

CURRICULUM  
FOR  
**DIPLOMA PROGRAMME**  
IN  
CIVIL ENGINEERING  
(5<sup>th</sup>& 6<sup>th</sup> Semester)  
**FOR THE STATE OF HIMACHAL PRADESH**



*(Implemented w.e.f. Session 2014-15)*

*Prepared by:-*

Composite Curriculum Development Centre  
Directorate of Technical Education,  
Vocational & Industrial Training, Sundernagar(H.P.)

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## PREFACE

*India, in last two decades, has made significant progress in all major spheres of activity. Since 1947, the Technical Education System has grown into fairly large sized system, offering opportunities for education and training in wide variety of trades / disciplines at different levels. Needless to say that well trained technical manpower is the backbone of any growing economy in the era of fast industrialization. It has been the endeavor of the Technical Education Department to take decisive steps to enhance the capacities of technical institutions with major emphasis on quality and excellence in technical education .Our country is the only country in the world which has 50% population below the age of 25 years whereas America has 30% and China 40%.Working Age Population (WAP) is increasing in India whereas it is decreasing in other parts in the world. Challenge before us is to train this WAP for the world of work .Updated curriculum is one of the most powerful tools to improve the quality of training.*

*Curriculum Document is a comprehensive plan or a blue print for developing various curriculum materials and implementing given educational programme to achieve desired and formally pre-stated educational objectives. Moreover it (the document) is the output of exhaustive process of curriculum planning and design, undertaken by the implementers under the expert guidance of curriculum designer.*

*While working out the detailed contents and study and evaluation scheme, the following important elements have been kept in mind:*

- i) Major employment opportunities of the diploma holders.*
- ii) Modified competency profile of the diploma holders with a view to meet the changing needs due to technological advancement and requirements of various employment sectors.*
- iii) Vertical and horizontal mobility of diploma pass outs for their professional growth.*
- iv) Pragmatic approach in implementing all the curricula of diploma programmes in engineering and technology in the state of H.P.*

*The document is an outcome of the feedback received from field organizations/ industry of different categories viz. small, medium and large scale which offer wage employment for the diploma pass outs. In every stage of planning and designing of this curriculum, suggestions and advice of experts representing industry, institutions of higher learning, research organizations etc. were sought and incorporated as per the requirement of curriculum . The document contains the study and evaluation scheme and detailed subject/course contents to enable the H.P. Polytechnics to implement revised curriculum and to achieve the desired objectives.*

*Time has specifically been allocated for undertaking extra-curricular activities. Emphasis has been laid on developing and improving communication skills in the students for which Communication Lab has been introduced during the first year itself.*

*We hope that this revision will prove useful in producing competent diploma holders in the state of Himachal Pradesh. The success of this curriculum depends upon its effective implementation and it is expected that the managers of polytechnic education system in Himachal Pradesh will make efforts to create better facilities, develop linkages with the world of work and foster conducive and requisite learning environment.*

**Er. L.R. Rana  
Head(CCDC)  
Directorate of Technical Education,  
Vocational & Industrial Training,  
Sundernagar, Himachal Pradesh.**

## **3<sup>rd</sup>YEAR OF THREE YEAR DIPLOMA PROGRAMME IN CIVIL ENGINEERING**

### **1. SALIENT FEATURES**

- |    |                           |   |   |
|----|---------------------------|---|---|
| 1) | Name of the Programme     | : | Three year Diploma Programme<br>CivilEngineering                          |
| 2) | Duration of the Programme | : | Three years (06 Semesters)  |
| 3) | Entry Qualification       | : | As prescribed by H.P. Takniki<br>Shiksha Board                            |
| 4) | Intake                    | : | As approved by H.P. Takniki<br>Shiksha Board                              |
| 5) | Pattern of the Programme  | : | Semester Pattern  |
| 6) | Curriculum for            | : | 3 <sup>rd</sup> year of Three year Diploma<br>Programme(Technical Stream) |

### **7) Student Centred Activities:**

A provision of 2-4 hrs per week has been made for organizing Student Centred Activities for overall personality development of students. These activities will comprise of co-curricular & other activities such as expert lectures, games, seminars, declamation contests, educational field visits, NCC, NSS and cultural activities & hobby classes like photography, painting, singing etc.

## 2. GUIDELINES

### 2.1 GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

**Distribution of 25 marks for SCA will be as follows:**

- i. 5 Marks shall be given for general behaviour
- ii. 5 Marks for attendance shall be based on the following distribution:
  1. Less than 75% Nil
  2. 75-79.9% 3 Marks
  3. 80-84.9% 4 Marks
  4. Above 85% 5 Marks
- iii. 15 Marks shall be given for the Sports/NCC/Cultural and Co-curricular activities/other activities after due consideration to the following points:
  1. For participation in sports/NCC/Cultural/Co-curricular activities at National or above level, shall be rewarded with minimum of 10 marks
  2. For participation in sports/NCC/Cultural/Co-curricular activities at Inter-polytechnic level, shall be rewarded with minimum of 08 marks
  3. For participation in two or more of the listed activities, 5 extra marks should be rewarded

**Note:** *Head of Department shall ensure that these marks are conveyed to the H.P. Takniki Shiksha Board, Dharamshala at the end of semester along with sessional record.*

### 2.2 GUIDELINES FOR SESSIONAL ASSESSMENT

- The distribution of marks for Internal Assessment in theory subjects and drawing shall be made as per the following guidelines:
  - i. 60% of internal assessment shall be based on the performance in the tests. At least three tests shall be conducted during the semester out of which at least one should be house test. 30% weightage shall be given to house test and 30% to class test(One best out of two).
  - ii. 20% marks shall be given to home assignments, class assignments, seminars etc.
  - iii. 20% marks shall be given for attendance/punctuality in the subject concerned.
- The distribution of marks for Internal/External Assessment in practical subjects shall be made as per the following guidelines:
  - i. 60% marks shall be awarded for performance in practical.
  - ii. 20% marks shall be given for Report/Practical book and punctuality in equal proportion.
  - iii. 20% marks shall be for Viva-voce conducted during the practicals.
- The distribution of mark for internal assessment in drawing subjects shall be as per following guidelines:-
  - (i) 60% marks for sheets
  - (ii) 40% for test.

### FIFTH SEMESTER (CIVIL ENGINEERING)

SR. NO	SUBJECTS	STUDY SCHEME Hrs/Week		MARKS IN EVALUATION									Total Marks of Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
				Th	Pr	Total	Th	Hrs	Pr	Hrs	Total		
5.1	RCC Design	4	-	50	-	50	100	3	-	-	100	150	
5.2	RCC Drawing & Detailing	-	4	-	50	50	100	3	-	-	100	150	
5.3	Highway Engineering	4	2	30	20	50	100	3	50	3	150	200	
5.4	Quantity Surveying	5	-	50	-	50	100	3	-	-	100	150	
5.5	Earthquake Resistant Building Construction	4	-	50	-	50	100	3	-	-	100	150	
5.6	* Generic skills & Entrepreneurship Development	2	1	50	50	100	50	2	-	-	50	150	
5.7	Computer Applications in Civil Engineering	-	6	-	50	50	-	-	100	3	100	150	
5.8	Minor project	-	4	-	50	50	50	3	-	-	50	100	
5.9	Survey Camp**	-	-	-	50	50	-	-	50	3	50	100	
	Industrial Training	-	-	-	50	50	-	-	50	3	50	100	
	Student Centred Activities	-	4	-	25	25	-	-	-	-	-	25	
	<b>Total</b>	<b>19</b>	<b>21</b>	<b>230</b>	<b>345</b>	<b>575</b>	<b>600</b>	<b>-</b>	<b>250</b>	<b>-</b>	<b>850</b>	<b>1425</b>	

\* Common with other diploma programmes.

\*\* Survey Camp to be held during the course of 5th Semester for minimum of one week covering all aspects of Surveying

### SIXTH SEMESTER (CIVIL ENGINEERING)

SR. NO	SUBJECTS	STUDY SCHEME Hrs/Week		MARKS IN EVALUATION								Total Marks of Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr	Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
6.1	*Basics of Management	3	-	50	-	50	100	3	-	-	100	150
6.2	Steel Structure Design and Drawing	4	4	30	20	50	100+50**	4	-	-	150	200
6.3	Irrigation Engineering and Drawing	4	2	30	20	50	100+50**	4	-	-	150	200
6.4	Construction Management and Accounts	4	-	50	-	50	100	3	-	-	100	150
6.5	Elective 6.5.1 Repair and Maintenance of Buildings 6.5.2 Environmental Engineering 6.5.3 Prestressed Concrete 6.5.4 Bridges, Tunnels and Airport Engineering 6.5.5 Railways, Bridges and Tunnels	3	-	50	-	50	100	3	-	-	100	150
6.6	Major Project	-	10	-	100	100	-	-	100	3	100	200
6.7	*Practice in Communication Skills	-	2	-	50	50	-	-	50	3	50	100
Student Centred Activities		-	4	-	25	25	-	-	-	-	-	25
<b>Total</b>		<b>18</b>	<b>22</b>	<b>210</b>	<b>215</b>	<b>425</b>	<b>600</b>	<b>-</b>	<b>150</b>	<b>-</b>	<b>750</b>	<b>1175</b>

\* Common with other Diploma Programmes

\*\* 100 Marks for Theory Examination and 50 Marks for Drawing

## 5.1 RCC DESIGN

L T P  
4 - -

### RATIONALE

*This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise RCC 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). He must be able to read and interpret structural drawings of different elements. This subject thus deals with elementary design principles as per BIS code of practice and their relevant drawings.*

### DETAILED CONTENTS

- 1. Introduction to R.C.C Designing using Limit State Method (4 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 structure as per I.S 875.
  - 1.4 Study of BIS:456-2000- clause 5, clause 6, clause 9, clause 18, clause 19, clause 22, clause 23.0, 23.2, 23.3, Clause 25, clause 26, clause 35, clause 36, clause 37, clause 38, clause 39, clause 40, clause 41, clause 42, clause 43,  
**Annexure –B,C,D,E,G,**
  
- 2. Shear, Bond and Development Length (LSM) (4 hrs)**
  - 2.1 Nominal Shear stress in R.C. Section, Design shear strength of concrete, Maximum shear stress, Design of shear reinforcement, Minimum shear reinforcement, Forms of shear reinforcement.
  - 2.2 Bond and types of bond, Bond Stress, check for bond stress, Development length in tension and compression, anchorage value for hooks 90° bend and 45° bend Standard Lapping of bars, Check for development length.
  - 2.3 Simple numerical problems on deciding whether shear reinforcement are required or not, check for adequacy of the section in shear. Design of shear reinforcement; Minimum shear reinforcement in beams;
  - 2.4 Determination of development length required for tension reinforcement of cantilever beam and slab, check for development length.
  
