

FOURTH SEMESTER (CIVIL ENGINEERING)

Sr. No.	SUBJECTS	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	*Communication Skill-II	4	-	2	4	20	10	30	50	2 ½	20	3	70	100
4.2	Highway Engineering	6	-	2	5	20	10	30	50	2 ½	20	3	70	100
4.3	Irrigation Engineering	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
4.4	Surveying - I	4	-	8	6	20	10	30	50	2 ½	20	3	70	100
4.5	Reinforced Cement Concrete Structures (RCC Structures)	6	-	-	5	20	-	20	50	2 ½	-	-	50	70
4.6	*Energy Conservation	3	-	2	3	20	10	30	50	2 ½	20	3	70	100
4.7	RCC Drawing	-	-	4	2	-	20	20	50	3	-	-	50	70
#Student Centred Activities (SCA)		-	-	2	1	-	30	30	-	-	-	-	-	30
Total		28	-	20	30	120	90	210	350	-	80	-	430	640

* Common with other diploma programmes

- **4 weeks industrial training will be organised after 4th Semester exam. The evaluation of industrial training will be done in 5th semester.**

Student Centred Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

4.1 COMMUNICATION SKILLS – II

L	T	P
4	-	2

RATIONALE

Knowledge of English Language plays an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills as parts of Communication Skill.

LEARNING OUTCOMES

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

- Frame correct sentences with illustrations
- Comprehend the language correctly
- Interpret the language correctly
- Use given material in new situations.
- Correspond effectively using various types of writings like letters, memos etc.
- Communicate effectively in English with appropriate body language making use of correct and appropriate vocabulary and grammar in an organised set up and social context.

DETAILED CONTENTS

- | | | |
|----|---|--------------|
| 1. | Functional Grammar | (16 periods) |
| | 1.1 Prepositions | |
| | 1.2 Framing Questions | |
| | 1.3 Conjunctions | |
| | 1.4 Tenses | |
| 2 | Reading | (16 periods) |
| | 2.1 Unseen Passage for Comprehension (Vocabulary enhancement - Prefixes, Suffixes, one word substitution, Synonym and Antonym) based upon the passage should be covered under this topic. | |
| 3 | Writing Skill | (24 periods) |
| | 3.1. Correspondence | |
| | a) Business Letters- Floating Quotations, Placing Orders, Complaint Letters. | |
| | b) Official Letters- Letters to Government and other Offices | |
| | 3.2. Memos, Circular, Office Orders | |
| | 3.3. Agenda & Minutes of Meeting | |

3.4. Report Writing

LIST OF PRACTICALS

Note: Teaching Learning Process should be focused on the use of the language in writing reports and making presentations.

Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught in a project oriented manner where the learning happens as a byproduct.

Speaking and Listening Skills

1. Debate
2. Telephonic Conversation: general etiquette for making and receiving calls
3. Offering- Responding to offers.
4. Requesting – Responding to requests
5. Congratulating
6. Exploring sympathy and condolences
7. Asking Questions- Polite Responses
8. Apologizing, forgiving
9. Complaining
10. Warning
11. Asking and giving information
12. Getting and giving permission
13. Asking for and giving opinions

INSTRUCTIONAL STRATEGY

Students should be encouraged to participate in role play and other student-centered activities in class rooms and actively participate in listening exercises

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by RevathiSrinivas; Abhishek Publications, Chandigarh.

2. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:

1. <http://www.mindtools.com/> page 8.html – 99k
2. <http://www.letstalk.com.in>
3. <http://www.englishlearning.com>
4. <http://learnenglish.britishcouncil.org/en/>
5. <http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	16	28
2	16	28
3	24	44
Total	56	100

4.2 HIGHWAY ENGINEERING

L T P
6 - 2

RATIONALE

Construction of roads is one of the major areas in which diploma holders in Civil Engineering may get very good opportunities for employment. The 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.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- classify the roads as per IRC types and geometrics
- explain various components of a flexible/rigid pavement
- select various highway materials and test them for different quality parameters
- supervise construction of a highway in plain areas and hilly areas
- supervise repair and maintenance of roads
- supervise preparation of bituminous mix in the hot mix plants
- describe the use various road construction equipment
- describe basic terminology of various components of an airport.

