

RCC DESIGN AND DRAWINGS

L T P
5 - 2

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

(a) Theory

1. Introduction (2 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

Working Stress Method

2. Theory of R.C.C Beams : (8 hrs)
 - 2.1 Assumptions in the theory of simple bending for RCC beam
 - 2.2 Flexural Strength of a singly reinforced RCC beam
 - 2.2.1 Position of the neutral axis ,concept of balanced ,under reinforced and over reinforced sections
 - 2.2.2 Moment of Resistance of balanced , under reinforced and over reinforced sections
3. Shear and Bond (8 hrs)
 - 3.1 Shear as per BIS:456-2000
 - i) Shear strength of concrete without shear reinforcement
 - ii) Maximum shear stress
 - iii) Shear reinforcement
 - 3.2 Bond and Development Length
 - i) Permissible bond stress for plain and deformed bars
 - ii) Development Length for bars
 - iii) Anchorage value of standard bend and hook
4. Singly Reinforced Rectangular RCC Beams (8 hrs)

- 4.1 Moment of resistance for given simply supported beams
- 4.2 Design of simply supported and cantilever beams including sketching showing reinforcement details and bar bending schedule.
5. Introduction to Limit State Method (8 hrs)
- 5.1 Definitions and assumptions made in limit state of collapse(flexure), partial factor of safety for materials strength and design strength, partial factor of safety for load and design load
- 5.2 Loading on structure as per BIS: 875
- 5.3 BIS specifications regarding spacing of reinforcement, cover to reinforcement, minimum reinforcement, lapping & anchoring effective span for beams and slabs.
6. Limit State of Collapse (Flexure) (5 hrs)
- 6.1 Basic assumptions and stress strain curve, neutral axis, moment of resistance for singly reinforced sections.
- 6.2 Design of singly reinforced simply supported and cantilever beams including sketching showing reinforcement details and bar bending schedule.
7. Doubly Reinforced Beam and T-Beam (Limit State Method) (5 hrs)
- 7.1 Design consideration of doubly reinforced beams including sketching showing reinforcement details and bar bending schedule.
- 7.2 Design consideration of T and L-beams(No numerical problems)
8. Simply Supported One Way Slab (Limit State Method) (5 hrs)
- Analysis and Design of simply supported one way slab including sketching showing reinforcement details (plan and sections) and bar bending schedule.
- 9 Staircase (5 hrs)
- Design considerations of simple dog legged stair for residential building (No Numerical problems).
10. Continuous Slab (5 hrs)
- Design aspects of continuous slab and arrangement of reinforcement in plan and sectional elevation (No problem in theory examination)
11. Two Way Slab (Limit State Method) (6 hrs)
- Design of two-way simply supported slab with corners free and no provision to resist torsion including sketching showing reinforcement details (plan and sections) and bar bending schedule

12. Design of Axially Loaded Column (Limit State Method) (6 hrs)
- 12.1 Definition and classification of columns, effective length of column, specifications for minimum reinforcement cover, maximum reinforcement, number of bars, main and lateral reinforcement for column.
- 12.2 Assumptions made in limit state of collapse (compression)
- 12.3 Design of axially loaded square columns only with lateral reinforcement and sketch the reinforcement details
13. Design of Square Footing (Limit State Method) (2 hrs)
- 13.1 Types of footing
- 13.2 Design of isolated square footing of uniform thickness and sketch the reinforcement details (7hrs)
14. PRESTRESSED CONCRETE:
- Concept of pre-stressed concrete, Methods of pre-stressing “ Pre tensioning and Post tensioning. Advantages and disadvantages of prestressed concrete. Losses in Pre-stress.
- Calculation of bending stressed in rectangular simply supported beam with straight and parabolic profile of tendons.

B. RCC DRAWING

1. Reinforcement details from given data for the following with bar bending schedules:
 - a) Slabs – one way slab, two way slab with torsional reinforcement and cantilever slab
 - b) Rectangular beams – singly reinforcement, doubly reinforcement and cantilever beams with shear reinforcement
 - c) Columns – square, rectangular and circular column with isolated footing of uniform depth and varying depth (sloped footings)
2. Details of reinforcement in a three bay two storeyed RCC portal frame with the details of reinforcement at the column – beam junctions from the given design data

Very Important Note:

Examiner will be setting questions of 75 marks from part (A) and drawing questions of 50 marks from part (B). 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, 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. Sushil Kumar, "Treasurers of Reinforced Concrete Design", Delhi Standard Publishers Distributors
2. Verghese "Reinforced Concrete Design"
3. Limit State Design by Dr AK Jain
4. Ramamurtham, S; "Design and Testing of Reinforced Structures", Delhi Dhanpat Rai and Sons
5. Punmia, BC; "Reinforced Concrete Structure Vol I", Delhi Standard Publishers Distributors
6. Mallick, SK; and Gupta, AP; "Reinforced Concrete", New Delhi, Oxford and IBH Publishing Co
7. Dayaratnam, P; "Design of Reinforced Concrete Structures", New Delhi, Oxford and IBH Publishing Co.
8. Gambhir, M.L., "Reinforced Concrete Design", Macmillan India Limited
9. Structural Analysis and Design, STAAD – PRO; Research Engineers - USA
10. STRUDD – Softtech – Pune

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	3
2	8	9
3	8	9
4	8	9
5	8	9
6	5	7
7	5	7
8	5	8
9	5	6
10	5	6
11	6	8
12	6	8
13	2	3
14	7	8
Total	80	100

HIGHWAY AND AIRPORT 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 and airports. Basic concepts of road geo-metrics, surveys and plans, elements of traffic engineering, road materials, construction of rigid and flexible pavements, special features of hill roads, road drainage system and various aspects of maintenance find place in above course.

DETAILED CONTENTS THEORY

1. Introduction (2 hrs)
 - 1.1 Importance of Highway engineering
 - 1.2 Functions of IRC, CRRI, MORTH, NHAI
 - 1.3 IRC classification of roads
 - 1.4 Organization of a state highway department

2. Road Geometrics (7 hrs)
 - 2.1 Glossary of terms used in road geo-metrics and their importance: Right of way, formation width, road margin, road shoulder, carriage way, side slopes, kerbs, formation levels, camber and gradient
 - 2.2 Average running speed, stopping and passing sight distance
 - 2.3 Necessity of curves, horizontal and vertical curves including transition curves. Super elevation and methods of providing super elevation
 - 2.4 Sketch of typical cross-sections in cutting and filling on straight alignment and at a curve
(**Note: No design/numerical problem to be taken**)

3. Highway Surveys and Plan (7 hrs)
 - 3.1 Topographic map, reading the data given on a topographic map
 - 3.2 Basic considerations governing alignment for a road in plain and hilly area
 - 3.3 Highway location; marking of alignment; importance of various stages viz

- a) Reconnaissance survey: Conduct reconnaissance and prepare reconnaissance report
- b) Preliminary survey: Object, organizing, conducting and information to be collected
- c) Location survey
- d) Standards for preparing the highway plans as per Ministry of Surface Transport (MORTH) (reference only)

4. Road Materials (8 hrs)

- 4.1 Different types of road materials in use; soil, aggregate, binders – bitumen, Emulsion and Modified Bitumen
- 4.2 Function of soil as highway subgrade
- 4.3 Introduction to California Bearing Ratio; method of finding CBR value and its significance
- 4.4 Aggregates: Availability of road aggregates in India, requirements of road aggregates as per IRC specifications
- 4.5 Testing aggregates: Los Angeles Abrasion test, impact test, crushing strength test
- 4.6 Binders: Common binders; bitumen, properties as per BIS specifications, penetration, softening point, ductility and viscosity test of bitumen, procedures and significance, cut back and emulsion and their uses, Bitumen modifiers

5. Road Pavements (7 hrs)

- 5.1 Road pavement: Flexible and rigid pavement, their merits and demerits, typical cross-sections, functions of various components
- 5.2 Sub-grade preparation:
Setting out alignment of road, setting out bench marks, control pegs for embankment and cutting, borrow pits, making profiles of embankment, construction of embankment, compaction, stabilization, preparation of subgrade, methods of checking camber, gradient and alignment as per recommendations of IRC, equipment used for subgrade preparation
- 5.3 Flexible pavements: sub base necessity and purpose, stabilized sub base; purpose of stabilization. Types of stabilization mechanical stabilization, line stabilization, cement stabilization, fly ash stabilization etc.(introduction only)

5.4 Base Course:

* Preparation of base course: Prime coat, Tack coat

- (a) Water Bound Macadam (WBM)
- (b) Wet Mix Macadam (WMM)

Binder Courses:

- (a) Bituminous Macadam
- (b) Dense Bituminous Macadam (DBM)

*Methods of construction as per MORTH

5.5 Surfacing:

* Types of surfacing

- a) surface dressing with seal coat
- b) open graded premix carpet
- c) mix seal surfacing
- d) semi dense bituminous concrete
- e) Aspsaltic concrete
- f) bituminous Penetration Macadam (reference only)

