

5.1 RCC DESIGN AND DRAWING

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RATIONALE

This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise RCC construction. 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 BIS: 456 – 2000 and their relevant drawings.

DETAILED CONTENTS

A. RCC THEORY & DESIGN

1. Introduction: Concept of Reinforced Cement Concrete (3 hrs)
2. Reinforcement Materials: (2 hrs)
 - 2.1 Various types of reinforcing materials
 - 2.2 Suitability of steel as reinforcing material
 - 2.3 Properties of different types of steel (mild steel, medium tensile steel, and deformed bars)
3. Theory of R.C.C. Beams: (12 hrs)
 - 3.1 Assumption in the theory of simple bending for RCC beam
 - 3.2 Flextural strength of a singly reinforced RCC beam

Position of the Neutral axis, concept of balanced, under reinforced and over reinforced sections moment of the section
 - 3.3 Shear strength of singly reinforced RCC beam, Assumptions made, permissible shear stresses as per IS code of practice, actual average shear stresses in singly reinforced concrete beam, concept of diagonal stirrups and inclined bars, shear strength of RCC beam section
 - 3.4 Bond in RCC beams:
 - 3.4.1 Concept of bond
 - 3.4.2 Permissible bond stresses for plain and deformed bars as per BIS code of practice, minimum length, standard hook

4. Singly Reinforced Concrete Beam (8 hrs)
 - 4.1 Loads and loading standards as per IS:875 (Part I-V)
 - 4.2 Design of singly reinforced concrete beam as per BIS-456 code of practice from the given data such as span, load and properties of materials used.
 - 4.3 Design of lintel with and without chajja
 - 4.4 Design of a main/secondary beam for RCC roof and floor
 - 4.5 Design of a cantilever beam/slab
5. Doubly Reinforced Concrete Beams: (6 hrs)
 - 5.1 Doubly reinforced concrete beam and its necessity
 - 5.2 Design of a doubly reinforced concrete beam
6. T-Beams: (8 hrs)
 - 6.1 Structural behaviour of beam and slab floor laid monolithically
 - 6.2 Rules for the design of T-beams
 - 6.3 Economical depth of T-beams
 - 6.4 Design of simply supported T-beams using IS code of practice
7. RCC Slabs: (8 hrs)
 - 7.1 Structural behaviour of slabs under UDL
 - 7.2 Type of Boundary conditions
 - 7.3 Design of one way slab
 - 7.4 Design of two way slab with the help of tables of IS:456
8. RCC Stairs (6 hrs)
 - 8.1 Generator principles for design of RCC stairs
 - 8.2 Design of horizontally spanning stairs

- 8.3 Design of dog legged RCC stairs
- 9. Columns and Isolated Footings (10 hrs)
 - 9.1 Concept of long and short columns
 - 9.2 IS specifications for main and lateral reinforcement including spiral reinforcement
 - 9.3 Behaviour of RCC columns under axial load
 - 9.4 Design of Axially loaded short and long columns with different end condition
 - 9.5 Design of isolated footings to determine depth and width of foundation
- 10. Basic concept of limit state design method and prestressed concrete – introduction to pre and post tensioning methods (4 hrs)

B. RCC DRAWING

- 1. Details of reinforcement in a simply supported RCC beam (singly reinforced and doubly reinforced) with the given design data regarding the size and number of bars, stirrups their size and spacing.
- 2. Details of reinforcement for a RCC square and circular column with isolated square footing
- 3. Details of reinforcement for a cantilever beam with given data regarding the size of the beam and the reinforcement

NOTE: Exercises on bar bending schedules for each of the three above items will be prepared

- 4. Details of reinforcement in plan and section for a simply supported RCC one way slab with intermediate support and two-way slabs from the given data. Bar bending schedule should be prepared
- 5. Details of reinforcement in a two storeyed RCC internal and corner column. In this, the details of reinforcement at the junction with beams must be shown from the given design data
- 6. Details of reinforcement of the junction of a secondary beam with the main beam with the given data

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.