DETAILED CONTENTS

1. Introduction (04 Periods)
 - 1.1 Importance of Highway engineering
 - 1.2 Functions of IRC, CRRI, MoRT & H, NHAI
 - 1.3 Classification of roads
 - 1.4 Mass Transportation system
 - 1.5 Concept of Smart highways

2. Road Geometrics (08 Periods)
 - 2.1 Glossary of terms used in road geo-metrics and their importance: Right-of-way, formation width, road margin, road shoulder, carriage way, side slopes, kerbs, formation levels, camber and gradient
 - 2.2 Average running speed, stopping and overtaking 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 L-section and X-section in cutting and filling on straight alignment and at a curve
(Note: No design/numerical problem to be taken)
3. Highway Alignment (06 Periods)
- 3.1 Basic considerations governing alignment for a road in plain and hilly area
- 3.2 Highway location, marking of alignment on ground, setting out alignment of road, setting out bench marks, control pegs for embankment and cutting
4. Road Materials (10 Periods)
- 4.1 Different types of road materials in use; soil, aggregate and binders
- 4.2 Introduction to California Bearing Ratio, method of finding CBR value and its significance. Aggregate : Source and types, important properties, strength, durability
- 4.3 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 (CRMB, PMB)
- 4.4 Use of recycled materials in pavements.
5. Road Pavements (16 Periods)
- 5.1 Road pavement: Flexible and rigid pavement, their merits and demerits, typical cross-sections, functions of various components
- 5.2 Sub-grade preparation
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.
- 5.3 Stabilization of subgrade. Types of stabilization mechanical stabilization, lime stabilization, cement stabilization, fly ash stabilization etc.(introduction only)
- 5.4 Base Course
Granular base course:
(a) Water Bound Macadam (WBM)
(b) Wet Mix Macadam (WMM)
Bitumen Courses:
(a) Bituminous Macadam
(b) Dense Bituminous Macadam (DBM)

*Methods of construction as per MoRT&H

5.5 Surfacing

* Types of surfacing

- a) Prime coat and tack coat
- b) Surface dressing with seal coat
- c) Open graded premix carpet
- d) Mix seal surfacing
- e) Semi dense bituminous concrete
- f) Bituminous Concrete

* Methods of constructions as per MORT&H specifications and quality control; equipments used for above.

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. Roller compacted concrete.

6. Hill Roads (08 Periods)

- 6.1 Introduction: Typical cross-sections showing all details of a typical hill road, partly in cutting and partly in filling
- 6.2 Special problems of hill areas
 - 6.2.1 Landslides: Causes, prevention and control measures, use of geogrids, geoflexibles, geo synthetics
 - 6.2.2 Drainage
 - 6.2.3 Soil erosion
 - 6.2.4 Snow: Snow clearance, snow avalanches, frost
 - 6.2.5 Land Subsidence

7. Road Drainage (06 Periods)

- 7.1 Necessity of road drainage work, cross drainage
- 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 (08 Periods)

- 8.1 Common types of road failures of flexible pavements: Pot hole, cracks, rutting, alligator, cracking, upheaval - their causes and remedies (brief description)
- 8.2 Maintenance of bituminous road such as crack sealing, patch-work and resurfacing.
- 8.3 Maintenance of concrete roads-filling cracks, repairing joints, maintenance of shoulders (beams)

9. Road Construction Equipment (10 Periods)

Output and use of the following plant and equipment

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

10 Airport Engineering (08 Periods)

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

* 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 crushing strength of aggregate
7. Determination of the California bearing ratio (CBR) for the sub-grade soil
8. Demonstration of working of hot mix plant through a field visit
9. 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