- 3. Analysis and Design of Singly Reinforced Sections (LSM) (10 hrs)**
  - 3.1 Limit State of collapse (Flexure), Assumptions stress. Strain relationship for concrete and steel neutral axis, Stress block diagram and Strain diagram for singly reinforced section.
  - 3.2 Concept of under- reinforced, over-reinforced and balanced section, neutral axis coefficient, limiting value of moment of resistance and limiting percentage of steel required for balanced singly R.C. Section.
  - 3.3 Simple numerical problems on determining design constants, moment of resistance and area of steel.
  - 3.4 Design of Singly reinforced simply supported beam and cantilever beam.
  
- 4. Analysis and Design of Doubly Reinforced Sections (LSM) (6hrs)**
  - 4.1 General features, necessity of providing doubly reinforced section reinforcement limitations.



- 4.2 Analysis of doubly reinforced section, strain diagram stress diagram, depth of neutral axis, moment of resistance of the section.
- 4.3 Numerical problems on finding moment of resistance
- 4.4 Design of beam sections.

**5. Design of Slab (LSM) (8hrs)**

- 5.1 Analysis & Design of simply supported one-way slab.

**6. Two Way Slab (LSM) (6hrs)**

- 6.1 Design of two-way simply supported slab with corners free & no provision for torsion reinforcement.

**7. Design of Axially Loaded Column (LSM) (10hrs)**

- 7.1 Assumptions in limit state of collapse – compression
- 7.2 Definition and classification of columns, effective length of column. Specification for minimum reinforcement; cover, maximum reinforcement, number of bars in rectangular, square and circular sections, diameter and spacing of lateral ties.
- 7.3 Analysis and Design of axially loaded short, square, rectangular and circular columns with lateral ties only; check for short column and check for minimum eccentricity may be applied.

**8. Design of stair case (LSM) (8hrs)**

- 8.1 Live load on stair as per IS875:1987
- 8.2 Effective span of stair
- 8.3 Design of Stair slab spanning longitudinally
- 8.4 Design of stair slab spanning horizontally

**SUGGESTED DISTRIBUTION OF MARKS**

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	4	5
2	4	5
3	10	15
4	6	15
5	8	15
6	6	15
7	10	15
8	8	15
<b>Total</b>	<b>56</b>	<b>100</b>

**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, practice of reading structural drawings is another important feature of this course. Commentary on BIS:456 may be referred along with code for relevant clauses.*

## **RECOMMENDED BOOKS**

1. *Birinder Singh, RCC Design and Drawing, Kaption Publishing House, New Delhi*
2. *Neelam Sharma RCC Design and Drawing S K Katria & Sons.*
3. *Ramamurtham, S; "Design and Testing of Reinforced Structures", Delhi Dhanpat Rai and Sons*
4. *Punmia, BC; "Reinforced Concrete Structure Vol I", Delhi Standard Publishers Distributors*
5. *Mallick, SK; and Gupta, AP; "Reinforced Concrete", New Delhi, Oxford and IBH Publishing Co*
6. *Gambhir, M.L., "Reinforced Concrete Design", Macmillan India Limited*
7. *S.N. Sinha Reinforced Concrete Design Tata Mc Graw Hill Publishing co. Ltd.*

## 5.2 RCC DRAWING & DETAILING

L T P  
- - 4

### RATIONALE

*This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise RCC Construction and fabrication. He must be able to read and interpret structural drawings of different elements. This subject thus deals with their relevant drawings & Detailing.*

### RCC DRAWING

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

1. Rectangular beams - Singly reinforced
2. Rectangular beams- Doubly reinforced
3. Rectangular beams- Cantilever
4. One way slab
5. Two way slab
6. Square columns with isolated footing of uniform depth and varying depth (sloped footings)
7. Rectangular columns with isolated footing of uniform depth and varying depth (sloped footings)
8. Circular column with isolated footing of uniform depth and varying depth (sloped footings)
9. Dog legged stair Case

*Note: Examiner will be required to set a question paper of 100 marks for drawing having a duration of 3 Hrs . Use of IS 456 -2000 is permitted in the examination.*

### RECOMMENDED BOOKS

1. Birinder Singh, *RCC Design and Drawing*, Kaption Publishing House, New Delhi
2. Neelam Sharma *RCC Design and Drawing* S K Katria & Sons.
3. J.S.loyal *RCC Design and Drawing* SatyaPrakashan New Delhi
4. V.B.Sikka *Civil Engineering Drawing* Kaption Publishing House, New Delhi

## 5.3 HIGHWAY ENGINEERING

L T P  
4 - 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. 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

#### THEORY

- 1. Introduction (2 hrs)**
  - 1.1 Importance of Highway engineering
  - 1.2 Functions of IRC, CRRRI, MORT&H, NHAH
  - 1.3 IRC classification of roads
  
- 2. Highway Alignment& Surveys (4 hrs)**
  - 2.1 Highway alignment- factors controlling alignment
  - 2.2 Engineering surveys for highway location
    - 2.2.1 Map study
    - 2.2.2 Reconnaissance
    - 2.2.3 Preliminary survey
    - 2.2.4 Final location and detailed survey
  - 2.3 Drawings and report
  
- 3. Highway Geometrics (8 hrs)**
  - 3.1 Importance of geometric design
  - 3.2 highway cross section element
    - 3.2.1 Pavement surface characteristic
    - 3.2.2 Cross slope or camber
    - 3.2.3 Width of pavement or carriageway
    - 3.2.4 Kerbs
    - 3.2.5 Road margin
    - 3.2.6 Right of way
    - 3.2.7 Typical cross section of roads
  - 3.3 Sight distance (No derivation and numerical)
    - 3.3.1 Introduction
    - 3.3.2 Stopping sight distance (SSD)
    - 3.3.3 Overtaking sight distance(OSD)
  - 3.4 Super elevation ( No derivation and numerical)
    - 3.4.1 Types of super elevation
    - 3.4.2 Maximum super elevation
    - 3.4.3 Minimum super elevation
    - 3.4.4 Attainment of super elevation
  - 3.5 Widening of pavement on horizontal curve(( No derivation and numerical)
    - 3.5.1 Mechanical widening
    - 3.5.2 Psychological widening
  - 3.6 Horizontal Transition Curves
    - 3.6.1 Object

- 3.6.2 Different type of transition curves
- 3.7 Gradient
  - 3.7.1 Ruling gradient
  - 3.7.2 Limiting gradient
  - 3.7.3 Exceptional gradient
  - 3.7.4 Minimum Gradient
- 3.8 Vertical curves
  - 3.8.1 Summit curves- types
  - 3.8.2 Valley curves

*(Note: No design/numerical problem to be taken)*

#### **4. Highway Materials**

**(8 hrs)**

- 4.1 Subgrade soil-
  - 4.1.1 Significance
  - 4.1.2 Characteristics of soil
  - 4.1.3 Desirable properties
  - 4.1.4 Index properties of soil
  - 4.1.5 Soil classification based upon size- IS soil classification
- 4.2 Subgrade soil strength
  - 4.2.1 CBR test- method and significance
- 4.3 Stone aggregate- Desirable properties of stone aggregate
- 4.4 Bituminous material
  - 4.4.1 type-i) bitumen- requirements, cut back bitumen, bituminous emulsion  
ii)tar
  - 4.4.2 Comparison of bitumen and tar

#### **5. Highway Pavements**

**(8 hrs)**

- 5.1 Object and requirements of pavement
- 5.2 Type of pavement structure
  - 5.2.1 Flexible pavement- their merits and demerits, typical cross-sections, functions of various Components
  - 5.2.2 Rigid pavement- their merits and demerits, typical cross-sections, functions of various components
- 5.3 Factor to be considered in the design of pavements

#### **6. Highway Construction**

**(8hrs)**

- 6.1 Type of highway construction
- 6.2 Earthwork
- 6.3 Construction of earth road- general, specification of material used, procedure
- 6.4 Construction of water bound macadam road- general, specification of material used, Procedure
- 6.5 Construction of bituminous macadam
  - 6.5.1.1 Interface treatment- prime coat, tack coat
  - 6.5.1.2 Bituminous surface dressing
  - 6.5.1.3 Seal Coat
  - 6.5.1.4 Penetration Macadam
  - 6.5.1.5 Built-up spray grout
  - 6.5.1.6 Premix method
  - 6.5.1.7 Bituminous macadam
  - 6.5.1.8 Bituminous premix carpet
  - 6.5.1.9 Bituminous concrete or asphalt concrete

- 6.5.1.10 Sheet Asphalt
- 6.5.1.11 Mastic Asphalt
- 6.5.2 Construction of surface dressing- specification of material used, construction procedure
- 6.5.3 Construction of Penetration (Grouted) macadam- specification of material used, construction Procedure
- 6.5.4 Construction of bituminous Macadam- specification of material used, construction Procedure
- 6.6 Construction of cement concrete pavement slab- specification of material used, construction Procedure

**7. Road Drainage: (4 hrs)**

- 7.1 Importance of highway drainage-significance, requirement of highway drainage system
- 7.2 Surface drainage- collection of surface water (No design)
- 7.3 Cross drainage
- 7.4 Sub surface drainage-Lowering of water table

**8. Hill Roads: (8 hrs)**

- 8.1 Classification of hill road
- 8.2 Alignment of hill road – resisting length, trace cut for hair pin band, geological consideration( brief description only)
- 8.3 Alignment survey-Reconnaissance, trace cut, detailed survey
- 8.4 Geometric of hill roads
  - 8.4.1 Width of pavement, formation and land
  - 8.4.2 Camber or cross fall
  - 8.4.3 Sight distance
  - 8.4.4 Super elevation
  - 8.4.5 Radius of horizontal curve
  - 8.4.6 Widening at curves
  - 8.4.7 Set back distance
  - 8.4.8 Gradient
  - 8.4.9 Hair pin band
- 8.5 Pavement type
- 8.6 Drainage in hill roads
  - 8.6.1 Road side drains
  - 8.6.2 Cross drainage
  - 8.6.3 Sub surface drainage