RECOMMENDED BOOKS

1. Jai Krishna and Jain, OP; "Plain and Reinforced Concrete", Vol. I, Roorkee, Nem Chand and Bros
2. Handoo, BL; Mahajan, VM and Singla, DR; "Elementary of RCC Design", New Delhi, Satya Prakashan
3. Mallick, SK; and Gupta, AP; "Reinforced Concrete", New Delhi, Oxford and IBH Publishing Co
4. Punmia, BC; "Reinforced Concrete Structure Vol I", Delhi Standard Publishers Distributors
5. Sushil Kumar, "Treasurers of Reinforced Concrete Design", Delhi Standard Publishers Distributors
6. Ramamurtham, S; "Design and Testing of Reinforced Structures", Delhi Dhanpat Rai and Sons
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. STRUDC – Softtech – Pune
11. Verghese “Reinforced Concrete Design”
12. Ram Chandra “Reinforced Concrete Design”

5.2 HIGHWAY ENGINEERING

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RATIONALE

Construction of roads is one of the area in which diploma holders in Civil Engineering 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 transportation;
 - 1.2 Functions of IRC, CRRI, MOST&H
 - 1.3 IRC classification of roads
 - 1.4 Organization of a state highway department
2. Road Geometrics (8 hrs)
 - 2.1 Glossary of terms used in 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 Design and average running speed, stopping and passing sight distance
 - 2.3 Curve necessity, horizontal and vertical curves including transition curves and super elevation. 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 (6 hrs)
 - 3.1 Designation of a 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 (MOST)
4. Road Materials (6 hrs)
- 4.1 Different types of road materials in use; soil, aggregate, binders
 - 4.2 Function of soil as highway subgrade
 - 4.3 California Bearing Ratio; method of finding CBR value and its significance
 - 4.4 Testing aggregates: Los Angeles Abrasion test, impact test, crushing strength test, water absorption test and soundness test
 - 4.5 Aggregates: Availability of road aggregates in India, requirements of road aggregates as per IRC specifications
 - 4.6 Binders: Common binders; cement, bitumen and tar, properties as per IS specifications, penetration and viscosity test of bitumen, procedures and significance, cut back and emulsion and their uses, Bitumen modifiers
5. Road Pavements (8 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:

- a) Mechanical stabilization
- b) Lime stabilization
- c) Cement stabilization
- d) Fly ash stabilization

5.4 Base Course:

* Preparation of base course: Prime coat, Tack coat

- (a) Water bound macadam
- (b) Wet mix macadam
- (c) Bituminous macadam

*Methods of construction as per Ministry of Surface Transport (MOST)

5.5 Surfacing:

*Types of surfacing

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

*Methods of constructions as per Ministry of Surface, Transport, specifications and quality control; equipment 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 in cut, 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

6.2.5 Maintenance of plant and machinery

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

8.1 Common types of road failures of flexible pavements: Pot hole, cracks, rutting, corrugation, fatty surface upheaval - their causes and remedies

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. Construction Equipment: (4 hrs)

Output and use of the following plant and equipment

9.1 Hot mix plant

9.2 Tipper, tractors (wheel and crawler) scraper, bulldozer, dumpers, shovels, grader, roller, dragline

9.3 Asphalt mixer and tar boilers

9.4 Road pavers

PRACTICAL EXERCISES

i) Determination of the california bearing ratio (CBR) for the sub-grade soil (demonstration only)

ii) Determination of penetration value of bitumen

iii) Determination of softening point of bitumen

iv) Determination of impact value and crushing value of the road aggregate

- v) Determination of abrasion value (Los Angeles') of road aggregate
- vi) Determination of ductility of bitumen
- vii) Determination of viscosity of tar/bitumen

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) Rao, GV' Transportation Engineering
- x) Duggal AK, "Maintenance of Highway – a Reader", TTTI, Sector 26, Chandigarh

IRC Publications

- i) MOST Specifications for Road and Bridge Works Latest Edition
- ii) MOST Pocket book for Highway Engineers, 2001
- iii) MOST Manual for Maintenance of Roads, 1983

5.3 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 for the students to develop team spirit
- f. To train the students for self management

Task:

Preparation of topographical plan of a given area

Sub Tasks:

1. Reconnaissance of the area and fixing control stations
2. Traversing for the establishment of the control stations
3. Adjusting and plotting the traverse (office work)
4. Carrying the BM from any available reference BM to the site of work
5. Planimetric detailing and contouring
6. Fair plotting of the contours and other details (office work)
7. Finalisation of the group sheet (office work)

5.4 COMPUTER APPLICATIONS IN CIVIL ENGINEERING - I

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RATIONALE

Computers play a very vital role in present day life, more so, in all the professional life of engineering. 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 AutoCAD
2. Development of various drawing elements e.g. line, rectangle, circle, surfaces etc.
3. Develop plan, elevation, section of single storey building by using AutoCAD
4. Development of 3D view of building
5. Development of various layouts like electrical, sanitary, water filling using layers concept