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

5.6 Rigid Pavements:

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

6. Hill Roads: (6 hrs)

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

6.2 Special problems of hill areas

- 6.2.1 Landslides: Causes, prevention and control measures
- 6.2.2 Drainage
- 6.2.3 Soil erosion
- 6.2.4 Snow: Snow clearance, snow avalanches, frost

7. Road Drainage: (5 hrs)

7.1 Necessity of road drainage work, cross drainage works

7.2 Surface and subsurface drains and storm water drains. Location, spacing and typical details of side drains, side ditches for surface drainage.

Intercepting drains, pipe drains in hill roads, details of drains in cutting embankment, typical cross sections

8. Road Maintenance: (5 hrs)
- 8.1 Common types of road failures of flexible pavements: Pot hole, cracks, rutting, corrugation, fatty surface, upheaval - their causes and remedies (brief description)
- 8.2 Maintenance of bituminous road such as seal-coat, patch-work and resurfacing.
- 8.3 Maintenance of concrete roads-filling cracks, repairing joints, maintenance of shoulders (berms), maintenance of traffic control devices
9. Road Construction Equipment: (4 hrs)
- Application 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 Mixing and spraying equipment
- 9.4 Road pavers – sensor paver
- * An expert may be invited from field/industry for extension lecture on this topic.
10. Airport Engineering :- (10 hrs)
- 10.1 Necessity of study of airport engineering aviation transport scenario in India.
- 10.2 Factors to be considered while selecting a site for an airport with respect to zoning laws.
- 10.3 Various types of airports
- 10.4 Runways – factors, affecting their configuration and orientation (concept only)
- 10.5 Taxiways - types of pavements for runways and taxi ways.
- 10.6 Aircraft parking system.
- 10.7 Apron

PRACTICAL EXERCISES

1. Determination of penetration value of bitumen
2. Determination of softening point of bitumen
3. Determination of impact value of the road aggregate

4. Determination of abrasion value (Los Angeles') of road aggregate
5. Determination of ductility of bitumen
6. Determination of viscosity of tar/bitumen
7. Determination of the California bearing ratio (CBR) for the sub-grade soil (demonstration only)

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
- iv) Sehgal, SB; and Bhanot, KL; "A Text Book on Highway Engineering and Airport" Delhi, S Chand and Co
- v) Bindra, SP; "A Course on Highway Engineering" New Delhi, Dhanpat Rai and Sons
- vi) 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
- ix) RK Khitoliya, "Principles of Highway Engineering (2005)", Dhanpat Rai Publishing Co. New Delhi
- x) Rao, GV' Transportation Engineering
- xi) Duggal AK, "Maintenance of Highway – a Reader", NITTTR, Chandigarh
Duggal AK Types of Highway constitution a Reader, NITTTR Chandigarh 2006

IRC Publications

- i) MORTH Specifications for Road and Bridge Works Latest Edition
- ii) MORTH Pocket book for Highway Engineers, 2001

iii) MORTH Manual for Maintenance of Roads, 1983

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	4
2	8	12
3	8	12
4	8	12
5	8	12
6	6	10
7	5	10
8	5	10
9	4	8
10	10	10
Total	64	100

SURVEY CAMP

Purpose

- a. To impart intensive training in the use of surveying instruments
- b. To train the students to appreciate practical difficulties in surveying on the field

- c. Making the students conversant with the camp life
- d. Training the students to communicate with the local population
- e. Providing an opportunity to the students to develop team spirit
- f. To train the students for self management

Task:

Preparation of topographical plan of a given area

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

COMPUTER APPLICATIONS IN CIVIL ENGINEERING-I

L T P
- - 4

RATIONALE

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

DETAILED CONTENTS

PRACTICAL EXERCISES

1. Introduction and use of AUTO CAD software for making Building Drawings
2. Use of various commands available in software for making 2D Drawings and 3D model.
3. Drawing plan of building, sections along two direction, elevation of building (2D view)
4. Development of 3D view of building
5. Prepare various layout of door/windows plan, electrical, sanitary using concept of layers.