**9. Highway Maintenance: (6 hrs)**

- 9.1 Need for highway maintenance
- 9.2 General cause of pavement failure
- 9.3 Classification of maintenance work
- 9.4 Typical flexible pavement failure- alligator cracking, consolidation of pavement layers, shear failure, longitudinal cracking, frost heaving, lack of binding to the lower course, reflection cracking, formation of waves and corrugation,
- 9.5 Typical rigid pavement failure-scaling of cement concrete, shrinkage cracks, spalling of joints, warping cracks, mud pumping, structural cracks
- 9.6 Maintenance of earth roads
- 9.7 Maintenance of W.B.M roads
- 9.8 Maintenance of bituminous surfaces-patch repair, surface treatment, resurfacing
- 9.9 Maintenance of cement concrete roads- treatment of cracks, maintenance of joints

## **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. *Visit to Hot mix plant*
7. *Visit to highway construction site for operation of:  
Tipper, tractors (wheel and crawler) scraper, bulldozer, dumpers, shovels, grader, roller, dragline,  
road pavers, JCB etc. Mixing and spraying equipment*

## **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" Roorkee, Nem Chand and Bros.*
- ii) *Vaswani, NK, "Highway Engineering" Roorkee, Roorkee Publishing House.*
- iii) *Priyani, VB, "Highway and Airport Engineering" Anand, Charotar Book Stall*
- v) *Sehgal, SB; and Bhanot, KL; "A Text Book on Highway Engineering and Airport" Delhi, S Chand and Co.*
- vi) *Bindra, SP; "A Course on Highway Engineering" New Delhi, DhanpatRai and Sons*
- vii) *Sharma, RC; and Sharma, SK; "Principles and Practice of Highway Engineering", New Delhi, Asia Publishing House*
- viii) *Duggal AK, Puri VP., "Laboratory Manual in Highway Engineering", Delhi, New Age Publishers (P) Ltd*
- xi) *NITTTTR, Chandigarh "Laboratory Manual in Highway Engineering", 2004*
- ix) *RK Khitoliya, "Principles of Highway Engineering (2005)", DhanpatRai Publishing Co. New Delhi*
- x) *Rao, GV' Transportation Engineering*
- xii) *Duggal AK, "Maintenance of Highway – a Reader", NITTTTR, Chandigarh*
- xiii) *Duggal AK Types of Highway constitution a Reader, NITTTTR Chandigarh 2006*  
*Rao, Airport Engineering*

## **IRC Publications**

- i) *MORTH Specifications for Road and Bridge Works Fifth Revision*
- ii) *MORTH Pocket book for Highway Engineers, 2001*
- ii) *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	2	4
2	4	10
3	8	15
4	8	15
5	8	15
6	8	13
7	4	8
8	8	10
9	6	10
Total	56	100



## 5.4 QUANTITY SURVEYING

LTP  
5 - -

### RATIONALE

*Diploma holders in Civil Engineering are supposed to prepare material estimates for various Civil Engineering works namely; buildings, irrigation works, public health works and roads etc. In addition, they must have basic knowledge regarding analysis of rates, contracting, principles of valuation. Therefore, this subject has great importance for diploma holders in Civil Engineering.*

### DETAILED CONTENTS

- 1. Introduction** (2 hrs)  
Meaning of the terms estimating & costing. Purpose of estimating and costing
- 2. Types of estimates** (5 hrs)
  - 2.1 Approximate and Detailed.
  - 2.2 Approximate estimate Types-
    - 2.2.1 Plinth area rate method,
    - 2.2.2 Cubic Content method,
    - 2.2.3 Approximate Quantity method ,
  - 2.3 Types of detailed estimate.
    - 2.3.1 Detailed estimate for new work.
    - 2.3.2 Revised estimate.
    - 2.3.3 Supplementary estimate.
    - 2.3.4 Revised & Supplementary estimate.
    - 2.3.5 Repair & Maintenance estimate.
- 3. Measurement** (3hrs)
  - 3.1 Units of measurement for various items of work as per BIS:1200
  - 3.2 Rules for measurements
  - 3.3 Different methods of taking out quantities – centre line method and long wall and short wall method
- 4. Preparation of detailed estimates and abstract of cost for:** (15hrs)
  - 4.1 One & two room residential building with flat roof.
  - 4.2 Septic tank for 10 users
- 5. Preparation of detailed estimates and abstract of cost for:** (10Hrs)
  - 5.1 Plain road with-mid section area method, mean sectional area method, prismatic formula
  - 5.2 Earth wok in hill road
- 6. Calculation of quantities of materials & Analysis of Rates for:** (10hrs)
  - 6.1 Calculation of quantities**
    - 6.1.1 Cement mortars of different proportion
    - 6.1.2 Cement concrete of different proportion
    - 6.1.3 Brick/stone masonry in cement mortar
    - 6.1.4 Plastering and pointing
    - 6.1.5 White washing, painting

## 6.2 Analysis of rate

- 6.2.1 Steps involved in the analysis of rates. Requirement of material, labour, sundries, contractor's profit and overheads
- 6.2.2 Analysis of rates for finished items when data regarding labour, rates of material and labour is given:
- Earthwork in excavation in hard/ordinary soil and filling with a concept of lead and lift
  - RCC in roof slab/beam/lintels/columns
  - Brick masonry in cement mortar
  - Cement Plaster
  - White washing, painting

## 7 Contractorship

(8 hrs)

- 7.1 Meaning of contract
- 7.2 Qualities of a good contractor and their qualifications
- 7.3 Essentials of a contract
- 7.4 Types of contracts, their advantages, dis-advantages and suitability, system of payment
- 7.5 Single and two cover-bids; tender, tender forms and documents, tender notice, submission of tender and deposit of earnest money, security deposit, retention money, maintenance period

## 8 Preparation of Tender Document based on Common Schedule Rates(CSR) (13hrs)

- 8.1 Introduction to CSR and calculation of cost based on premium on CSR
- 8.2 Exercises on writing detailed specifications of different types of building works from excavation to foundations, superstructure and finishing operation
- 8.3 Exercises on preparing tender documents for the following
- 8.3.1 Earth work
  - 8.3.2 Construction of a Single room building as per given drawing
  - 8.3.3 RCC works
  - 8.3.4 Pointing, plastering and flooring
  - 8.3.5 White-washing, distempering and painting
  - 8.3.6 Wood work including polishing
  - 8.3.7 Tile flooring including base course

## 9. Exercises on preparation of comparative statements for item rate contract

(4hrs)

### INSTRUCTIONAL STRATEGY

*This is an applied engineering subject. Teachers are expected to provide working drawings for various Civil Engineering works and students be asked to calculate the quantities of materials required for execution of such works and use of relevant software for preparing estimates. Teachers should conceptualize making analysis of rates for different items of works. It will be advantageous if students are given valuation reports for reading.*

### RECOMMENDED BOOKS

1. Pasrija, HD; Arora, CL and S. Inderjit Singh, "Estimating, Costing and Valuation (Civil)", Delhi, New Asian Publishers
2. Rangwala, BS; "Estimating and Costing". Anand, Charotar Book Stall
3. Kohli, D; and Kohli, RC; "A Text Book on Estimating and Costing (Civil)with Drawings", Ambala Ramesh Publications
4. Chakraborti, M; "Estimating, Costing and Specification in Civil Engineering", Calcutta
5. Dutta, BN; "Estimating and Costing
6. Estimating and Costing by Mahajan, Satya Parkashan.

### SUGGESTED DISTRIBUTION OF MARKS

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	2	4
2	5	8
3	3	5
4	15	17
5	10	12
6	10	17
7	8	15
8	13	17
9	4	5
<b>Total</b>	<b>70</b>	<b>100</b>

## 5.5 EARTHQUAKE RESISTANT BUILDING CONSTRUCTION

L T P  
4 - -

### RATIONAL

*Diploma holders in civil engineering have to supervise construction of various earthquake resistant buildings. Therefore, the students should have requisite knowledge regarding terminology of earthquake and the precautions to be taken while constructing earthquake resistant buildings*

### DETAILED CONTENTS

- 1. Elements of Engineering Seismology (08hrs)**
  - 1.1 General features of tectonic of seismic regions.
  - 1.2 Causes of earthquakes,
  - 1.3 Seismic waves,
  - 1.4 Earthquake size (magnitude and intensity),
  - 1.5 Epicentre,
  - 1.6 Seismograph,
  - 1.7 Classification of earthquakes,
    - 1.7.1 Seismic zoning map of India
  - 1.8 Seismic design codes
    - 1.8.1 Importance
    - 1.8.2 Indian seismic codes
  
- 2. Seismic Behaviour of Traditionally-Built Constructions of India (08hrs)**
  - 2.1 Earthquake effects,
  - 2.2 Traditionally built construction in India,
  - 2.3 Advantages and disadvantages of masonry construction,
  - 2.4 Behaviour of masonry construction during earth quakes,
  - 2.5 Performance of building during earthquakes and Mode of failure (Out-of plane failure, in-plane failure, Diaphragm failure, Connection failure, Non-structural components failure)
  
- 3. Ductile detailing of reinforced concrete buildings(IS 13920-1993) (08hrs)**
  - 3.1 Introduction
  - 3.2 Common modes of failure in reinforced concrete buildings
  - 3.3 Irregularities in reinforced concrete buildings
  - 3.4 Types of irregularities
    - 3.4.1 Vertical irregularities
    - 3.4.2 Horizontal irregularities
  - 3.5 Identification seismic damages in R.C.C. buildings
    - 3.5.1 Column
    - 3.5.2 Beams
    - 3.5.3 Slabs
  - 3.6 Ductile detailing as per IS13920-1993
  - 3.7 Details of reinforcement
  
- 4. Introduction to IS 1893(part-I)-2002 (05hrs)**
  - 4.1 Introduction
  - 4.2 Assumptions
  - 4.3 Design lateral forces
  - 4.4 Equivalent later force procedure

**5. Introduction to IS 4326-1993 (05hrs)**

- 5.1 Introduction
- 5.2 Earthquake resistant constructions
- 5.3 General Principal for earthquake resistant buildings (clause 4)
- 5.5 Special construction features (clause 5)
- 5.6 Categories of buildings
- 5.7 Codal provision of IS 4326-1993
- 5.8 Seismic strengthening arrangements (clause 8.4)
  - 5.8.1 Horizontal reinforcement
  - 5.8.2 Vertical reinforcement

**6. Introduction to IS 13828-1993 (05hrs)**

- 6.1 Earthquake resistant features of stone masonry
- 6.2 Earthquake resistance features for burnt clay brick in weak mortar

**7. Introduction to IS13827-1993 (04hrs)**

- 7.1 General recommendation for improving earth quake resistance of earthen construction
- 7.2 Seismic strengthening features of earthen buildings

**8. Retrofitting measure for traditionally built construction (08hrs)**

- 8.1 Introduction
- 8.2 Need of retrofitting
- 8.3 Retrofitting materials
- 8.4 Retrofitting measure of traditionally built construction
  - 8.4.1 Retrofitting of masonry buildings
  - 8.4.2 Retrofitting of concrete structure
  - 8.4.3 Retrofitting of low cost buildings

**9. Disaster Management (05hrs)**

- 9.1 Disaster rescue,
- 9.2 Psychology of rescue, rescue workers, rescue plan, rescue by steps, rescue equipment,
- 9.3 Safeties in rescue operations,
- 9.4 Debris clearance
- 9.5 Causality management.