10. Demonstration of working of mixing and spraying equipment through a field visit

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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Actual Practical Performance
- Report Writing
- Viva-voce

RECOMMENDED BOOKS

1. Highway Engineering by Khanna, SK and Justo, CEG; Nem Chand and Bros., Roorkee
2. A Text Book on Highway Engineering and Airport by Sehgal, SB; and Bhanot, KL; S Chand and Co, Delhi
3. A Course on Highway Engineering by Bindra, SP; Dhanpat Rai and Sons, New Delhi
4. Laboratory Manual in Highway Engineering by Duggal AK, Puri VP; New Age Publishers (P) Ltd, Delhi
5. Laboratory Manual in Highway Engineering, by NITTTR, Chandigarh
6. Maintenance of Highway – a Reader by Duggal AK; NITTTR, Chandigarh
7. Types of Highway Construction by Duggal AK; NITTTR Chandigarh
8. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

IRC Publications

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	05
2	08	10
3	06	07
4	10	12
5	16	19
6	08	10
7	06	07
8	08	10
9	10	12
10	08	08
Total	84	100

4.3 IRRIGATION ENGINEERING

L T P
5 - -

RATIONALE

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

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- explain concept of necessity of irrigation in India
- recognize different crops and their water requirements
- define rainfall and runoff
- measure rainfall and read rain gauges and hydrographs
- monitor construction and maintenance work of canal and canal linings
- monitor installation of tubewells and water harvesting techniques
- supervise maintenance and construction work of canal head works and cross regulators
- supervise construction of various river training works
- carry out desilting operation of canals

DETAILED CONTENTS

THEORY

- | | | |
|----|---|--------------|
| 1. | Introduction | (03 Periods) |
| | 1.1 Definition of irrigation | |
| | 1.2 Necessity of irrigation, Role of Irrigation in country's economy. | |
| | 1.3 History of development of irrigation in India | |
| | 1.4 Major, medium and minor irrigation projects of India. | |
| 2. | Water Requirement of Crops | (06 Periods) |
| | 2.1 Principal crops in India and their water requirements | |
| | 2.2 Crop seasons – Kharif and Rabi | |

- 2.3 Soil water, soil crop and crop water relationships, Duty, Delta and Base Period, their relationship
- 2.4 Gross commanded area (GCA), culturable commanded area (CCA), Intensity of Irrigation, Paleo, Kor, Crop Ratio, Crop period, Base period, Duty, Delta. Relation between Duty-Delta and Base period.
3. Hydrological Cycle Catchment Area and Run-off (06 Periods)
- Rainfall , definition rain-gauges – automatic and non-automatic, methods of estimating average rainfall, Advantages of keeping rainfall records, (Arithmetic system); catchment area, runoff, factors affecting runoff, hydrograph, basic concept of unit hydrograph.
4. Methods of Irrigation (06 Periods)
- 4.1 Flow irrigation - its advantages and limitations
- 4.2 Lift Irrigation – Tubewell, submersible and well irrigation advantages and disadvantages
- 4.3 Sprinkler irrigation conditions favourable and essential requirements for sprinkler irrigation, sprinkler system – classification and component parts
- 4.4 Drip irrigation, suitability of drip irrigation, layout, component parts, advantages
5. Canals (10 Periods)
- 5.1 Factors to be considered in Canal Alignment.
- 5.2 Functions/Purpose of various components of Canal.
- 5.3 Classification of Canals and their functions, sketches of different canal cross-sections
- 5.4 Various types of canal lining - their related advantages and disadvantages, sketches of different lined canal X-sections
- 5.5 Breaches – Causes, Method to plug canal breaches and their control
- 5.6 Maintenance of lined and unlined canals
6. Tubewell Irrigation (09 Periods)
- 6.1 Introduction, occurrence of ground water, location and command, advantages and disadvantages, comparison with canal irrigation
- 6.2 Tubewells, explanation of terms: water table, radius of influence, depression head, cone of depression, confined and unconfined aquifers. Yield of a well and methods of determining yield of well
- 6.3 Types of tubewells (cavity type, strainer type and slotted type) and their choice