RAILWAYS, BRIDGES AND TUNNELS

L T P
4 - -

RATIONALE

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

DETAILED CONTENTS

PART – I: RAILWAY

(28 hrs)

1. Introduction – brief history of railways, advantages of railways, Indian railways and its salient features
2. Railway surveys: Factors influencing the railways route, brief description of various types of railway survey
3. Classification of permanent way describing its component parts
4. Rail Gauge: Definition, types, practice in various countries and India, Uniformity of gauge, unigauge project of Indian Railways
5. Rails – types of rails, steel for rails, corrugation, corrosion of rails, wear, methods to reduce wear, failure, coning of wheels, hogged rails, buckling, their cause and remedies creep: definition, causes, effects and remedies
6. Rail Fastenings: Rail joints, types of rail joints, requirements of an ideal fastening, fastenings for rails, fish plates, brief idea of spikes, fang bolts, hook bolts, chairs and keys; bearing plates
7. Sleepers: Functions of sleepers, types of sleepers, requirements of an ideal material for sleepers. Brief idea of timber and steel sleepers, concrete and pre-stress type sleepers: their salient features and advantages
8. Ballast: Function of ballast, requirements of an ideal material for ballast, various methods used for laying ballast, size and quantity of ballast
9. Plate laying: meanings of the terms, methods of plate laying, tram line method, telescopic method, American method, material required per unit length of track, ballast train, relaying a track
10. Crossings and signallings: Brief description regarding different types of crossings/signallings
11. Maintenance of track: necessity, maintenance of track, inspection of soil, track and fixtures; maintenance and boxing of ballast maintenance gauges, tools

12. Earth work and Drainage: features of rail road, bed level, width of formation, side slopes, drains, methods of construction, requirement of drainage system.

PART-II: BRIDGES

(28 hrs)

13. Introduction

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

14. Classification of Bridges

Their structural elements and suitability:

14.1 According to life-permanent and temporary

14.2 According to track level – Deck, through and semi-through

14.3 According to material –wooden, steel, RCC, pre-stressed and masonry

14.4 According to structural form;

- Beam type –RCC, T-Beam, steel girder bridges, plate girder and box girder, balanced cantilever. Trussed bridges, N and warren
- Arch type – open spandrel and filled spandrel barrel and rib type
- Suspension type – unstiffened sling type, its description with sketches
- According to the position of highest flood level submersible and non submersible

14.5 FRC classification

15. Site Selection and Collection of Data: Factors affecting the selection of site for a bridge, data to be collected

16. Bridge Foundations: Pile foundation, well foundation, caisson, cofferdams: types pile/well caps

17. Piers, Abutments and Wingwalls

17.1 Piers-definition, parts; types –solid (masonry and RCC), open; cylindrical and abutment piers. Definition of the terms: height of pier, water way (natural and artificial); afflux and clearance

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

18. Bridge bearings
Purpose of bearings; types of bearings – fixed plate, sliding plate, deep cast base, knuckle, rocker, rocker and roller,
19. Temporary bridges
Necessity, description with sketches of pontoon and boat bridges
20. Maintenance of Bridges
 - 20.1 Inspection of bridges
 - 20.2 Routine maintenance

PART - III: TUNNELS

(8 hrs)

21. Definition and necessity of tunnels
22. Typical section of tunnels for a national highway and single and double broad gauge railway track
23. Transfer of centre line of tunnel by shaft method
24. Introduction to Method of construction of tunnels by needle beam method and full face method
25. Lining of tunnels with concrete
26. Ventilation –necessity and methods of ventilation, by blowing, exhaust and combination of blowing and exhaust
27. Drainage method of draining water in tunnels
28. Lighting of tunnels

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

INSTRUCTIONAL STRATEGY

This subject is of practical nature. While imparting instructions, teachers are expected to organize demonstrations and field visits to show various components and 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”, Anand Charotar 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 Dhanpat Rai and Sons

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	28	43
2	28	43
3	8	14
Total	64	100

IRRIGATION ENGINEERING AND DRAWING

L T P
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 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.

DETAILED CONTENTS

A) THEORY

1. Introduction: (2 hrs)
 - 1.1 Definition of irrigation
 - 1.2 Necessity of irrigation
 - 1.3 History of development of irrigation in India
 - 1.4 Major, medium and minor irrigation projects

2. Water Requirement of Crops (5 hrs)
 - 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, Irrigable area

3. Hydrological Cycle Catchment Area and Run-off (5 hrs)

Rainfall , definition rain-gauges – automatic and non-automatic, methods of estimating average rainfall (Arithmetic system); catchment area runoff, factors affecting runoff, hydrograph, basic concept of unit hydrograph.