**INSTRUCTIONAL STRATEGY**

*The student may be taken for visit to various building construction sites where precautions related to earthquake resistant construction are being taken so that the students may appreciate the importance of the subject.*

**RECOMMENDED BOOKS**

1. *Elements of Earthquake Engineering* by Jai Krishana and AR Chandrasekaran; Sarita Parkashan, Meerut.
2. *Building Construction* by BL Gupta and NL Arora, Satya Prakashan, New Delhi
3. *Manual Published by Earthquake Engineering department, IIT Roorkee / IIT Kanpur*
4. *IS 13920, IS: 13827, IS: 13828, IS 1893-2002, IS 4326 (latest edition)*
5. *Earthquake Engineering* by RL Weigel, Prentice Hall Inc., N.I., 1970
6. *Dynamics of Structure* by AK Chopra, Prentice Hall Inc. New Delhi
7. *Earthquake resistant building construction* by neelam Sharma, Katson
8. *Earthquake resistant building construction* by Jagroop Singh, Rajiv Bhatia, Eagle Publication

**SUGGESTED DISTRIBUTION OF MARKS**

<b>TopicNo.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	8	15
2	8	10
3	8	10
4	5	10
5	5	10
6	5	10
7	4	10
8	8	15
9	5	10
<b>Total</b>	<b>56</b>	<b>100</b>

## 5.6 GENERIC SKILLS & ENTREPRENEURSHIP DEVELOPMENT

L T P  
2 - 1

### RATIONALE

*In present scenario, there is an urgent need to develop right kind of attitude, knowledge and skills amongst the Diploma engineers leading them to achieve gainful wage/ self -employment. There is a huge gap in perceptions of employers and employees regarding meeting the job requirements. Also the dual challenges of competing in global working environment and keeping pace with the rapid technological advancements call for re-design of curricula and thus enabling the importance of employability or generic skills. Entrepreneurship development aim at developing conceptual understanding for setting up owns' business/enterprise to cope up with the problem of unemployment and also to promote the socio-economic development of our country.*

*Both the subject areas, "generic skills and entrepreneurship development" are supplementary to each other. Knowledge and skills of these must be imparted to diploma engineering students for enhancing their employability and confidence in their personal and professional life.*

### DETAILED CONTENTS

- 1. Introduction to Generic Skills (02 Hrs)**
  - 1.1 Concept and importance
  - 1.2 Local and global scenario
  - 1.3 Concept of life-long learning (LLL)
  
- 2. Self- Management and Development (07 Hrs)**
  - 2.1 Concept of Personality Development, Ethics and Moral values
  - 2.2 Concept of Intelligence and Multiple intelligence Types viz, linguistic, mathematical & Logical reasoning, emotional, and social intelligence (interpersonal & intrapersonal).
  - 2.3 Concept of Physical Development; significance of health, hygiene, body gestures & kinesics.
  - 2.4 Time Management concept and its importance
  - 2.5 Intellectual Development; reading skills (systematic reading, types and SQ5R), speaking, listening skills, writing skills (Note taking, rough draft, revision, editing and final drafting), concept of critical Thinking and problem solving (approaches, steps and cases).
  - 2.6 Psychological Management; stress, emotions, anxiety and techniques to manage these.
  - 2.7 ICT & Presentation skills; use of IT tools for good and impressive presentations.
  
- 3. Team Management (03 Hrs)**
  - 3.1 Concept of Team Dynamics. Team related skills such as; sympathy, empathy, leading, coordination, negotiating and synergy. Managing cultural, social and ethnic diversity.
  - 3.2 Effective group communication and conversations.
  - 3.3 Team building and its various stages like forming, storming, norming, performing and adjourning (Bruce Tuckman's five stage Model)
  
- 4. Project Management (02 Hrs)**
  - 4.1 Concept of Management and features
  - 4.2 Stages of Project Management; initiation, planning, execution, closing and review (through case studies)

4.3 SWOT analysis concept.

- 5. Introduction to Entrepreneurship (02 Hrs)**  
5.1 Entrepreneurship, Need of entrepreneurship, and its concept, Qualities of a good entrepreneur  
5.2 Business ownerships and its features; sole proprietorship, partnership, joint stock companies, cooperative, private limited, limited, public limited, PPP mode.  
5.3 Types of industries viz, micro, small, medium and large
- 6. Entrepreneurial Support System (features and roles in brief) (03 Hrs)**  
District Industry Centres (DIC's), State Financial Corporation's (SFC's), Small Industries Service Institutes(SISI), Commercial Banks, Micro Financing Institutions, SIDBI, NABARD, National Small Industry Corporations (NSIC), Cooperative Societies and Venture Capitalists. Various Consultancy Organizations; HIMCON, Khadi and Gramodyog Board (H.P.) etc.
- 7. Market Study and Opportunity Identification (04 Hrs)**  
Types of study; primary and secondary, product or service identification, assessment of demand and supply, type of surveys and important features; qualitative, empirical, schedules, questionnaire, interview.
- 8. Project Report Preparation (05 Hrs)**  
8.1 Preliminary Report, Techno-Economic Feasibility Report, Detailed Project Report (DPR) and illustration of these through examples.  
8.2 Exercises on writing project reports of micro and small projects.

#### **List of Practical Exercises**

1. *Understanding Self-Management and Development (Related to Chapter 02); through examples, cases, exercises, panel discussions, seminars, meditation and yoga techniques.*
2. *Team Management (Related to chapter 03); through examples, cases, role plays, group discussions and panel discussions.*
3. *Market Study and Opportunity Identification (Related to Chapter 07); through literature reviewing, making questionnaires, conducting mock interviews and analysing data for product/service identification and demand assessment.*
4. *Project Management and Project Report Preparation (Related to chapter 04 and 08); through exercises on making project reports on micro and small enterprises. Case studies and SWOT analysis of projects can be taken.*

#### **Instructional Strategy**

*Since the emphasis of present training need and work requirements is on budding entrepreneurs as well as intelligent and multi skilled work force. Therefore skill development and knowledge imparting should be focussed on generic and entrepreneurial skill development. Thus instructional strategy of the subject should be more practical oriented and theories must be taught up to conceptual or informal levels. Different methodologies may be used with inclusive approach and must be supported with different training tools such as group and panel discussions , role plays, case studies, field surveys through questionnaires, schedules and interviews, presentations, seminars and expert talks in practical lectures and through student centred activities. Students may also be provided with extracted study material and hand outs too.*



**Recommended Books:**

1. *Generic Skill Development Manual, MSBTE, Mumbai*
2. *Lifelong Learning, Policy Brief (www.oecd.org)*
3. *Towards Knowledge Society, UNESCO Publication, Paris*
4. *Human Learning, Ormrod*
5. *What Work Requires of Schools? SCANS Report: U.S. Department of Labour*
6. *Entrepreneurship Development by CB Gupta and P Srinivasan: Sultan Chand and sons: New Delhi*
7. *Entrepreneurship Development by S. L. Gupta and Arun Mittal: IBH Publication*
8. *A Handbook of Entrepreneurship, Edited by B S Rathore and Dr. J S Saini*
9. *Entrepreneurship Development and Small Business Enterprises by Poornima M: Pearson Education India*
10. *Handbook of Small Scale Industry by P M Bhandari*

**Inspirational Books**

1. *Stay Hungry stay Foolish by Rashmi Bansal*
2. *An Autobiography by Lee Iacocca*
3. *Steve Jobs: The Biography by Walter Isaacson*

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (hrs.)</b>	<b>Marks Allotted %</b>
1	2	7
2	7	26
3	3	10
4	2	7
5	2	10
6	3	10
7	4	15
8	5	15
<b>Total</b>	<b>28</b>	<b>100</b>

## 5.8 COMPUTER APPLICATIONS IN CIVIL ENGINEERING

L T P  
- - 6

### RATIONALE

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

### DETAILED CONTENTS

#### PRACTICAL EXERCISES

##### 1. Introduction

Starting up of Auto CAD, Auto CAD Window, Tool bar, Drop down menu, Command window, Saving the drawing. Introduction of Graphic screen.

##### 2. CAD Commands

Co-ordinates, drawing limits, grid, snap, ortho features. Drawing commands, line, circle, polyline, multiline, ellipse, polygon etc. Editing commands – Copy, move, offset, fillet, chamfer, trim, lengthen, mirror, rotate, array etc. Working with hatches, fills, dimensioning, text etc.

##### 3. Submission / Working Drawing

- 1) Drawing T, L, I, E, H with absolute, consecutive and polar coordinate system
- 2) Preparation of line plan of a residential building.
- 3) Preparation of detailed plan of a two room residential building, Elevation, Section, Site Plan (using different type of layers)
- 4) Introduction to STAAD Pro, (Expert may be invited to demonstrate)

#### RECOMMENDED BOOKS:-

1. *Reference Manual of AutoCAD by AutoDesk*
2. *Auto CAD 2013 by IPH publication.*

#### Note:

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

## 5.8 MINOR PROJECT WORK (CONSTRUCTION SITE ORIENTED)

L T P  
- - 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.
- x) Low Cost Housing

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 distemping 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 visit one or more sites mentioned above. 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. External examiner will ask the questions on the construction, working, processes observed by the students during their visit: Shortcomings in the works (site) and their remedial measures should be suggested by the students. Presentation of their technical report in their respective class for internal assessment.