- 6.4 Method of boring, installation of well assembly, development of well, pump selection and installation and maintenance
- 6.5 Water Harvesting Techniques: Need and requirement of various methods, Run-off from roof top and ground surface, construction of recharge pits and recharge wells and their maintenance.
7. Dams (08 Periods)
- 7.1 Classification of dams; earthen dams - types, causes of failure; cross-section of homogeneous, zoned and diaphragm type earthen dams, method of construction. Gravity dams – types, cross-sections of a dam, method of construction
- 7.2 Concept of small and micro dams
- 7.3 Concept of spillways and energy dissipators
8. Canal Head Works and Regulatory Works (06 Periods)
- Choice of location of Canal Head Works, definition, object, general layout, functions of different parts of head works. Difference between weir and barrage
9. Cross Drainage Works (05 Periods)
- 9.1 Functions and necessity Cross Drainage Works, Types of Cross Drainage Works: aqueduct, super passage, level crossing, inlet and outlet
- 9.2 Sketches of the above cross drainage works
10. Definitions of following Hydraulic Structures with Sketches (04 Periods)
- 10.1 Falls
- 10.2 Cross and head regulators
- 10.3 Outlets
- 10.4 Canal Escapes
11. River Training Works (04 Periods)
- Various River Stages, Purpose/functions of River Training works, Meandering of rivers, Methods of river training, guide banks, Marginal Embankment, retired (levees) embankments, groynes and spurs, pitched island, cut-off
12. Water Logging and Drainage and Ground Water Re-charge (03 Periods)
- 12.1 Definition of water logging – its causes and ill effects, detection, prevention and remedies
- 12.2 Surface and sub-surface drains and their layout

12.3 Concept and various techniques used for ground water re-charge

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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-Voce

RECOMMENDED BOOKS

1. Irrigation Engineering and Hydraulics Structures by Garg, Santosh Kumar; Khanna Publishers, Delhi,
2. Irrigation and Water Power Engineering by Punmia, BC and Pande Brij Bansi Lal; Standard Publishers Distributors, Delhi
3. Irrigation Engineering and Hydraulic Structures by Saharsabudhe SR
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/ NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	03	04
2	06	08
3	06	08
4	06	08
5	10	16
6	09	12
7	08	12
8	06	08
9	05	08
10	04	06
11	04	06
12	03	04
Total	70	100

4.4 SURVEYING - I

L T P
4 - 8

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.

LEARNING OUTCOMES

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

- Measure a long line with chain or tape
- Prepare maps for closed traverse and open traverse with survey instruments
- Measure bearing of line
- Perform leveling with digital level
- Find difference of level between two points with dumpy level, auto level and digital level
- Perform temporary adjustments of leveling instruments

DETAILED CONTENTS

- | | | |
|----|---|--------------|
| 1. | Introduction | (05 Periods) |
| | 1.1 Basic principles of surveying | |
| | 1.2 Concept and purpose of surveying, measurements-linear and angular, units of measurements | |
| | 1.3 Instruments used for taking these measurements, classification based on surveying instruments | |
| 2. | Chain surveying | (06 Periods) |
| | 2.1 Purpose and principles of Chain Surveying | |
| | 2.2 Introduction, advantages and disadvantages | |

