, Delhi
3. Gambhir, M.L., "Reinforced Concrete Design", Macmillan India Limited
4. Singh, Birinder "RCC Design and Drawing", Kaption Publishing House, New Delhi
5. Singh Harbhajan " Reinforced Concrete Design" Abhishek Publishers Ltd., Chandigarh
6. Mallick, SK; and Gupta, AP; "Reinforced Concrete", Oxford and IBH Publishing Co, New Delhi.

**SUGGESTED DISTRIBUTION OF MARKS**

| <b>Topic No.</b> | <b>Time Allotted (Hrs)</b> | <b>Marks Allotted (%)</b> |
|------------------|----------------------------|---------------------------|
| 1                | 02                         | 03                        |
| 2                | 02                         | 03                        |
| 3                | 04                         | 05                        |
| 4                | 08                         | 10                        |
| 5                | 08                         | 10                        |
| 6                | 10                         | 12                        |
| 7                | 09                         | 12                        |
| 8                | 04                         | 5                         |
| 9                | 10                         | 12                        |
| 10               | 10                         | 12                        |
| 11               | 10                         | 12                        |
| 12               | 03                         | 04                        |
| <b>Total</b>     | <b>80</b>                  | <b>100</b>                |

## 5.2 HIGHWAY ENGINEERING

**L T P**  
**5 - 2**

### RATIONALE

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

### DETAILED CONTENTS

1. Introduction (02 hrs)
  - 1.1 Importance of Highway engineering
  - 1.2 Functions of IRC, CRRI, MORT&H, NHAI
  - 1.3 IRC classification of roads
  
2. Road Geometrics (10 hrs)
  - 2.1 Glossary of terms used in road geo-metrics and their importance: Right of way, formation width, road margin, road shoulder, carriage way, side slopes, kerbs, formation levels, camber and gradient
  - 2.2 Average running speed, stopping and passing sight distance
  - 2.3 Necessity of curves, horizontal and vertical curves including transition curves. Super elevation and methods of providing super elevation
  - 2.4 Sketch of typical cross-sections in cutting and filling on straight alignment and at a curve  
**(Note: No design/numerical problem to be taken)**
  
3. Highway Surveys and Plan (10 hrs)
  - 3.1 Topographic map, reading the data given on a topographic map
  - 3.2 Basic considerations governing alignment for a road in plain and hilly area
  - 3.3 Highway location; marking of alignment

4. Road Materials (10 hrs)
- 4.1 Different types of road materials in use; soil, aggregate, binders – bitumen, cutback, Emulsion and Modified Bitumen (CRMB, PMB)
- 4.2 Binders: Common binders; bitumen, properties as per BIS specifications, penetration, softening point, ductility and viscosity test of bitumen, procedures and significance, cut back and emulsion and their uses, Bitumen modifiers
5. Road Pavements (12 hrs)
- 5.1 Road pavement: Flexible and rigid pavement, their merits and demerits, typical cross-sections, functions of various components
- 5.2. Introduction to California Bearing Ratio, method of finding CBR value and its significance. Aggregate : Source and types, important properties, strength, durability
- 5.3 Sub-grade preparation:  
Setting out alignment of road, setting out bench marks, control pegs for embankment and cutting, borrow pits, making profiles of embankment, construction of embankment, compaction, preparation of subgrade, methods of checking camber, gradient and alignment as per recommendations of IRC, equipment used for subgrade preparation. Stabilization of subgrade. Types of stabilization mechanical stabilization, lime stabilization, cement stabilization, fly ash stabilization etc.(introduction only)
- 5.4 Introduction to Sub Base Course and Base Course:  
a) Granular base course:  
(i) Water Bound Macadam (WBM)  
(ii) Wet Mix Macadam (WMM)  
b) Bitumen Courses:  
(i) Bituminous Macadam  
(ii) Dense Bituminous Macadam (DBM)  
c) \*Methods of construction as per MORT&H
- 5.5 Surfacing:  
a) \* Types of surfacing  
i) Prime coat and tack coat  
ii) Surface dressing with seal coat  
iii) Open graded premix carpet  
iv) Mix seal surfacing  
v) Semi dense bituminous concrete