## 6.1 BASICS OF MANAGEMENT

L T P  
3 - -

### RATIONALE:

*Diploma holders are expected to take up middle level managerial positions, their exposure to basic management principles is very essential. Some topics like Structure and ownership of Organization, Leadership, Motivation, Customer Relationship Management (CRM), Legal Environment of Business, Environmental Management, Accident and Safety: Total Quality Management (TQM), Intellectual Property Rights (IPR) etc. have been included in the subject.*

### DETAILED CONTENTS

1. **Introduction:** (12 hrs)  
Definition and concept of management, functions of management- planning, organizing, staffing, coordinating and controlling. Various areas of management-  
(a) Human Resource Management(HRM)-Manpower recruitment and selection, induction , training and development and performance appraisal.  
(b) Financial Management- Meaning of financial management, its importance, various sources of finance- long term and short term. Concept of Internal Rate of Return(IRR), Net Present Value (NPV) and Average Rate of Return.  
(c) Marketing Management- Product life cycle, concept of pricing, promotion strategies- advertising, sales promotion and market research.  
(d) Material Management – Inventory management, concept of economic order quantity and waste management.
2. **Structure and Ownership of Organization:** (04 hrs)  
Concept and structure of an organization, hierarchical management structure (top, middle and lower level management), functional management structure and matrix organizational structure. Types of business ownership (salient features)- Sole Proprietorship, Partnership, Joint Stock Companies and Cooperative Ownership.
3. **Leadership:** (02 hrs)  
Meaning, importance , types of leadership and qualities of a good leader.
4. **Motivation:** (04 hrs)  
Concept and importance of motivation-drives and incentives, types of motivation and theories of motivation- Abharam Maslow Theory and Herzberg Two Factor Theory.
5. **Customer Relationship Management:** (04hrs)  
Need, various types of customers, customer satisfaction, Customer Satisfaction Index(CSI) and its significance in playing effective role of engineers in changing scenario.
6. **Legal Environment and Business:** (08 hrs)  
a) Various labour laws and their necessity. Salient features of Income Tax Act – computation of income tax on salary income, Sales and Excise Tax Act-VAT & Excise duty and Factory Act. 1948.

- b) Labour Welfare Schemes including wage payment types, system of wage payment and incentives.
- c) Intellectual Property Rights(IPR)- Concepts, infringements and remedies related to patents, copy rights, trademarks and designs.
- d) Accident and Safety- Meaning and concept of accident and safety, causes, safety precautions and various measures after accidents.

**7. Total Quality Management:** (04 hrs)

Meaning and concept of Total Quality Management(TQM), various factors/measures to achieve TQM in an organization. Standards and Codes-National & International.

**8. Environmental Management:** (04 hrs)

Concept of ecology and environment, factors contributing to air pollution, water pollution and noise pollution. Different measures to control pollution. Disaster management-features and measures.

**INSTRUCTIONAL STRATEGY:**

*Generally the diploma holders occupy middle level managerial positions in an organization, therefore, their exposure to basic management principles is very essential. Accordingly students may be given conceptual understanding of different topics related to management. Some of the topics may be taught using question answer, assignment or seminar. The teacher will discuss success stories and case studies with students, which in turn, will develop appropriate managerial qualities in the students. In addition, expert lectures may also be arranged from within the institutions or from management organisations. Appropriate extracted reading material and hand-outs may be provided.*

**RECOMMENDED BOOKS:**

1. *Principles of Management by Philip Kotler TEE Publication*
2. *Principles and Practice of Management by ShyamalBannerjee: Oxford and IBM Publishing Co, New Delhi.*
3. *Financial Management by MY Khan and PK Jain, Tata McGraw Hill Publishing Co:: 7, West Patel Nagar , New Delhi.*
4. *Modern Management Techniques by SL Goel: Deep and Deep Publications Pvt Limited , Rajouri Garden, New Delhi.*
5. *Management by James AF Stoner, R Edward Freeman and Daniel R Gilbert Jr. : Prentice Hall of India Pvt Ltd, New Delhi.*
6. *Essentials of Management by H Koontz, C O' Daniel , Mc Graw Hill Book Company, New Delhi.*
7. *Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi*
8. *Total Quality Management by Dr DD Sharma, Sultan Chand and Sons, New Delhi.*
9. *Intellectual Property Rights and the Law by Dr. GB Reddy.*
10. *Service Quality Standards, Sales & Marketing Department, MarutiUdyog Ltd.*
11. *Customer Relationship Management: A step-by-step approach, Mohamed & Sagadevan Oscar Publication, Delhi*
12. *Customer Relation Management, Sugandhi RK, Oscar Publication, Delhi*
13. *Environment Engineering by GN Pandey & GC Pandey, Tata McGraw Hill Publication.*

### SUGGESTED DISTRIBUTION OF MARKS

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	12	20
2	4	10
3	2	08
4	4	12
5	4	10
6	8	18
7	4	10
8	4	12
<b>TOTAL</b>	<b>42</b>	<b>100</b>

## 6.2 STEEL STRUCTURES DESIGN AND DRAWING

L T P  
4 - 4

### RATIONALE

*This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise steel construction and fabrication. He may also be required to design simple structural elements, make changes in design depending upon availability of materials. He must be able to read and interpret structural drawings of different elements. This subject thus deals with elementary design principles as per IS code of practice IS: 800 and their relevant drawings.*

### DETAILED CONTENTS

#### A) Steel Theory and Design

1. **Structural Steel and Sections:** (02hrs)
  - 1.1 Properties of structural steel as per IS Code
  - 1.2 Designation of structural steel sections as per IS handbook and IS:800
2. **Riveted Connections:** (10hrs)

Riveted connections, Types of rivets and their use, Types of riveted joint and its failure, Strength of riveted joint and efficiency of a riveted joint. Assumptions in theory of riveted joint Design of riveted joint for axially loaded member.
3. **Welded connections:** (8 hrs)

Introduction, Permissible stress in weld, strength of weld, advantages and disadvantages of welded joint. Types of welds and their symbols. Design of fillet weld and butt weld subjected to axial load. (Descriptive No numerical on plug and slot welds)
4. **Tension Members** (12 hrs)

*Types of section used, permissible stresses in axial tension. Gross and net cross – sectional area of tension member, Analysis and Design of tension member with welded and riveted connection. Introduction to Lug Angle and Tension splice. (Theory only)*
5. **Compression Members** (12 hrs)

Types of sections used, Effective length, Radius of gyration, slenderness ratio and its limit, Permissible compressive stresses. Analysis and Design of axially loaded angle struts with welded and riveted connection. Stanchion and Columns Types of sections- simple and built up sections, Effective length, Introduction to lacing and battening (No numerical problem on Lacing and Battening)
6. **Beams** (12 hrs)

Different steel sections used; Simple and built-up sections Permissible bending stresses. Design of simple I beam section, check for shear only. Introduction to Plate Girder: Various components and their functions. (No numerical Problem on Plate Girder)



## B) Steel Structures Drawing

1. Details of splicing for steel columns.
2. Column Beam Connection Drawings:
  - a) Beam to beam connections (Seated and framed)
  - b) Beam to column (Seated and framed)
  - c) Column bases (Slab base, and gusseted base)
3. Detailed drawing showing plan and elevation for a riveted plate girder with the given design data regarding the sizes of its parts, with details at the supports and connections of stiffeners, flange angles and cover plates with the web
4. Preparation of drawing of a steel roof truss with details of joints for the given span, shape of the truss and the design data regarding the size of the members and the connections.

## INSTRUCTIONAL STRATEGY

Teachers are expected to give simple problems for designing various steel 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 fabrication and erection of steel structures. Practice of reading structural drawings is another important feature of this course. Commentary on BIS:800 may be referred along with code for relevant clauses

## RECOMMENDED BOOKS

1. "Design of Steel Structures" by Duggal SK, Standard Publishers Distributors.
2. "Structures Design and Drawing" by Birinder Singh, Kaptian Publishing House, Ludhiana
3. "Design of Steel Structures" by Ram Chandra, Delhi, Standard Publishers Distributors
4. "Design of Steel Structure" by LS Negi, Tata McGraw Hill, New Delhi
5. "Design of Steel Structures", by S Ramamurthan

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	06
2	10	16
3	08	15
4	12	16
5	12	16
6	12	16
<b>Total</b>	<b>56</b>	<b>100</b>

## 6.3 IRRIGATION ENGINEERING AND DRAWING

LTP  
4 - 2

### 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 and prepare and interpret the irrigation engineering drawings. 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. **In drawing sessional : i) 60% drawing sheets ii) 40% test**

### DETAILED CONTENTS

#### A) THEORY

1. **Introduction:** (2 hrs)
  - 1.1 Definition of irrigation
  - 1.2 Historical development of irrigation in India
  - 1.3 Necessity of irrigation
  - 1.4 Advantages, Disadvantages and ill effect of irrigation
  
2. **Water Requirement of Crops** (5 hrs)
  - 2.1 Principal crops in India and their water requirements
  - 2.2 Crop period or base period
  - 2.2 Crop seasons – Kharif and Rabi
  - 2.3 Duty, Delta ,Base Period and their relationship, Factor affecting duty
  
3. **Hydrology and Run-off** (5 hrs)
  - 3.1Defination, importance of hydrology
  - 3.2 Hydrological cycle
  - 3.3 Precipitation
    - 3.3.1 Definition
    - 3.3.2. Types of precipitation
    - 3.3.3 Rain gauges, types with diagrams
  - 3.4 Runoff , Factor affecting runoff
  
4. **Methods of Irrigation** (5 hrs)
  - 4.1 Type of irrigation- Surface irrigation and sub-surface irrigation
  - 4.2 methods of supplying water to the field ( Brief description)
    - 4.2.1 Free Flooding
    - 4.2.2 Border flooding
    - 4.2.3 Check Flooding
    - 4.2.4 Furrow irrigation method
    - 4.2.5 Basin flooding
    - 4.2.5 Sprinkler irrigation with its suitability
    - 4.2.6 Drip Irrigation with its suitability
  
5. **Canals** (8 hrs)
  - 5.1 Alluvial and non-alluvial canals
  - 5.2 Alignment of canal- ridge canal, contour canal, side slope canal

- 5.3 Distribution system for canal irrigation- Main canal, Branch canal, Distributaries, water course
- 5.4. Cross section of canal showing- Side slope, Berm, Free board, Service road, Spoil bank, Dowel and Borrow pit( with their definition & functions)
- 5.5 Lining of canals and their types
- 5.5 Maintenance of irrigation canal
- 5.6 Closure of breaches