- 2.3 Direct and indirect ranging, offsets and recording of field notes
- 2.4 Obstacles in Chain Surveying
- 2.5 Errors in Chain Surveying and their correction.
3. Compass surveying (11 Periods)
- 3.1 Purpose of compass surveying. Use of prismatic compass: Setting and taking observations
- 3.2 Concept of following with simple numerical problems:
- Meridian - Magnetic and true, Arbitrary
 - Bearing - Magnetic, True and Arbitrary
 - Whole circle bearing and reduced bearing
 - Fore and back bearing
 - Magnetic dip and declination
- 3.3 Local attraction - causes, detection, errors and corrections, problems on local attraction, magnetic declination and calculation of included angles in a compass traverse (Simple Numerical Problems)
4. Levelling (17 Periods)
- 4.1 Purpose of levelling, concept of a level surface, horizontal surface, vertical surface, datum, reduced level and bench marks
- 4.2 Identification of various parts of Dumpy level and use of Dumpy level, Engineer' level, Auto level: advantages and disadvantages, use of auto level.
- 4.3 Concepts of line of collimation, axis of the bubble tube, axis of the telescope and vertical axis
- 4.4 Levelling staff: single piece, folding, invar precision staff, telescopic
- 4.5 Temporary adjustment and permanent adjustment of dumpy level by two peg method.
- 4.6 Concept of back sight, foresight, intermediate sight, change point, to determine reduce levels
- 4.7 Level book and reduction of levels by
- Height of collimation method and
 - Rise and fall method
- 4.8 Arithmetic checks, problem on reduction of levels, fly levelling, check leveling and profile levelling (L-section and X-section), errors in levelling, permissible limits, reciprocal leveling. Numerical problems.
5. Plane Table Surveying (17 Periods)
- 5.1 Purpose of plane table surveying, equipment used in plane table survey:
- 5.2 Setting of a plane table:
- Centering
 - Levelling

(c) Orientation

5.3 Methods of plane table surveying

- (a) Radiation,
- (b) Intersection
- (c) Traversing
- (d) Resection

5.4 Concept of Two point and Three point problems (Concept only)

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

PRACTICAL EXERCISES

I. Chain surveying

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

III. Compass Surveying

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

III. Levelling

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

IV. Plane Table Surveying

- i)
 - a) Study of the plane table survey equipment
 - b) Setting the plane table
 - c) Marking the North direction
 - d) Plotting a few points by radiation method
- ii)
 - a) Orientation by
 - Trough compass
 - Back sighting
 - b) Plotting few points by intersection, radiation and resection method
- iii) Traversing an area with a plane table (at least five lines)

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

INSTRUCTIONAL STRATEGY

This is highly practice-oriented course. While imparting theoretical instructions, teachers are expected to demonstrate the use of various instruments in surveying, stress should be laid on correct use of various instruments so as to avoid/minimize errors during surveying. It is further recommended that more emphasis should be laid in conducting practical work by individual students. Technical visit to Survey of India, Northern Region and Great Trigonometrical Survey(GTS), Dehradun.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests,
- Mid-term and end-term written tests
- Actual Practical Performance
- Viva-Voce

RECOMMENDED BOOKS

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

Websites for Reference

<http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	05	10
2	06	10
3	11	20
4	17	30
5	17	30
Total	56	100

4.5 REINFORCED CEMENT CONCRETE STRUCTURES

L T P
6 - -

RATIONALE

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

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Explain methods of RCC design i.e.
 - Working stress methods
 - Limit state methods
- Design singly, doubly reinforced rectangular and T&L beams as per IS Code
- Design one way and two way slab
- Design axially loaded column and their isolated footing

DETAILED CONTENTS

- | | | |
|----|---|---------------|
| 1. | Introduction | (03 Periods) |
| | 1.1 Concept of Reinforced Cement Concrete (RCC) | |
| | 1.2 Reinforcement Materials: | |
| | - Suitability of steel as reinforcing material | |
| | - Properties of mild steel, HYSD steel and TMT bars | |
| | 1.3. Loading on structures as per IS: 875 | |
| 2. | Introduction to following methods of RCC design | (04 Periods) |
| | 2.1 Working stress method: Definition and basic assumptions | |
| | 2.2 Limit state method: Definition and basic assumptions | |
| | 2.3 Problems of singly, doubly and T beam analysis by working stress method | |
| 3. | Shear and Development Length | (06 Periods) |
| | 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. | Concept of Limit State Method | (08 Periods) |

- 4.1. Definitions and assumptions made in limit state of collapse (flexure)
- 4.2. Partial factor of safety for materials
- 4.3. Partial factor of safety for loads
- 4.4. Design loads
- 4.5. Stress block, parameters