- vi) Bituminous Concrete/Asphaltic concrete
- vii) Mastic Asphalt

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

#### 5.6 Rigid Pavements:

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

#### 6. Hill Roads: (06 hrs)

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

6.2 Special problems of hill areas

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

6.2.2 Drainage

6.2.3 Soil erosion

6.2.4 Snow: Snow clearance, snow avalanches, frost

6.2.5 Land Subsidence

#### 7. Road Drainage: (06 hrs)

7.1 Necessity of road drainage work, cross drainage works

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

#### 8. Road Maintenance: (06 hrs)

8.1 Common types of road failures of flexible pavements: Pot hole, rutting, alligator cracking, upheaval - their causes and remedies (brief description)

8.2 Maintenance of bituminous road such as seal-coat, patch-work and recarpetng.

8.3 Maintenance of concrete roads-filling cracks, repairing joints, maintenance of shoulders (berms), maintenance of traffic control devices

9. Road Construction Equipment: (08 hrs)

Output and use of the following plant and equipment

- 9.1 Hot mix plant
- 9.2 Tipper, tractors (wheel and crawler) scraper, bulldozer, dumpers, shovels, grader, roller, dragline
- 9.3 Asphalt mixer and tar boilers
- 9.4 Road pavers

10 Airport Engineering :- (10 hrs)

- 10.1 Necessity of study of airport engineering, aviation transport scenario in India.
- 10.2 Factors to be considered while selecting a site for an airport with respect to zoning laws.
- 10.3 Introduction to Runways, Taxiways and Apron

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

### PRACTICAL EXERCISES

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

### INSTRUCTIONAL STRATEGY

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



**RECOMMENDED BOOKS**

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

**IRC Publications**

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

**SUGGESTED DISTRIBUTION OF MARKS**

| <b>Topic No.</b> | <b>Time Allotted (Hrs)</b> | <b>Marks Allotted (%)</b> |
|------------------|----------------------------|---------------------------|
| 1                | 02                         | 04                        |
| 2                | 10                         | 12                        |
| 3                | 10                         | 12                        |
| 4                | 10                         | 12                        |
| 5                | 12                         | 14                        |
| 6                | 06                         | 08                        |
| 7                | 06                         | 08                        |
| 8                | 06                         | 08                        |
| 9                | 08                         | 10                        |
| 10               | 10                         | 12                        |
| <b>Total</b>     | <b>80</b>                  | <b>100</b>                |

### 5.3 SURVEY CAMP

**15 Days Duration**

#### **Purpose**

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

#### **Task:**

Preparation of topographical plan of a given area. The survey camp will be organized for a duration of 15 days time span.

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

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

## 5.4 COMPUTER APPLICATIONS IN CIVIL ENGINEERING

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### RATIONALE

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

### DETAILED CONTENTS

### PRACTICAL EXERCISES

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

### Note:

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

## 5.5 RAILWAYS, BRIDGES AND TUNNELS

|          |          |          |
|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> |
| <b>5</b> | <b>-</b> | <b>-</b> |

### RATIONALE

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

### DETAILED CONTENTS

#### PART – I: RAILWAYS

(35 hrs)

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

**PART-II: BRIDGES**

(35 hrs)

## 12. Introduction

Bridge – its function and component parts, difference between a bridge and a culvert

## 13. Classification of Bridges

Their structural elements and suitability:

13.1 According to life-permanent and temporary

13.2 According to deck level – Deck, through and semi-through

13.3 According to material –timber, masonry, steel, RCC, pre-stressed

13.4 According to structural form;

- Grade Separators-Railway Overbridges (ROB), Railway underbridge (RUB)
- Beam type –RCC, T-Beam, steel girder bridges, plate girder and box girder, balanced cantilever, Trussed bridges.
- Arch type – open spandrel and filled spandrel barrel and rib type
- Suspension type – unstiffened and stiffened and table (its description with sketches)
- According to the position of highest flood level submersible and non submersible

13.5 IRC classification

## 14. Bridge Foundations: Introduction to open foundation, pile foundation, well foundation

## 15. Piers, Abutments and Wingwalls

15.1 Piers-definition, parts; types –solid (masonry and RCC), open

15.2 Abutments and wing walls – definition, types of abutments (straight and tee), abutment with wing walls (straight, splayed, return and curved)

15.3 Launching of Equipment Bridges

## 16. Bridge bearings

Purpose of bearings; types of bearings – fixed plate, rocker and roller.