**6. Well and Tube well Irrigation (7hrs)**

- 6.1 Open well
  - 6.1.1. Shallow well
  - 6.1.2 Deep well
- 6.2 Construction of open well
- 6.3 Yield of open well ( brief description , no derivation and numerical)
  - 6.3.1 Pumping test
  - 6.3.2 Recuperating test
- 6.4 Tube well
- 6.5 Types of tube well (Brief description with neat diagram)
  - 6.5.1 Cavity type tube well
  - 6.5.2 Screen type tube well
  - 6.5.3 Slotted Type tube well
- 6.6 Methods of boring tube wells
- 6.7 well development
- 6.7 Advantages and disadvantages of tube well irrigation over canal irrigation

**7. Diversion Head Works (4 hrs)**

- 7.1 Definition, object, general layout, functions of different parts of diversion head works.
- 7.2 Types of Weir
- 7.3 Difference between weir and barrage

**8. Cross Drainage Works (5 hrs)**

- 8.1 Functions and necessity of the following types: aqueduct, super Passage, level crossing, inlet and outlet
- 8.2 Sketches of the above cross drainage works

**9. Regulatory works (5 hrs)**

- 9.1 Introduction
- 9.2 Cross and head regulators
- 9.3 Outlets
- 9.4 Canal Escapes
- 9.5 Falls

**10. River Training Works (6 hrs)**

- 10.1 Control and river training
- 10.2 Objective of river training

10.3 Method of river training ( Brief description)

10.3.1 Marginal embankment

10.3.2 Groynes

10.3.3 Pitched island

10.3.4 Guide banks

## 11. Water Logging

(4 hrs)

11.1 Definition

11.2 Causes

11.3 Preventive & remedial measures

11.4 Reclamation of water logged areas

## SECTION “B”

### Irrigation Drawing

- 1) Draw the L section of a canal from the given data.
- 2) Draw the cross section of a canal showing various parts like base width, R.L. of top & bottom, free board, inspection road etc. in (from given data)
  - i) Fully cutting
  - ii) Fully filling
  - iii) Partially cutting & partially filling
- 3) Draw the L section of a Weir from given data
- 4) Draw the cross section of a head work showing various parts like weir, divide wall, under sluice, fish ladder from a given data
- 5) Draw the cross section of earthen dam from given data
  - i) Homogenous type
  - ii) Zoned type
- 6) Draw the Plan & section of a strainer type tube well with pump house from given data.

## 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.*

## RECOMMENDED BOOKS

1. Bharat Singh, 'Fundamentals of Irrigation Engineering', Roorkee, Nem Chand and Bros
2. Garg, Santosh Kumar, 'Irrigation Engineering and Hydraulics Structures', Delhi, Khanna Publishers
3. Punmia, BC; and Pande Brij Bansi Lal, 'Irrigation and Water Power Engineering', Delhi, Standard Publishers Distributors
4. Sharma, RK; 'Text Book of Irrigation Engineering and Hydraulics Structures', New Delhi, Oxford and IBH Publishing Company
5. Sharma, SK; 'Principles and Practice of Irrigation Engineering', New Delhi, Prentice Hall of India Pvt. Ltd.
6. Varshney RS, Gupta SC, Gupta RL etc. "Theory and Design of Irrigation Structures", Vol. I and II
7. Saharsabudhe SR, "Irrigation Engineering and Hydraulic Structures"
8. Priyani BB, 'The Fundamental Principles of Irrigation and Water Power
9. BIS Codes
10. Wan. E. Houk, "Irrigation Engineering" Vol. I and II

**SUGGESTED DISTRIBUTION OF MARKS**

<b>TopicNo.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	2	5
2	5	8
3	5	8
4	5	12
5	8	9
6	7	14
7	4	9
8	5	9
9	5	8
10	6	8
11	4	10
<b>Total</b>	<b>56</b>	<b>100</b>

## 6.4 CONSTRUCTION MANAGEMENT AND ACCOUNTS

L T P  
4 - -

### RATIONALE

*This is an applied civil engineering subject. The subject aims at imparting basic knowledge about construction planning and management, site organisation, construction labour, control of work progress, inspection and quality control, accidents and safety, accounts and stores.*

**Note:- (student have to attempt at least two question from each section)**

### DETAILED CONTENTS

#### THEORY

#### SECTION-A

#### CONSTRUCTION MANAGEMENT:

1. **Introduction:** (4 hrs)
  - 1.1 Significance of construction management
  - 1.2 Main objectives of construction management and overview of the subject
  - 1.3 Functions of construction management, planning, organising, staffing, directing, controlling and coordinating, meaning of each of these with respect to construction job.
  - 1.4 Classification of construction into light, heavy and industrial construction
  - 1.5 Stages in construction from conception to completion
  
2. **Construction Planning:** (6 hrs)
  - 2.1 Importance of construction planning
  - 2.2 Stages of construction planning
    - Pre-tender stage
    - Contract stage
  - 2.4 Scheduling construction works by bar charts
    - Definition of activity, identification of activities though
    - Limitations of bar charts
  - 2.5 Scheduling by network techniques
    - Introduction to network techniques; PERT and CPM, differences between PERT and CPM terminology
  - 2.6 CPM Network including critical path & critical activities.
  
3. **Organization:** (3 hrs)
  - 3.1 Types of organizations: Line, line and staff, functional and their characteristics
  
4. **Site Organization:** (3 hrs)
  - 4.1 Principle of storing and stacking materials at site
  - 4.2 Location of equipment
  - 4.3 Organizing labour at site
  
5. **Construction Labour:** (3 hrs)
  - 5.1 Conditions of construction workers in India, wages paid to workers
  - 5.2 Important provisions of the following Acts:
    - Labour Welfare Fund Act 1936 (as amended)

- Payment of Wages Act 1936 (as amended)
- Minimum Wages Act 1948 (as amended)

- 6. Control of Progress:** (4 hrs)
- 6.1 Methods of recording progress
  - 6.2 Analysis of progress
  - 6.3 Taking corrective actions keeping head office informed
- 7. Inspection and Quality Control:** (5 hrs)
- 7.1 Need for inspection and quality control
  - 7.2 Principles of inspection
  - 7.3 Stages of inspection and quality control for
    - Earth work
    - Masonry
    - RCC
- 8. Accidents and Safety in Construction:** (4 hrs)
- 8.1 Accidents – causes and remedies
  - 8.2 Safety measures for
    - Excavation work
    - Hot bituminous works
    - Scaffolding, form work
  - 8.3 Safety campaign and safety devices

## **SECTION-B**

### **ACCOUNTS**

- 9. Public Work Accounts:** (24 hrs)
- 9.1 Introduction
  - 9.2 necessities of accounts
  - 9.3 Public works department system of account
  - 9.4 Classification of transaction and head of account
  - 9.5 Classification of works
  - 9.6 condition to be fulfilled before a work can taken in hand
  - 9.7 work order
  - 9.8 bill-first and final bill, running account bill, account of secured advances, running account bill "c", running account bill "D", final bill, Hand receipt, refund of security money, cash, debit and credit
  - 9.9 cash book-procedure for maintain the cash book, cash found surplus or deficient, subsidiary cash Book
  - 9.10 contract ledger
  - 9.11 completion report and completion certificate
  - 9.12 Imprest
  - 9.13 temporary advance or temporary Imprest
  - 9.14 Cheques
  - 9.15 remittance transfer receipts

- 9.16 Advise of transfer debit/ credit
- 9.17 Receipt of money
- 9.18 Treasury challan
- 9.19 Treasury remittance book
- 9.20 work abstract
- 9.21 register of works
- 9.22 Transfer entries
- 9.23 appropriation and re appropriation
- 9.24 Deposit works
- 9.25 Stores
  - 9.25.1 Necessity of stores
  - 9.25.2 Unstamped receipt
  - 9.25.3 Accounting procedure for store
  - 9.25.4 Suspense head
  - 9.25.5 Suspense sub- head
  - 9.25.6 Reserve limit of stock
  - 9.25.7 Indent
  - 9.25.8 Stock taking and shortage and surplus
  - 9.25.9 Classification of store
- 9.26 road metal
- 9.27 materials charged to work
- 9.28 issue of material to contractor
- 9.29 Issue of machinery and equipment
- 9.30 bin card
- 9.31 stock register
- 9.32 write off
- 9.33 Handing over taking over charge on transfer
- 9.34 voucher
- 9.35 Establishments in P.W.D.
- 9.36 Cash payment to labourers
- 9.37 Tools and plant

(Students will prepare the various form used in P.W.D. for different terms mentioned above in class)

### **INSTRUCTIONAL STRATEGY**

*This is highly practice-based course and efforts should be made to relate process of teaching with direct experiences at work sites. Participation of students should be encouraged in imparting knowledge about this subject. To achieve this objective the students should be taken to different work sites for clear conception of particular topics, such as site organization, inspection of works at various stages of construction and working of earth moving equipment*

### **RECOMMENDED BOOKS**

1. Shrinath, LS, "PERT and CPM - Principles and Applications", New Delhi, East West Press
2. Harpal Singh, "Construction Management and Accounts", New Delhi, Tata McGraw Hill Publishing Company.
3. Peurifoy, RL, "Construction Planning, Equipment and Methods" Tokyo, McGraw Hill



4. Wakhlo, ON; "Civil Engineering Management", New Delhi Light and Life Publishers
5. Verma, Mahesh; "Construction Equipment and its Planning and Application
6. Dharwadker, PP; "Management in Construction Industry", New Delhi, Oxford and IBH Publishing Company.
7. Gahlot PS; Dhir, BM; "Construction Planning and Management", Wiley Eastern Limited, New Delhi
8. MS Project – Microsoft USA or Primavera or Bentley Company
9. Primavera

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

<b>Topic No.</b>	<b>Time Allotted(Hrs)</b>	<b>Marks Allotted (%)</b>
1	4	4
2	6	6
3	3	9
4	3	9
5	3	8
6	4	8
7	5	8
8	4	8
9	24	40
<b>Total</b>	<b>56</b>	<b>100</b>

## 6.5.1 REPAIR AND MAINTENANCE OF BUILDINGS

L T P  
3 - -

### RATIONALE

*One of the major concerns of a civil engineer is to take care of the building works, already constructed, in order to keep these buildings in utmost workable conditions. Usually it is being felt that the buildings deteriorate faster for want of care and proper maintenance. The buildings usually have a shabby appearance due to cracks, leakage from the roofs and sanitary/water supply fittings. Thus the need for teaching the subject in proper perspective has arisen making students aware of importance of maintenance of buildings.*

### DETAILED CONTENTS

- 1. Need for Maintenance** (6 hrs)
  - 1.1 Importance and significance of repair and maintenance of buildings
  - 1.2 Meaning of maintenance
  - 1.3 Objectives of maintenance
  - 1.4 Factors influencing the repair and maintenance
  