5.5 RAILWAYS, BRIDGES AND TUNNELS

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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 – A: 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. Rail Gauge: Definition, types, practice in various countries and India, Uniformity of gauge, unigauge project of Indian Railways
4. Rails – permanent way and its requirements, types of rails, steel for rails, corrugation, corrosion of rails, welding of rails, wear, methods to reduce wear, failure, coning of wheels, hogged rails, buckling, their cause and remedies creep: definition, causes, effects and remedies
5. 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
6. 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
7. Ballast: Function of ballast, requirements of an ideal material for ballast, various methods used, size and quantity of ballast
8. 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
9. Maintenance of track: necessity, maintenance of track, inspection of soil, track and fixtures; maintenance and boxing of ballast maintenance gauges, tools

10. Earth work and Drainage: Forms of cross-section, features of rail road, bed level, width of formation, side slopes, drains, methods of construction, requirement of drainage system.

PART-B: BRIDGES

(28 hrs)

11. Introduction

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

12. Classification of Bridges

Their structural elements and suitability:

12.1 According to life-permanent and temporary

12.2 According to road way level – Deck, through and semi-through

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

12.4 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

13. Site Selection and Collection of Data

Factors affecting the selection of site for a bridge, data to be collected

14. Foundations

14.1 Depth of foundation, types of foundations, well foundation and caisson (open type only), their details of construction with sketches

14.2 Laying of foundations (i) dry soil (ii) soil charged with water (iii) under water, coffer dams their types and construction

15. Piers, Abutments and Wingwalls
 - 15.1 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
 - 15.2 Abutments and wing walls – definition, types of abutments (straight and tee), abutment with wing walls (straight splayed, return and curved)
16. Bridge bearings

Purpose of bearings; types of bearings – fixed plate, sliding plate, deep cast base, rocker, rocker and roller, thier functions with sketches
17. Temporary bridges

Necessity, description with sketches of pontoon and boat bridges
18. Maintenance of Bridges
 - 19.1 Inspection of bridges
 - 19.2 Routine maintenance

PART - C: TUNNELS

(8 hrs)

19. Definition and necessity of tunnels
20. Typical section of tunnels for a national highway and single and double broad gauge railway track
21. Transfer of centre line of tunnel by shaft method
22. Method of construction of tunnels in soft rock by needle beam method
23. Method of construction of tunnels in hard rock with full face method and safety precaution to be taken, other methods of tunneling (names only)
24. Lining of tunnels with concrete
25. Ventilation –necessity and methods of ventilation, by combination of blowing and exhaust
26. Drainage method of draining water in tunnels
27. Lighting of tunnels
28. Shafts, mucking, hauling

Notes: Field visits may be organized to Bridge construction site or a bridge/Tunnel construction site/Railways tracks to explain the various components

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. MOST drawings for various types of bridges
9. MOST pocket books for bridge Engineers, 2000 (First Revision)

5.6 IRRIGATION ENGINEERING AND DRAWING

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RATIONALE

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

DETAILED CONTENTS

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
 - 1.5 Planning of irrigation project
2. Water Requirement of Crops (3 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 command area, culturable command area, Intensity of Irrigation, Irrigable area
3. Rainfall and Run-off (3 hrs)

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

- affecting runoff, runoff formulae - Dicken's, Ryve's and Rational formulae hydrograph, basic concept of unit hydrograph.
4. Methods of Irrigation (6 hrs)
 - 4.1 Surface methods and their advantages and limitations
 - 4.2 Sprinkler irrigation conditions favourable and essential requirements for sprinkler irrigation, sprinkler system – classification and component parts, design consideration
 - 4.3 Drip irrigation, suitability of drip irrigation, layout, Component parts, advantages
 5. Design of Irrigation Canals (4 hrs)
 - 5.1 Classification, apurtenancs of a canal and their functions, sketches of different canal cross-sections
 - 5.2 Design of irrigation canals – Chezy's formula, Manning's, Kennedy's and Lacey's silt theories and equations, comparison of above two silt theories
 - 5.3 Use of Garrets charts
 - 5.4 Various types of canal lining - Advantages and disadvantages, sketches of different lined canal, x-section with drainage behind lining
 6. Tube Well Irrigation (4 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-simple problems
 - 6.3 Types of tube wells and their choice-cavity, strainer and slotted type;
 - 6.4 Method of construction boring, installation of well assembly, development of well, pump selection and installation and maintenance Testing of tube-well and rehabilitation of a tube-well
 7. Dams (hrs)
 - 7.1 Classification, earth dams - types, causes of failure; cross-section of zoned earth dam, gravity dams – types, labeled cross-sections of a dam