17. Maintenance of Bridges
  - 17.1 Inspection of Steel and Equipment bridges
  - 17.2 Routine maintenance

**PART - III: TUNNELS**

(10 hrs)

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

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

**INSTRUCTIONAL STRATEGY**

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

**RECOMMENDED BOOKS**

1. Vaswani, NK, “Railway Engineering”, Publishing House, Roorkee
2. Rangwala, SC, “Railway Engineering”, Anand, Charotar Book Stall
3. Deshpande, R, “A Text Book of Railway Engineering”, Poonam United Book Corporation
4. Algia, JS “Bridge Engineering”, Anand, Charotar Book Stall
5. Victor Johnson, “Essentials of Bridge Engineering” Oxford and IBH, Delhi
6. Rangwala S.C., “Bridge Engineering”, Anand, Charotar Book Stall
7. IRC Bridge Codes

8. MORTH drawings for various types of bridges
9. MORTH pocket books for bridge Engineers, 2000 (First Revision)
10. Subhash C Saxena, "Tunnel Engineering", Dhanpat Rai and Sons, Delhi

#### **SUGGESTED DISTRIBUTION OF MARKS**

| <b>Topic No.</b> | <b>Time Allotted (Hrs)</b> | <b>Marks Allotted (%)</b> |
|------------------|----------------------------|---------------------------|
| 1                | 35                         | 43                        |
| 2                | 35                         | 43                        |
| 3                | 10                         | 14                        |
| <b>Total</b>     | <b>80</b>                  | <b>100</b>                |



## 5.6 SOIL AND FOUNDATION ENGINEERING

**L T P**  
**4 - 2**

### RATIONALE

Civil Engineering diploma engineers are required to supervise the construction of structural buildings, roads, pavements, dams, embankments, and other Civil Engineering structures. As such the knowledge of basic soil engineering is the pre-requisite for these engineers for effective discharge of their duties. This necessitates the introduction of Soil and Foundation Engineering subject in the curriculum for Diploma Course in Civil Engineering.

The subject covers only such topics which will enable the diploma engineers to identify and classify the different types of soils, their selection and proper use in the field for various types of engineering structures.

The emphasis will be more on teaching practical aspect rather than theory.

### DETAILED CONTENTS

#### THEORY

1. Introduction: (03 hrs)
  - 1.1 Importance of soil studies in Civil Engineering
  - 1.2 Geological origin of soils with special reference to soil profiles in India: residual and transported soil, alluvial deposits, lake deposits, local soil found in J&K, dunes and loess, glacial deposits, black cotton soils, conditions in which above deposits are formed and their engineering characteristics.
  - 1.3 Names of organizations dealing with soil engineering work in India, soil map of India
2. Physical Properties of Soils: (04 hrs)
  - 2.1 Constituents of soil and representation by a phase diagram
  - 2.2 Definitions of void ratio, porosity, water content, degree of saturation, specific gravity, unit weight, bulk density/bulk unit weight, dry unit weight, saturated unit weight and submerged unit weight of soil grains and correlation between them
  - 2.3 Simple numerical problems with the help of phase diagrams

3. Classification and Identification of Soils (04 hrs)
  - 3.1. Particle size, shape and their effect on engineering properties of soil, particle size classification of soils
  - 3.2 Gradation and its influence on engineering properties
  - 3.3 Relative density and its use in describing cohesionless soils
  - 3.4 Behaviour of cohesive soils with change in water content, Atterberg's limit - definitions, use and practical significance
  - 3.5 Field identification tests for soils
  - 3.6 Soil classification system as per BIS 1498; basis, symbols, major divisions and sub divisions, groups, plasticity chart; procedure for classification of a given soil
4. Flow of Water Through Soils: (04 hrs)
  - 4.1 Concept of permeability and its importance
  - 4.2 Darcy's law, coefficient of permeability, seepage velocity and factors affecting permeability
  - 4.3 Comparison of permeability of different soils as per BIS
  - 4.4 Measurement of permeability in the laboratory
5. Effective Stress: (Concept only) (04 hrs)
  - 5.1 Stresses in subsoil
  - 5.2 Definition and meaning of total stress, effective stress and neutral stress
  - 5.3 Principle of effective stress
  - 5.4 Importance of effective stress in engineering problems
6. Deformation of Soils (04 hrs)
  - 6.1 Meaning, conditions/situations of occurrence with emphasis on practical significance of:
    - a) Consolidation and settlement
    - b) Creep