- 2. Agencies Causing Deterioration (Sources, Causes, Effects)** (6 hrs)
  - 2.1 Definition of deterioration/decay
  - 2.2 Factors causing deterioration, their classification
    - 2.2.1 Human factors causing deterioration
    - 2.2.2 Chemical factors causing deterioration
    - 2.2.3 Environmental conditions causing deterioration
    - 2.2.4 Miscellaneous factors
  
- 3. Investigation and Diagnosis of Defects** (6 hrs)
  - 3.1 Systematic approach/procedure of investigation
  - 3.2 Sequence of detailed steps for diagnosis of building defects/problems
  - 3.3 List non-destructive and others tests on structural elements and materials to evaluate the condition of the building and study of three most commonly used tests
  
- 4. Defects and their root causes** (6 hrs)
  - 4.1 Define defects in buildings
  - 4.2 Classification of defects
  - 4.3 Main causes of building defects in various building elements
    - 4.3.1 Foundations, basements and DPC
    - 4.3.2 Walls
    - 4.3.3 Decorative and protective finishes
    - 4.3.4 Defects caused by dampness
  
- 5. Materials for Repair, maintenance and protection** (6 hrs)
  - 5.1 Compatibility aspects of repair materials
  - 5.2 State application of following materials in repairs:
    - 5.2.1 Anti corrosion coatings
    - 5.2.2 Adhesives/bonding aids
    - 5.2.3 Repair mortars

- 5.2.4 Curing compounds
- 5.2.5 Joints sealants
- 5.2.6 Waterproofing systems for roofs
- 5.2.7 Protective coatings

**6. Remedial Measures for Building Defects**

(12hrs)

- 6.1 Preventive maintenance considerations
- 6.2 Surface preparation techniques for repair
- 6.3 Crack repair methods
  - 6.3.1 Epoxy injection
  - 6.3.2 Grooving and sealing
  - 6.3.3 Stitching
  - 6.3.4 Adding reinforcement and grouting
  - 6.3.5 Flexible sealing by sealant
- 6.4 Repair of surface defects of concrete
  - 6.4.1 Bug holes
  - 6.4.2 Form tie holes
  - 6.4.3 Honey comb and larger voids
- 6.5 Repair of corrosion in RCC elements
  - 6.5.1 Steps in repairing
  - 6.5.2 Prevention of corrosion in reinforcement
- 6.6 Material placement techniques with sketches
  - 6.6.1 Pneumatically applied (The gunite techniques)
  - 6.6.2 Open top placement
  - 6.6.3 Pouring from the top to repair bottom face
  - 6.6.4 Birds mouth
  - 6.6.5 Dry packing
  - 6.6.6 Form and pump
  - 6.6.7 Preplaced – aggregate concrete
  - 6.6.8 Trowel applied method
- 6.7 Repair of DPC against Rising Dampness
  - 6.7.1 Physical methods
  - 6.7.2 Electrical methods
  - 6.7.3 Chemical methods
- 6.8 Repair of walls
  - 6.8.1 Repair of mortar joints against leakage
  - 6.8.2 Efflorescence removal
- 6.9 Waterproofing of wet areas and roofs
  - 6.9.1 Water proofing of wet areas
  - 6.9.2 Water proofing of flat RCC roofs
  - 6.9.3 Various water proofing systems and their characteristics
- 6.10 Repair of joints in buildings
  - 6.10.1 Types of sealing joints with different types of sealants
  - 6.10.2 Techniques for repair of joints
  - 6.10.3 Repair of overhead and underground water tanks

## **INSTRUCTIONAL STRATEGY**

*This is very important course and efforts should be made to find damaged/defective work spots and students should be asked to think about rectifying/finding solution to the problem. Visits to work site, where repair and maintenance activities are in progress can be very useful to students. The students will also prepare a project report based upon the available water proofing materials, sealant, special concrete for repair and adhesives and other repair material available in the market.*

## **RECOMMENDED BOOKS**

1. Gahlot P.S., Sanjay Sharma, *Building Defects and Maintenance Management* by CBS Publishers New Delhi
2. Nayak, BS; *"Maintenance Engineering for Civil Engineers"*, Khanna Publishers, Delhi
3. Ransom, WH; *"Building Failures - Diagnosis and Avoidance"*, Publishing E and F.N. Span
4. Hutchinson, BD;etc, *"Maintenance and Repair of Buildings"*, Published by Newness – Butterworth

## **SUGGESTED DISTRIBUTION OF MARKS**

<b>TopicNo.</b>	<b>Time Allotted(Hrs)</b>	<b>Marks Allotted (%)</b>
1	6	15
2	6	15
3	6	15
4	6	15
5	6	15
6	12	25
<b>Total</b>	<b>42</b>	<b>100</b>

## 6.5.2 ENVIRONMENTAL ENGINEERING

L T P  
3 - -

### RATIONALE

*Civil Engineering diploma holders must have the knowledge of different types of environmental aspects related to development activities so that they may help in maintaining the ecological balance and control pollution. They should also be aware of the related environmental laws for effectively combating environmental pollution. The class room instructions should be supplemented by field visits to show the pollution caused by urbanization and the combatment measures being adopted at site. Extension lectures by experts may be encouraged.*

### DETAILED CONTENTS

1. **Study of Importance of Environmental Engineering** (4 hrs)  
Importance of clean environment, control of environmental pollution with respect to air, land and water. Conservation of natural resources, environmental education and awareness, sustainable development.
2. **Environments and Ecology** (4 hrs)  
Definition and understanding of environment and ecology concept, ecosystem and types of ecosystems, energy flow in an ecosystem, food chain, ecological pyramids, consortium and ecological balance
3. **Water Pollution** (4 hrs)  
Causes of pollution in surface and underground water eutrophication of lakes and its preventing measure; BIS standards for water quality.
4. **Air Pollution** (4 hrs)  
Definition, principal air pollutants, atmospheric parameters influencing air pollution, types of air contaminants and their sources, effects of air pollution on human beings, plants, animals, automobile pollution, BIS ambient air quality standards and measures to combat air pollution
5. **Noise Pollution** (4 hrs)  
Definition, unit of measurement of noise, sources and effects of noise pollution and control of noise pollution
6. **Effects of mining, blasting and deforestation** (4 hrs)  
Effects of mining, blasting and deforestation on the environment human life and wild life.
7. **Land Use** (4 hrs)  
Effect of land use on environmental quality, land use and natural disasters,(landslides etc.) soil degradation problems - erosion, water logging, soil pollution etc.
8. **Environmental Impact Assessment** (4 hrs)

Definition and requirements, environmental impact assessment. Flow chart of environmental impact assessment methodology. Describe the need and importance of EIA.

9. **Legislation to Control Environmental Pollution (idea)** (4hrs)  
 Indian legislative acts for water, land and air pollution control – provisions, scope and implementation
10. **Global Issues of Environmental Engineering** (3 hrs)  
 Global warming, ozone depletion, acid rain, oil pollution; radiation hazards and their control
11. **Renewable Source of Energy** (3 hrs)  
 Role of non-conventional sources of energy (biogas, solar, wind etc) in environmental protection. Conservation of energy resources like coal, oil etc., alternative fuels, bio-diesel etc.

### INSTRUCTIONAL STRATEGY

*Students should be encouraged to undertake project work related to environmental problems. They should visit industrial effluent treatment plant, water treatment plant and environmental engineering laboratory and study the impact of utilization of reclaimed by products*

### RECOMMENDED BOOKS

1. *Environmental Engineering by Deswal and SS Deswal; DhanpatRai and Company (P) Ltd., Delhi*
2. *Odum EP, "Fundamentals of Ecology", Amarind publication Co., Delhi*
3. *Environmental Engineering and Management by SK Dhamija; SK kataria and Sons, Delhi*
4. *De AK, "Engineers Chemistry", New Age Publication, Delhi*
5. *Kendeigh SC, "Ecology", Prentice Hall of India, Delhi*
6. *RK Khitoliya, Environmental Pollution, (2007), S Chand & Co. Ltd., New Delhi*
7. *Bhatia HS A text book of environmental pollution and control Galogotia.*

### SUGGESTED DISTRIBUTION OF MARKS

TopicNo.	Time Allotted(Hrs)	Marks Allotted (%)
1	4	8
2	4	8
3	4	8
4	4	12
5	4	4
6	4	12
7	4	12
8	4	9
9	4	9
10	3	9
11	3	9
<b>Total</b>	<b>42</b>	<b>100</b>

## 6.5.3 PRESTRESSED CONCRETE

LTP  
3 - -

### RATIONALE

Now a day, diploma holders in Civil Engineering has to supervise prestressed concrete construction. So, it is necessary that they should have basic knowledge of prestressed concrete.

### DETAILED CONTENTS

1. **Introduction** (8 hrs)  
Basic concept of prestressed concrete, advantages of prestressed concrete in comparison with RCC application of prestressed to various building elements, bridges, water tanks and precast elements
2. **Materials** (8 hrs)  
Materials requirement for prestressing concrete – High strength concrete, prestressing steel wires, strands and high strength bars. Stresses in high strength steel and stress-strain relationship, tendon profile
3. **Prestressing Methods** (8 hrs)  
Introduction to prestressing methods – pre-tensioning and post-tensioning, their suitability and comparison, circular prestressing and its application
4. **Bending and Shear Capacity** (10hrs)  
Concept of bending and shear capacity of prestressed members. Calculation of bending stresses in rectangular simply supported beams with straight and parabolic profile of tendons
5. **Losses in Prestressing** (8 hrs)  
Types of losses in prestress – Elastic shortening, creep and shrinkage of concrete, friction loss and stress relaxation in prestress steel. Computation of losses for simple beam problems

### RECOMMENDED BOOKS

1. *Prestressed Concrete* by N Krishna Raju, Tata McGraw Hill, Delhi
2. *Prestressed Concrete* by P Dayaratnam
3. *Prestressed Concrete* by S Ramamurthum

### SUGGESTED DISTRIBUTION OF MARKS

TopicNo.	Time Allotted(Hrs)	Marks Allotted (%)
1	8	20
2	8	16
3	8	16
4	10	32
5	8	16
<b>Total</b>	<b>42</b>	<b>100</b>

## 6.5.4 BRIDGES, TUNNELS AND AIRPORT ENGINEERING

L T P  
3 - -

### RATIONALE

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

### DETAILED CONTENTS

#### PART-I: BRIDGES

(16hrs)

##### Bridge Engineering :

##### 1. Site selection and investigation

- 1.1 Factors affecting selection of site of a bridge.
- 1.2 Bridge alignment
- 1.3 Collection of design data
- 1.4 Classification of bridges according to function, material, span, size, alignment, position of HFL.