5. Singly Reinforced beam (10 Periods)
Theory and design of singly reinforced beam by Limit State Method

6. Doubly Reinforced Beams (10 Periods)
Theory and design of simply supported doubly reinforced rectangular beam by Limit State Method

7. Behavior of T beam, inverted T beam, isolated T beam and 'L' beams. Simple problems related to moment capacity. (07 Periods)

8. One Way Slab (11 Periods)
Theory and design of simply supported one way slab including sketches showing reinforcement details (plan and section) by Limit State Method..

9. Two Way Slab (11 Periods)
Theory and design of two-way simply supported slab with corners free to lift, no provisions for torsional reinforcement by Limit State Method including sketches showing reinforcement details (plan and two sections)

10. Axially Loaded Column (09 Periods)
 - 10.1 Definition and classification of columns
 - 10.2 Effective length of column,
 - 10.3 Specifications for longitudinal and lateral reinforcement
 - 10.4 Design of axially loaded square, rectangular and circular short columns by Limit State Method including sketching of reinforcement(sectional elevation and plan)

11. Pre-stressed Concrete (05 periods)
 - 11.1 Concept of pre-stressed concrete
 - 11.2 Methods of pre-stressing: pre-tensioning and post-tensioning
 - 11.3 Advantages and disadvantages of pre-stressing

11.4 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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Presentations
- Viva-Voce

RECOMMENDED BOOKS

1. Design of Reinforced Concrete Structures by Alok Srivastava
2. Reinforced Concrete Structure Vol I by Punmia, BC; Standard Publishers, Delhi
3. Design and Testing of Reinforced Structures by Ramamurtham, S; Dhanpat Rai and Sons, Delhi
4. RCC Design and Drawing by Singh, Birinder; Kaption Publishing House, New Delhi
5. E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	03	03
2	04	05
3	06	07
4	08	10
5	10	12
6	10	12
7	07	10
8	11	12
9	11	12
10	09	10
11	05	07
Total	84	100

4.6 ENERGY CONSERVATION

L T P
3 - 2

RATIONALE

The requirement of energy has increased manifolds in last two decades due to rapid urbanization and growth in industrial/service sector. It has become challenging task to meet ever increasing energy demands with limited conventional fuels and natural resources. Due to fast depletion of fossil fuels and a tremendous gap between supply and demand of energy, it is essential to adopt energy conservation techniques in almost every field like industries, commercial and residential sectors etc. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This course covers the concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in general industry and details out energy audit methodology and energy audit instruments.

LEARNING OUTCOMES

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

- define principles and objectives of energy management and energy audit.
- understand Energy Conservation Act 2001 and its features.
- understand various forms & elements of energy.
- identify electrical and thermal utilities. Understand their basic principle of operation and assess performance of various equipments.
- identify areas of energy conservation and adopt conservation methods in various systems.
- evaluate the techno economic feasibility of the energy conservation technique adopted.

DETAILED CONTENTS

1. Basics of Energy
 - 1.1 Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators.
 - 1.2 Global fuel reserve
 - 1.3 Energy scenario in India and state of U.P. Sector-wise energy consumption (domestic, industrial, agricultural and other sectors)
 - 1.4 Impact of energy usage on climate