- c) Plastic flow
  - d) Heaving
  - e) Lateral movement
  - f) Freeze and thaw of soil
- 6.2 Definition and practical significance of compression index, coefficient of consolidation, degree of consolidation.
- 6.3 Meaning of total settlement, uniform settlement and differential settlement; rate of settlement and their effects
- 6.4 Settlement due to construction operations and lowering of water table
- 6.5 Tolerable settlement for different structures as per BIS
7. Shear Strength Characteristics of Soils: (09 hrs)
- 7.1. Concept and Significance of shear strength
  - 7.2 Factors contributing to shear strength of cohesive and cohesion less soils, Coulomb's law
  - 7.3 Examples of shear failure in soils
8. Compaction: (04 hrs)
- 8.1 Definition and necessity of compaction
  - 8.2 Laboratory compaction test (standard and modified proctor test as per BIS) definition and importance of optimum water content, maximum dry density; moisture dry density relationship for typical soils with different compactive efforts
  - 8.3. Compaction control; Density control, measurement of field density by core cutter method and sand replacement method, moisture control, Proctor's needle and its use, thickness control, jobs of an embankment supervisor in relation to compaction
9. Soil Exploration: (08 hrs)
- 9.1 Purpose and necessity of soil exploration
  - 9.2 Reconnaissance, methods of soil exploration, Trial pits, borings (auger, wash, rotary, percussion to be briefly dealt)

- 9.3 Sampling; undisturbed, disturbed and representative samples; selection of type of sample; thin wall and piston samples; area ratio, recovery ratio of samples and their significance, number and quantity of samples, resetting, sealing and preservation of samples.
- 9.4 Presentation of soil investigation results
- 10 Bearing Capacity of soil (10 hrs)
- 10.1 Concept of bearing capacity
- 10.2 Definition and significance of ultimate bearing capacity, net safe bearing capacity and allowable bearing pressure
- 10.3 Guidelines of BIS (IS 6403) for estimation of bearing capacity of soil
- 10.4 Factors affecting bearing capacity
- 10.5 Concept of vertical stress distribution in soils due to foundation loads, pressure bulb
- 10.6 Applications of SPT, unconfined compression test and direct shear test in estimation of bearing capacity
- 10.7 Plate load test (no procedure details) and its limitations
- 10.8 Improvement of bearing capacity by sand drain method, compaction, use of geo-synthetics.
11. Foundation Engineering: (10 hrs)
- Concept of shallow and deep foundation; types of shallow foundations: isolated, combined, strip, mat, and their suitability. Factors affecting the depth of shallow foundations, deep foundations, type of piles and their suitability; pile classification on the basis of material, pile group and pile cap.

### **PRACTICAL EXERCISES**

1. To determine the moisture content of a given sample of soil
2. Auger Boring and Standard Penetration Test
  - a) Identifying the equipment and accessories
  - b) Conducting boring and SPT at a given location
  - c) Collecting soil samples and their identification

- d) Preparation of boring log and SPT graphs
  - e) Interpretation of test results
3. Extraction of Disturbed and Undisturbed Samples
- a) Extracting a block sample
  - b) Extracting a tube sample
  - c) Extracting a disturbed samples for mechanical analysis.
  - d) Field identification of samples
4. Field Density Measurement (Sand Replacement and Core Cutter Method)
- a) Calibration of sand
  - b) Conducting field density test at a given location
  - c) Determination of water content
  - d) Computation and interpretation of results
5. Liquid Limit and Plastic Limit Determination:
- a) Identifying various grooving tools
  - b) Preparation of sample
  - c) Conducting the test
  - d) Observing soil behaviour during tests
  - e) Computation, plotting and interpretation of results
6. Mechanical Analysis
- a) Preparation of sample
  - b) Conducting sieve analysis
  - c) Computation of results
  - d) Plotting the grain size distribution curve
  - e) Interpretation of the curve
7. Laboratory Compaction Tests (Standard Proctor Test)
- a) Preparation of sample
  - b) Conducting the test
  - c) Observing soil behaviour during test
  - d) Computation of results and plotting
  - e) Determination of optimum moisture content and maximum dry density
8. Demonstration of Unconfined Compression Test
- a) Specimen preparation
  - b) Conducting the test
  - c) Plotting the graph
  - d) Interpretation of results and finding/bearing capacity

9. Demonstration of:
- Direct Shear and Vane Shear Test on sandy soil samples
  - Permeability test apparatus

### **INSTRUCTIONAL STRATEGY**

The teacher while imparting instructions are expected to lay greater emphasis on the practical aspects rather than theory and mathematical treatment. To bring clarity regarding concepts and principles involved, teachers should organize demonstrations in the laboratories and fields. It is necessary to create understanding that soils fail either under shear or settlement due to heavy loads. This can be shown by making use of photographs on working models of such failures. Efforts should be made in the practical classes that students perform practical exercises individually. Conduct of viva examination at the end of each practical work will develop clear understanding about the concepts and principles related to this subject.