4. Methods of Irrigation (7 hrs)
- 4.1 Flow irrigation - its advantages and limitations
- 4.2 Lift Irrigation – Tubewell 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 (5 hrs)
- 5.1 Classification, apurtenancs of a canal and their functions, sketches of different canal cross-sections
- 5.2 Various types of canal lining - their related advantages and disadvantages, sketches of different lined canal x-sections
6. Tube Well Irrigation (9 hrs)
- 6.1 Introduction, occurrence of ground water, location and command, advantages and disadvantages, comparison with canal irrigation
- 6.2 Tube wells, 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 tube wells and their choice-cavity, strainer and slotted type;
- 6.4 Method of boring, installation of well assembly, development of well, pump selection and installation and maintenance
- 6.5 Ground water recharging (concept only)
7. Dams (6 hrs)
- 7.1 Classification of dams; earth dams - types, causes of failure; cross-section of zoned earth dam, gravity dams – types, cross-sections of a dam
- 7.2 Concept of small and micro dams
- 7.3 Concept of spillways and energy dissipators
8. Canal Head Works and Regulatory Works (6 hrs)
- Definition, object, general layout, functions of different parts of head works. Difference between weir and barrage

9. Cross Drainage Works (4 hrs)
- 9.1 Functions and necessity of the following types: 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 (2 hrs)
- 12.2 Falls
- 10.2 Cross and head regulators
- 10.3 Outlets
- 10.4 Canal Escapes
11. River Training Works (4 hrs)
- Methods of river training, guide banks, retired (levees) embankments, groynes and spurs, pitched island, cut-off
12. Water Logging and Drainage and Ground Water Re-charge (3 hrs)
- 12.2 Definition of water logging – its causes and 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
- B) Irrigation Engineering Drawing:
- 13 Typical cross-section of a channel
- L-section of a channel for given data
 - Typical cross section of an unlined and lined channel in cuttn, partly cutting and partly filling and fully in filling with given design data.
- 14 Layout plan of a canal head works.
- 15 Draw the typical L section of a weir
- 16 Draw the X-section of an Earthen Dam
- i) Homogeneous
 - ii) Zoned type
 - iii) Diaphragm type
- 17 Cross section of a tube well
- 18 Details of an outlet (APM)

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

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	1	3
2	4	8

3	4	8
4	5	11
5	4	8
6	7	13
7	5	9
8	5	9
9	4	8
10	2	7
11	4	9
12	3	7
Total	64	100

QUANTITY SURVEYING AND VALUATION

L T P
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 to quantity surveying and its importance. Duties of quantity surveyor (2 hrs)
2. Types of estimates (3 hrs)
 - 2.1 Preliminary estimates
 - Plinth area estimate
 - Cubic rate estimate
 - Estimate per unit base
 - 2.2 Detailed estimates
 - Definition
 - Stages of preparation – details of measurement and calculation of quantities and abstract
3. Measurement (3 hrs)
 - 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 and Abstract Estimates from Drawings for: (20 hrs)
 - 4.1 A small residential building with a flat roof comprising of
 - Two rooms with W.C., bath, kitchen and verandah
 - 4.2 Earthwork for unlined channel
 - 4.3 Water supply lines
 - 4.4 WBM road and pre-mix carpeting
 - 4.5 Single span RCC slab culvert
 - 4.6 Earthwork for plain and hill roads
 - 4.7 RCC work in beams, slab, column and lintel foundations
 - 4.8 Masonry retaining walls
 - 4.9 10 users septic tank

5. Calculation of quantities of materials for (10 hrs)
- 5.1 Cement mortars of different proportion
 - 5.2 Cement concrete of different proportion
 - 5.3 Brick stone masonry in cement mortar
 - 5.4 Plastering and pointing
 - 5.5 White washing, painting
 - 5.6 Cement concrete flooring
 - 5.7 Terrazzo flooring
 - 5.8 Bath room and toilet fittings
6. Analysis of Rates (12 hrs)
- 6.1 Steps involved in the analysis of rates. Requirement of material, labour, sundries, contractor's profit and overheads
 - 6.2 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
 - Cement concrete in foundation
 - RCC in roof slab/beam/lintels/columns
 - Brick masonry in cement mortar
 - Cement Plaster
 - White washing, painting
 - 6.3 Running and maintenance cost of construction equipment
7. Contractorship (8 hrs)
- Meaning of contract
 - Qualities of a good contractor and their qualifications
 - Essentials of a contract
 - Types of contracts, their advantages, dis-advantages and suitability, system of payment
 - 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
 - Types of contracting firms/construction companies
8. Preparation of Tender Document based on Common Schedule Rates (CSR) (16 hrs)
- Introduction to CSR
 - Exercises on writing detailed specifications of different types of building works from excavation to foundations, superstructure and finishing operation
 - Exercises on preparing tender documents for the following
 - a) Earth work
 - b) Masonry works
 - c) Construction of a small house as per given drawing