2. Energy Conservation and EC Act 2001

- 2.1 Introduction to energy management, energy conservation, energy efficiency and its need
 - 2.2 Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance. Prominent organizations at centre and state level responsible for its implementation.
 - 2.3 Standards and Labeling: Concept of star rating and its importance, Types of product available for star rating
3. Electrical Supply System and Motors
 - 3.1 Types of electrical supply system
 - 3.2 Single line diagram
 - 3.3 Losses in electrical power distribution system
 - 3.4 Understanding Electricity Bill: Transformers Tariff structure, Components of power (kW, kVA and kVAR) and power factor, improvement of power factor, Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC)
 - 3.5 Transformers: Introduction, Losses in transformer, transformer Loading, Tips for energy savings in transformers
 - 3.6 Electric Motors
Types of motors, Losses in induction motors Features and characteristics of energy efficient motors, Estimation of motor loading, Variation in efficiency and power factor with loading, Tips for energy savings in motors
4. Energy Efficiency in Electrical Utilities
 - 4.1 Pumps: Introduction to pump and its applications, Efficient pumping system operation, Energy efficiency in agriculture pumps, Tips for energy saving in pumps
 - 4.2 Compressed Air System: Types of air compressor and its applications, Leakage test, Energy saving opportunities in compressors.
 - 4.3 Energy Conservation in HVAC and Refrigeration System: Introduction, Concept of Energy Efficiency Ratio (EER), Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems.
5. Lighting and DG Systems
 - 5.1 Lighting Systems: Basic definitions- Lux, lumen and efficacy, Types of different lamps and their features, Energy efficient practices in lighting
 - 5.2 DG Systems: Introduction, Energy efficiency opportunities in DG systems, Loading estimation
6. Energy Efficiency in Thermal Utilities

- 6.1 Thermal Basics: Thermal energy, Energy content in fuels, Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE)
- 6.2 Energy Conservation in boilers and furnaces : Introduction and types of boilers, Energy performance assessment of boilers, Concept of stoichiometric air and excess air for combustion, Energy conservation in boilers and furnaces, Do's and Don'ts for efficient use of boilers and furnaces
- 6.3 Cooling Towers: Basic concept of cooling towers, Tips for energy savings in cooling towers
- 6.4 Efficient Steam Utilization
- 7. Energy Conservation Building Code (ECBC)
 - 7.1 ECBC and its salient features
 - 7.2 Tips for energy savings in buildings: New Buildings, Existing Buildings
- 8. Waste Heat Recovery and Co-Generation
 - 8.1 Concept, classification and benefits of waste heat recovery
 - 8.2 Concept and types of co-generation system
- 9. General Energy Saving Tips

Energy saving tips in:

 - 9.1 Lighting
 - 9.2 Room Air Conditioner
 - 9.3 Refrigerator
 - 9.4 Water Heater
 - 9.5 Computer
 - 9.6 Fan, Heater, Blower and Washing Machine
 - 9.7 Colour Television
 - 9.8 Water Pump
 - 9.9 Cooking
 - 9.10 Transport
- 10. Energy Audit
 - 10.1 Types and methodology
 - 10.2 Energy audit instruments
 - 10.3 Energy auditing reporting format

PRACTICAL EXERCISES

- 1. To conduct load survey and power consumption calculations of small building.

2. To check efficacy of different lamps by measuring power consumption and lumens using lux meter.
3. To measure energy efficiency ratio (EER) of an air conditioner.
4. To measure effect of valve throttling and variable frequency drive (VFD) on energy consumption by centrifugal pump.
5. To measure and calculate energy saving by arresting air leakages in compressor.
6. To measure the effect of blower speed on energy consumed by it.

STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY

- Presentations of Case Studies
- Debate competitions
- Poster competitions
- Industrial visits
- Visual Aids

INSTRUCTIONAL STRATEGY

Teachers are expected to lay considerable stress on understanding the basic concepts in energy conservation, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject must be supplemented by demonstrations and practical work in the laboratory. Visits to industries must be carried out. Expert from industry must be invited to deliver talks on energy conservation to students and faculty.

RECOMMENDED BOOKS

1. Guide book on General Aspects of Energy Management and Energy Audit by Bureau of Energy Efficiency, Government of India. Edition 2015
2. Guide book on Energy Efficiency in Electrical Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
3. Guide book on Energy Efficiency in Thermal Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
4. Handbook on Energy Audit & Environmental Management by Y P Abbi & Shashank Jain published by TERI. Latest Edition

Important Links:

- (i) Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India.
www.beeindia.gov.in
- (ii) Ministry of New and Renewable Energy (MNRE), Government of India.
www.mnre.gov.in

- (iii)Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh. www.upneda.org.in.
- (iv)**Central Pollution Control Board (CPCB)**, Ministry of Environment, Forest and Climate Change, Government of India. www.cpcb.nic.in.
- (v) **Energy Efficiency Sevices Limited (EESL)**. www.eeslindia.org.
- (vi)Electrical India, Magazine on power and electrical products industry. www.electricalindia.in.