### **RECOMMENDED BOOKS**

- Punmia, BC, "Soil Mechanics and Foundations"; Standard Publishers, Delhi
- Bharat Singh and Shamsheer Prakash; "Soil Mechanics and Foundations Engineering", Nem Chand and Bros, Roorkee,
- Sehgal, SB, "A Text Book of Soil Mechanics"; CBS Publishers and Distributors, Delhi,
- Gulati, SK and Manoj Dutta, "Geotechnical Engineering ", Tata McGraw Hill, Delhi,
- Ranjan Gopal and Rao ASR "Basic and Applied Soil Mechanics", New Age Publication (P) Ltd., New Delhi
- Singh Harbhajan "Soil and Foundation Engineering", Abhishek Publishers, Chandigarh
- S Mittal and JP Shukla, "Soil Testing for Engineers", Khanna Publishers Ltd., Delhi
- BIS Codes IS 6403 (latest edition) and IS 1498 (latest edition)
- Jagroop Singh, "Soil and Foundation Engineering", Eagle Parkashan, Jalandhar
- Rabinder Singh, "Soil and Foundation Engg." SK Kataria and Sons, Ludhiana
- NITTTR, Chandigarh, "Shallow Foundations"
- Video films on Geo-technical Laboratory Practices by NITTTR, Chandigarh

**SUGGESTED DISTRIBUTION OF MARKS**

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

## 5.7. GENERIC SKILLS AND ENTREPRENEURSHIP DEVELOPMENT

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### RATIONALE

Generic Skills and Entrepreneurship Development is one of the courses from “Human Science” subject area. Generic skills have emerged as an important component of employability skills, which enable an individual to become and remain employable over lifetime and to lead happy and prosperous life. Entrepreneurship development aim at developing conceptual understanding for setting-up one’s own business venture/enterprise. This aspect of Human Resource Development has become equally important in the era, when wage employment prospects have become meager.

Both the subject areas are supplementary to each other and soft skills are required to be developed in diploma passouts for enhancing their employability and self confidence.

### DETAILED CONTENTS

1. Introduction to Generic Skills (04 hrs)
  - 1.1 Importance of Generic Skill Development (GSD)
  - 1.2 Global and Local Scenario of GSD
  - 1.3 Life Long Learning (LLL) and associated importance of GSD.
  
2. Managing Self (08 hrs)
  - 2.1 Knowing Self for Self Development
    - Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc.
  - 2.2 Managing Self - Physical
    - Personal grooming, Health, Hygiene, Time Management
  - 2.3 Managing Self – Intellectual development
    - Information Search: Sources of information
    - Listening: Effective Listening
    - Speaking: Effective Oral Communication
    - Reading: Purpose of reading, different styles of reading, techniques of systematic reading; Note Taking: Importance and techniques of note taking
    - Writing: Correspondence - personal and business



Note: Practical sessions should be coupled with teaching of effective listening, speaking, reading and writing.

#### 2.4 Managing Self – Psychological

- Stress, Emotions, Anxiety-concepts and significance (Exercises related to stress management)
- Techniques to manage the above

### 3. Managing in Team (06 hrs)

- 3.1 Team - definition, hierarchy, team dynamics
- 3.2 Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background
- 3.3 Communication in group - conversation and listening skills

### 4 Task Management (03 hrs)

- 4.1 Task Initiation, Task Planning, Task execution, Task close out
- 4.2 Exercises/case studies on task planning towards development of skills for task management

### 5. Problem Solving (05 hrs)

- 5.1 Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving
- 5.2 Different approaches for problem solving.
- 5.3 Steps followed in problem solving.
- 5.4 Exercises/case studies on problem solving.