- d) RCC works
 - e) Pointing, plastering and flooring
 - f) White-washing, distempering and painting
 - g) Wood work including polishing
 - h) Sanitary and water supply installations
 - i) False ceiling, aluminum (glazed) partitioning
 - j) Construction of an Industrial shed
 - k) Tile flooring
9. Exercises on preparation of comparative statements for item rate contract (2 hrs)
10. Valuation (4 hrs)
- a) Purpose of valuation, principles of valuation
 - b) Definition of various terms related to valuation like depreciation, sinking fund, salvage and scrap value, market value, fair rent, year's purchase etc.
 - c) Methods of valuation (i) replacement cost method (ii) rental return method

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	3
2	3	4
3	3	4
4	20	19
5	10	12
6	12	17
7	8	12
8	16	19
9	2	3
10	4	7
Total	80	100

MINOR PROJECT WORK (INDUSTRY 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:

- i) Building construction sites
- ii) Water treatment plant
- iii) Sewage treatment plant
- iv) River valley projects
- v) Crusher plant, Cement Manufacturing Plant, Brick kiln
- vi) Highway construction site
- vii) Material and Soil testing laboratory
- viii) Soil investigation projects
- ix) Hydel Power Project
- x) Land surveying projects
- xi) Community development works
- xii) Any other constructional site like bridge, tunnel, canal lining, construction of railway track, irrigation works etc
- xiii) Quality control projects

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. These students should be guided by respective subject teachers. Each teacher may guide a group of 4 – 5 students.

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

1. Survey of a village approach road, drawings of L-section and x-sections
2. Estimation of white washing and distempering in hostel building
3. Preparation of detailed estimate with drawings of septic tank for 30-40 users
4. Plumbing work and installation of PVC over-head water tank on a toilet block and then prepare report
5. Identification of water-supply fittings and replacement of defective fittings and then prepare report.
6. Replacement of window by door or vice versa
7. Repair of plaster of a wall in polytechnic campus

This Industry oriented minor project work will carry 50 marks for internal assessment . 50% marks will be given by industrial/field supervisors and 50% marks by the teacher supervising this work. The suggestive components of evaluation may include the following:

a)	Punctuality and regularity	15%
b)	Initiative in learning new things	15%
c)	Relationship with workers	15%
d)	Industrial training report	40%
e)	Seminar based on Project	15%

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. 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.

GENERIC SKILL DEVELOPMENT CAMP – I

As per general feedback received from the employers regarding Technician Engineers during formal interactions, the pass outs of polytechnics are labeled of falling short of employable skills which comprises of Communication, inter-personal relationship, leadership qualities, team work, problem solving, managing task, managing self etc. in addition to technical knowledge and skills. We have, therefore, added papers such as English and Communication Skills and Entrepreneurship Development and Management in the curriculum in addition to proposed camps of 3-4 days to be conducted in polytechnics on common and vital issues e.g. Environmental Awareness, Entrepreneurship Development and Generic Skill Development.

It is proposed that a camp of 3-4 days duration on Generic Skills Development (GSD) during 5th semester be organized by arranging expert lectures/discussion sessions either by polytechnic teachers or by eminent educationists from the neighborhood to deal with the following topics. Few students may also be encouraged to prepare on some of these topics and make presentation during the camp. Expert lectures must be followed by distribution of relevant handouts for further study. The attendance of students should be compulsory and marks be awarded under provision of Student Centred Activities.

It is envisaged that such camps will bring in a significant improvement in confidence level and personality of the pass outs from polytechnics.

Suggested list of topics for arranging lectures/discussion sessions:

1. Independent Study Technique
 - 1.1 Information search, information extraction, storage and retrieval
 - 1.2 Reading skills
 - 1.3 Life long learning
 - 1.4 Continuing education
2.
 - 2.1 Introduction
 - 2.2 Time Management
 - 2.3 Stress and emotions
 - 2.4 Health and hygiene
3. Task Management
 - 3.1 Task planning and organizing
 - 3.2 Task execution
 - 3.3 Task evaluation
 - 3.4 Event management
4. Action Research
 - 4.1 Importance and Scope
 - 4.2 Steps in action research
 - 4.3 Analysis of data
 - 4.4 Conclusions and report writing