##### 2 Component parts of bridge.

- 2.1 Plan & sectional elevation of bridge showing component parts of , substructure & super structure.
- 2.2 Different terminology such as effective span, clear span, economical span, waterway, afflux, scour, HFL, freeboard, etc.
- 2.3 Foundation – function, types
- 2.4 Piers-function, requirements, types.
- 2.5 Abutment – function, types
- 2.5 Wing walls – functions and types.
- 2.6 Bearing – functions, types of bearing for RCC & steel bridges.
- 2.7 Approaches –in cutting and embankment.
- 2.8 Bridge flooring- open and solid floors

##### 3 Permanent and Temporary Bridges-

- 3.1 Permanent Bridges - Sketches & description in brief of culverts, causeways, masonry, arch, steel, movable steel bridges, RCC girder bridge, prestressed girder bridge, cantilever, suspension bridge.
- 3.2 Temporary Bridges- timber, flying, floating bridges
- 3.4 Inspection & Maintenance Of Bridge.

##### 4. Inspection of bridges

- 4.1 Maintenance of bridges & types – routine & special maintenance.

#### PART - II: TUNNELS

(10hrs)

- 1 Definition, necessity, advantages, disadvantages
- 2 Classification of tunnels.
- 3 Shape and Size of tunnels
- 4 Tunnel Cross sections for highway and railways



- 5 Tunnel investigations and surveying –Tunnel surveying locating center line on ground, transferring center line inside the tunnel.
- 6 Shaft - its purpose
- 7 Methods of tunnelling in Soft rock-needle beam method, fore-poling method. line plate method, shield method.
- 8 Methods of tunnelling in Hard rock-Full-face heading method, Heading and bench method, drift method.
- 9 Precautions in construction of tunnels
- 10 Tunnel lining and ventilation.

## **PART - II: AIRPORTS**

(16 hrs)

### **1. INTRODUCTION**

- 1.1 History of transport
- 1.2 Air transport in India
- 1.3 Civil aviation department

### **2. AIRPORT SURVEY**

- 2.1 TYPE OF SURVEY
- 2.2 DRAWINGS TO BE PREPARED

### **3. AIRPORT PLANNING**

- 3.1 Airport site selection- factor affecting site selection
- 3.2 Airport obstruction-imaginary surfaces, objects with actual height
- 3.3 Clear zone
- 3.4 Turning zone

### **4. RUNWAY**

- 4.1 Runway orientation
- 4.2 Basic runway length

### **5. TAXIWAY**

- 5.1 GENERAL
- 5.2 Layout of taxiway
- 5.3 Exit taxiway

### **6. TERMINAL AREA**

- 6.1 GENERAL
- 6.2 TERMINAL BUILDING
- 6.3 Apron
- 6.4 Hangers
- 6.5 Typical airport layouts

## **INTRODUCTION**

**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*

iii) 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 their construction of railway track, bridges and tunnel.

### **RECOMMENDED BOOKS**

1. Vaswani, NK; "Railway Engineering", Roorkee Publishing House
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", AnandCharotar Book Stall
5. Victor Johnson, "Essentials of Bridge Engineering" Oxford and IBH
6. Rangwala, "Bridge Engineering", Aand, 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 "Tunnal Engineering DhanpatRai and Sons

### **SUGGESTED DISTRIBUTION OF MARKS**

<b>TopicNo.</b>	<b>Time Allotted(Hrs)</b>	<b>Marks Allotted (%)</b>
1	16	43
2	10	43
3	16	14
<b>Total</b>	<b>42</b>	<b>100</b>

## 6.5.5 RAILWAYS, BRIDGES AND TUNNELS

LTP  
3 - -

### 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 board based knowledge regarding various components and construction of railway track, bridges and tunnels*

### DETAILED CONTENTS

#### PART – 1: RAILWAYS

(18 hrs)

1. Introduction to Indian Railways
2. Railways surveys : Factors influencing the railways route, brief description of various types of railway survey
3. Classification of permanent way describing its component part
4. Rail Gauge ; Definition, types, practice in India
5. Rail – types of rails
6. Rail Fastening : Rail joints, types of rail joints, fastening for rails, fish plates, bearing plates
7. Sleepers: Functions of sleepers, types of sleepers, requirements of an ideal material of sleepers.
8. Ballast: Function of ballast, requirements of an ideal material of ballast
9. Crossing and signalling: Brief description regarding different types of crossing/signalling
10. Maintenance of track: Necessity, track fixtures; maintenance and boxing of ballast, maintenance gauges, tools.
11. Drains, methods of construction.

#### PART-II: BRIDGES

(15 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 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 abutment (straight and tee), abutment with wing walls (straight, splayed, return and curved)
16. Bridge bearings  
Purpose of bearing; types of bearing –fixed plate, rocker and roller,
17. Maintenance of Bridges
  - 17.1 Inspection of bridges
  - 17.2 Routine maintenance

**PART –III : TUNNELS****(9 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 in tunnels & lining 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*

iii) *Examiners should set question from all the parts*

**INSTRUCVTIONAL STRATEGY**

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

**RECOMMENDED BOOKS**

1. *Vaswani, NK ; “ Railway Engineering”, Roorkee Publishing House*
2. *Rangwala, SC; “ Railway Engineering”, Anand Charotar Book Stall*
3. *Deshpande, R: “ A Text Book of Railway Engineering”, Poonam United Book Corporation*
4. *Algaia, JS “Bridge Engineering”, Anand Charotar Book Stall*
5. *Victor Johnson, “Essentials of Bridge Engineering” Oxford and IBH*
6. *Rangwala, “ Bridge Engineering”, Anand Charotar Book Stall*
7. *IRC Bridge Codes*
8. *MORTH drawings for various types of bridges*
9. *MORTH pocket books for bridge Engineering, 2000 (First Revision)*
10. *Subhash C Saxena “ Tunnel Engineering Dhanpat Rai and Sons*

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	18	43
2	15	43
3	9	14
<b>Total</b>	<b>42</b>	<b>100</b>

## **6.6 MAJOR PROJECT (INDUSTRY/FIELD ORIENTED - PRACTICE BASED)**

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As far as possible students should be given live project problems with a view to :

- i) Develop understanding regarding the size and scale of operations and nature of field work in which students are going to play their role after completing the courses of study.
- ii) Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- iii) Provide first hand experience to develop confidence amongst the students to enable them to use and apply classroom based knowledge and skills to solve practical problems of the world of work.
- iv) Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

For the fulfillment of above objectives, polytechnics may establish close linkage with 8-10 relevant organization for providing such an experience. It is necessary that each organization is visited well in advance by respective teachers and activities to be performed by students are well defined. The chosen activities should be such which are of curricular interest to students and of professional

value to industrial/field organizations. Each teacher is expected to supervise and guide 5 - 6 students. Effort should be made to identify actual field problems to be given as project work to the students. Project selected should not be too complex which is beyond the comprehension level of the students. The placement of the students for such a practical cum project work should match with the competency profile and interest of students. Students may be assessed both by industry and polytechnic faculty. The suggested performance criteria is given below:

- |                           |     |
|---------------------------|-----|
| a) Performance Evaluation | 60% |
| b) Report Writing         | 20% |
| c) VIVA                   | 20% |

**Some of suggested projects are given below:** These are only guidelines; teacher may take any project related to Civil Engineering depending upon the availability of projects. Preference should be given to practical oriented projects. According to the need of the polytechnic, the following major projects are suggested:

### **1. Construction of a small concrete road consisting of following activities**

- Survey and preparation of site plan
- Preparation of drawings i.e. L-Section and X-Section
- Estimating and earth work
- Preparation of sub grade with stone ballast
- Laying of concrete
- Testing of slump, casting of cubes and testing
- Material estimating and costing with specifications
- Technical report writing

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## **2. Water Supply system for a one or two villages**

- 2.1 Surveying
- 2.2 Design of water requirements and water distribution system
- 2.3 Preparation of drawing of overhead tank
- 2.4 Material estimating and costing
- 2.5 Specifications
- 2.6 Technical report writing

## **3. Construction of shopping complex detailing of RCC drawings, estimating and costing of material**

## **8. Rainwater harvesting**

- 8.1 Assessment of catchment's area
- 8.2 Intensity of rainfall
- 8.3 Collection of water
- 8.4 Soak pit design
- 8.5 Supply of water
- 8.6 Monitoring during rainy season

## **9. Construction of concrete cubes including concrete mix design by mixing with appropriate quantity of fly ash with fibres**

- (i) the fibres like polypropylene, carbon, steel etc. can be used
- (ii) students will show the comparison between concrete mixed with fibres verses the controlled quality concrete.

## **10. Estimation and designing of a State Highway Road**

- (i) Reconnaissance survey of proposed road
- (ii) To take L and cross sections
- (iii) Fixing of grades
- (iv) Estimation of cutting and filling of earth mass
- (v) Planting of proposed road
- (vi) Estimation of proposed road

## **11. Designing a small height gravity dam**

- (i) Constructing of catchment tree
- (ii) Calculating the reservoir capacity
- (iii) Designing of gravity dam by taking the account various forces

**Note: The projects undertaken should be field oriented**

## 6.7 PRACTICE IN COMMUNICATION SKILLS

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### RATIONALE

*For successful completion of diploma programme, the students should possess adequate command on language and communication skills so that they are able to express themselves with ease and felicity. The language used by the students should be appropriate to objectives and occasion. The contents of this subject shall provide them practical training through language laboratory.*

### LIST OF PRACTICAL EXERCISES

1. Exercises on phonetics
2. Group Discussion
3. Exercises on self-assessment using tools like SWOT analysis.
4. Internet communication
5. Correspondence
  - a. Resume writing
  - b. Covering letter
  - c. Follow-up correspondence
  - d. Business Correspondence
6. Practice on listening skills.
7. Speaking exercises with emphasis on voice modulation (reading and extempore)
8. Demonstration and practice on Body language and Dress sense.
9. Exercises on etiquettes and mannerism in difficult situations like business meetings, table manners, telephone etiquette and manners related to opposite gender.
10. Mock interviews (telephonic/personal)
11. Cross-cultural Communication
12. Role play for effective Communication.
13. Exercises on wit and humour in conversations and creating lively environment.