### 6. Entrepreneurship

#### 6.1 Introduction (22 hrs)

- Concept/Meaning and its need
- Competencies/qualities of an entrepreneur
- Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level.

#### 6.2 Market Survey and Opportunity Identification (Business Planning)

- How to start a small scale industry
- Procedures for registration of small-scale industry
- List of items reserved for exclusive manufacture in small-scale industry

- Assessment of demand and supply in potential areas of growth.
- Understanding business opportunity
- Considerations in product selection
- Data collection for setting up small ventures.

### 6.3 Project Report Preparation

- Preliminary Project Report
- Techno-Economic Feasibility Report
- Exercises on Preparation of Project Report in a group of 3-4 students

## **INSTRUCTIONAL STRATEGY**

This subject will require a blend of different teaching and learning methods beginning with lecture method. Some of the topics may be taught using question answer, assignment, case studies or seminar. In addition, expert lectures may be arranged from within the institution or from management organizations. Conceptual understanding of Entrepreneurship, inputs by teachers and outside experts will expose the students so as to facilitate in starting ones own business venture/enterprise. The teacher will discuss success stories and case studies with students, which in turn, will develop managerial qualities in the students. There may be guest lectures by successful diploma holding entrepreneurs and field visits also. The students may also be provided relevant text material and handouts.

## **RECOMMENDED BOOKS**

1. Soft Skills for Interpersonal Communication by S.Balasubramaniam; Published by Orient BlackSwan, New Delhi
2. Generic skill Development Manual, MSBTE, Mumbai.
3. Lifelong learning, Policy Brief ([www.oecd.org](http://www.oecd.org))
4. Lifelong learning in Global Knowledge Economy, Challenge for Developing Countries – World Bank Publication
5. Towards Knowledge Society, UNESCO Paris Publication
6. Your Personal Pinnacle of Success by DD Sharma, Sultan Chand and Sons, New Delhi
7. Human Learning, Ormrod
8. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
9. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
10. Handbook of Small Scale Industry by PM Bhandari

**SUGGESTED DISTRIBUTION OF MARKS**

| <b>Topic No.</b> | <b>Time Allotted<br/>(hrs)</b> | <b>Marks Allotted<br/>(%)</b> |
|------------------|--------------------------------|-------------------------------|
| 1.               | 04                             | 05                            |
| 2.               | 08                             | 15                            |
| 3.               | 06                             | 10                            |
| 4.               | 03                             | 10                            |
| 5.               | 05                             | 10                            |
| 6.               | 22                             | 50                            |
| <b>Total</b>     | <b>48</b>                      | <b>100</b>                    |

### **5.8 MINOR PROJECT WORK (CONSTRUCTION SITE ORIENTED)**

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**- - 4**

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

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

As a minor project activity, each student is supposed to study the operations at site and prepare a detailed project report of the observations/processes seen by him/her and give seminar using computer aided presentation slides using photographs. These students should be guided by respective subject teachers. Each teacher may guide a group of 10 – 15 students.

The teachers along with field supervisors will conduct performance assessment of students. Some of the projects are suggested below:

1. Survey of a village approach road, drawings of L-section and x-sections
2. Estimation of white washing and distempering in hostel building
3. Preparation of detailed estimate with drawings of septic tank for 30-40 users

4. Plumbing work and installation of PVC over-head water tank on a toilet block and then prepare report
5. Construction of different components of a building
6. Identification of water-supply fittings and replacement of defective fittings and then prepare report.
7. Construction of a pipe/slab culvert
8. Ferro-cement construction techniques
  - a) Low cost housing
  - b) New construction materials
9. Study and preparation of models of hydraulic pumps.

This Industry oriented minor project work will carry 50 marks for internal assessment .

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

**PERSONALITY DEVELOPMENT AWARENESS CAMP**

This is to be organized at a stretch for two to three days during fifth or sixth semester. Extension Lectures by experts or teachers from the polytechnic will be delivered on the following broad topics. There will be no examination for this subject.

1. Communication Skills
2. Correspondence and job finding/applying/thanks and follow-up
3. Resume Writing
4. Interview Techniques: In-Person Interviews; Telephonic Interview' Panel interviews; Group interviews and Video Conferencing etc.
5. Presentation Techniques
6. Group Discussions Techniques
7. Aspects of Personality Development
8. Motivation
9. Leadership
10. Stress Management
11. Time Management
12. Interpersonal Relationship
13. Health and Hygiene