4.7 REINFORCED CEMENT CONCRETE (RCC) DRAWING

L T P
- - 4

RATIONALE

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

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Draw the reinforcement details for various structural elements from the given data
- Calculate reinforcement details from the given drawings
- Draw bar bending schedule from drawing
- Read and interpret R.C.C. drawings

DETAILED CONTENTS

1. RC Drawing:

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

- (i) General instruction and rules, Drawing 1- lap, joint, development drawing: length, rings, hook etc.
- (ii) Drawing No. 2: RC Slabs - One way slab, Two way slab and Cantilever Slab.
- (iii) Drawing No.3: Beams - Singly and doubly reinforced rectangular beams and Cantilever beam (All beams with vertical stirrups), T Beam, Tapered Beam.
- (iv) Drawing No.4: Columns and Footings – Square, Rectangular and Circular Columns with lateral ties and their isolated sloped column footings, column and beam junction
- (v) Drawing No. 5: Portal Frame – Three bay two storey RC portal frame with blow up of column beam junctions.
- (vi) Drawing of cantilever retaining wall showing details of all the members and reinforcement.
- (vii) Drawing of Intze type water tank showing details of all the members and reinforcement.
- (viii) Drawing No. 6 : Draw at least one sheet using AutoCAD software

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Software installation and operation
- Drawing sheets
- Report writing
- Viva-voce

RECOMMENDED BOOKS

1. Civil Engineering Drawing by Loyal JS; Satya Parkashan, New Delhi
2. Civil Engineering Drawing by Kumar NS; IPH, New Delhi
3. RCC Design and Drawing by Singh, Birinder; Kaption Publishing House, New Delhi.
4. Steel Structures Design and Drawing by Singh, Birinder; Kaption Publishing House, New Delhi
5. E-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

INDUSTRIAL TRAINING

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of 4 weeks duration to be organised during the semester break starting after second year i.e. after 4th semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An external assessment of 50 marks has been provided in the study and evaluation scheme of 5th Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 4th semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

a) Punctuality and regularity	15%
b) Initiative in learning new things	15%
c) Presentation and Viva	15%
d) Industrial training report	55%

5.1 WATER AND WASTE WATER ENGINEERING

L T P
6 - 2

RATIONALE

One of the basic necessities of life is water which is not easily available to a lot of people. Providing potable water at the first place then collection and disposal of waste solids and liquids are important activities of civil engineering field. This subject provides basic knowledge and skills in the field of water supply system and waste disposal system. Classroom instructions should be supplemented by field visits to show functional details of water supply and waste disposal systems. It will also be advantageous to invite professionals from field to deliver extension lectures on specialized operations.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Calculate the water requirement for a particular population
- Check and improve the quality of water by giving required treatment to water
- Calculate the size of different pipes to carry water
- Lay the network of pipes for water supply as well as sewerage in a building
- Draw the location of different appurtenances
- Carry out the disposal of sewage
- Supervise the water supply and waste water schemes

DETAILED CONTENTS

A. WATER SUPPLY

- | | | |
|----|---|--------------|
| 1. | Introduction | (04 Periods) |
| | 1.1 Necessity and brief description of water supply system. | |
| | 1.2 Sources of water – surface/sub-surface sources | |
| 2. | Quantity of Water | (08 Periods) |
| | 2.1 Water requirement | |
| | 2.2 Rate of demand and variation in rate of demand | |
| | 2.3 Per capita consumption for domestic, industrial, public and fire fighting uses as per BIS standards (no numerical problems) | |
| | 2.4 Population Forecasting | |