- 7.2 Spillways and energy dissipators
- 7.3 Concept of small and micro dams
- 8. Canal Head Works and Regulatory Works (4 hrs)
Definition, object, general layout, functions of different parts of head works.
Difference between weir and barrage
- 9. Cross Drainage Works (5 hrs)
 - 9.1 Functions and necessity of the following types: aqueduct, siphon, super passage, level crossing, inlet and outlet
 - 9.2 Constructional details of the above
- 10. Design of Hydraulic Structures (4 hrs)
 - 10.1 Falls
 - 10.2 Gross and head regulators
 - 10.3 Outlets
 - 10.4 Energy dissipators and canal excepes
- 11. River Training Works (3 hrs)
Methods of river training, guide banks and their design, approach embankments, afflux embankments, groynes and spurs
- 12. Water Logging and Drainage and Ground Water Re-charge (3 hrs)
 - 12.1. Definition, 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

IRRIGATION ENGINEERING DRAWING

1. Typical cross-section of a channel
 - L-section of a channel for given data
 - Typical cross section of an unlined and lined channel in cutting, partly cutting and partly filling and fully in filling with given design data
2. Plan and cross-section of an aqueduct
3. Details of guide banks
4. Distributory falls: Plan, cross section and L-section of a typical fall with details of wing wall, pitching, flooring and toe wall
5. Details of canal head works
6. Details of an outlet

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 drawings of various irrigation works.

RECOMMENDED BOOKS

1. Singhal, RP; 'A Text Book on Irrigation Engineering', Singhal publications
2. Bharat Singh, 'Fundamentals of Irrigation Engineering', Roorkee, Nem Chand and Bros
3. Garg, Santosh Kumar, 'Irrigation Engineering and Hydraulics Structures', Delhi, Khanna Publishers
4. Punmia, BC; and Pande Brij Bansi Lal, 'Irrigation and Water Power Engineering', Delhi, Standard Publishers Distributors
5. Sharma, RK; 'Text Book of Irrigation Engineering and Hydraulics Structures', New Delhi, Oxford and IBH Publishing Company
6. Sharma, SK; 'Principles and Practice of Irrigation Engineering', New Delhi, Prentice Hall of India Pvt. Ltd.
7. Asawa, CL, "Irrigation Engineering"

8. Varshney RS, Gupta SC, Gupta RL etc. "Theory and Design of Irrigation Structures", Vol. I and II
9. Saharsabudhe SR, "Irrigation Engineering and Hydraulic Structures"
10. Priyani BB, 'The Fundamental Principles of Irrigation and Water Power
11. BIS Codes
12. Wan. E. Houk, "Irrigation Engineering" Vol. I and II

5.7 QUANTITY SURVEYING

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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 (4 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 (4 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 (20 hrs)
 - 4.1 A small residential building with a flat roof
 - 4.2 Pitched roof with steel truss
 - 4.3 Timber structures

- 4.4 Earthwork for unlined channel
- 4.5 Water supply lines
- 4.6 Sanitary and water supply fittings i.e. septic tank for a domestic building
- 4.7 WBM road and pre-mix carpeting
- 4.8 Single span RCC slab culvert
- 4.9 Earthwork for plain and hill roads
- 4.10 RCC work in beams, slab, column and lintel
- 4.11 Stone masonry in retaining walls
- 4.12 Arches
- 5. Calculation of quantities of materials for (12 hrs)
 - 5.1 Cement mortars of different proportion
 - 5.2 Portland cement concrete of different proportion
 - 5.3 Brick masonry in cement mortar
 - 5.4 Plastering and pointing
 - 5.5 White washing
 - 5.6 Cement concrete flooring
 - 5.7 Terrazo flooring
 - 5.8 Stone masonry – random rubble and Ashlar
- 6. Analysis of Rates (14 hrs)
 - 6.1 Steps involved in the analysis of rates. Requirement of material, labour, sundaries, 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 hard/ordinary soil and filling with a concept of lead and lift
- Cement concrete in foundation
- RCC in roof slab
- Brick masonry in cement mortar
- Cement Plaster
- White washing

6.3 Running and maintenance cost of construction equipment

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. Teachers should conceptualise 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. STAAD – Research Engineers - USA