Fifth Semester

REINFORCED CONCRETE DESIGN (DCE-501)

Discipline core (DC) : Credit 3(3-0-0)

Objective:

This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise RC Construction and fabrication. He may also be required to design simple structural elements, make changes in design depending upon availability of materials (bars of different diameters)

COURSE OUTLINE:

1. Introduction

1.1 Concept of Reinforced Cement Concrete (RCC)

1.2 Reinforcement Materials:

- Suitability of steel as reinforcing material
- Properties of mild steel and HYSD steel

1.3. Loading on structures as per IS: 875

2. Introduction to following methods of RCC design

2.1 Working stress method

2.2 Limit state method

3. Shear and Development Length

3.1 Shear as per IS:456-2000 by working stress method

i) Shear strength of concrete without shear reinforcement ii) Maximum shear stress

iii) Shear reinforcement

4. Singly Reinforced Beam (Working stress method)

4.1 Basic assumptions and stress strain curve, neutral axis, balanced, under-reinforcement and over reinforced beams, Moment of resistance for singly reinforced beam.

4.2 Design of singly reinforced beam including sketches showing reinforcement details.

5. Concept of Limit State Method

5.1 Definitions and assumptions made in limit state of collapse (flexure)

5.2 Partial factor of safety for materials

5.3 Partial factor of safety for loads

5.4 Design loads

5.5 Stress block, parameters

6. Singly Reinforced beam

Theory and design of singly reinforced beam by Limit State Method. Check for shear, Check for deflection, check for development length

7. Doubly Reinforced Beams

Theory and design of simply supported doubly reinforced rectangular beam by Limit State Method

8. Behaviour of T beam, inverted T beam, isolated T beam and „L" beams (No Numericals)

9. One Way Slab

Theory and design of simply supported one way slab including sketches showing reinforcement details (plan and section) by Limit State Method. Check for shear, Check for deflection,

10. Two Way Slab

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

11. Axially Loaded Column

11.1 Definition and classification of columns

11.2. Effective length of column,

11.3. Specifications for longitudinal and lateral reinforcement

11.4. Design of axially loaded square, rectangular and circular short columns by Limit State Method including sketching of reinforcement(sectional elevation and plan)

12. Pre-stressed Concrete

12.1. Concept of pre-stressed concrete

12.2. Methods of pre-stressing: pre-tensioning and post tension

RECOMMENDED BOOKS

1. Punmia, BC; "Reinforced Concrete Structure Vol I", Standard Publishers, Delhi

2. Ramamurtham, S; "Design and Testing of Reinforced Structures", Dhanpat Rai and Sons, Delhi

HIGHWAY & AIRPORTS ENGINEERING (DCE-502)

Discipline core (DC): Credit 4(3-0-2)

Objective: 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.

COURSE OUTLINE:

1. Introduction

1.1 Importance of Highway engineering

1.2 Functions of IRC, CRRI, MORT&H, NHAI

1.3 IRC classification of roads

1.4 PMGSY and MNERGA Roads

2. Road Geometrics

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

3. Highway Surveys and Plan

3.1 Topographic map, reading the data given on a topographic map

3.2 Basic considerations governing alignment for a road in plain and hilly area
3.3 Highway location; marking of alignment
4. Road Materials
4.1 Different types of road materials in use; soil, aggregate, binders – bitumen, cutback, Emulsion and Modified Bitumen (CRMB, PMB)
4.2 Binders: Common binders; bitumen, properties as per BIS specifications, penetration, softening point, ductility and viscosity test of bitumen, procedures and significance, cut back and emulsion and their uses, Bitumen modifiers
5. Road Pavements
5.1 Road pavement: Flexible and rigid pavement, their merits and demerits, typical cross-sections, functions of various components
5.2. Introduction to California Bearing Ratio, method of finding CBR value and its significance. Aggregate : Source and types, important properties, strength, durability
5.3 Sub-grade preparation: Setting out alignment of road, setting out bench marks, control pegs for embankment and cutting, borrow pits, making profiles of embankment, construction of embankment, compaction, preparation of subgrade, methods of checking camber, gradient and alignment as per recommendations of IRC, equipment used for subgrade preparation. Stabilization of subgrade. Types of stabilization mechanical stabilization, lime stabilization, cement stabilization, fly ash stabilization etc.(introduction only)
5.4 Introduction to Sub Base Course and Base Course:
a) Granular base course: (i) Water Bound Macadam (WBM) (ii) Wet Mix Macadam (WMM)
b) Bitumen Courses: (i) Bituminous Macadam (ii) Dense Bituminous Macadam (DBM)
c) Methods of construction as per MORT&H 5.5 Surfacing: a) Types of surfacing i) Prime coat and tack coat ii) Surface dressing with seal coat
7.Road Drainage:
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:
8.1 Common types of road failures of flexible pavements: Pot hole, rutting, alligator cracking, upheaval - their causes and remedies (brief description)
8.2 Maintenance of bituminous road such as seal-coat, patch-work and recarpeting.
8.3 Maintenance of concrete roads-filling cracks, repairing joints, maintenance of shoulders (berms), maintenance of traffic control devices
9. Road Construction Equipment:
Output and use of the following plant and equipment
9.1 Hot mix plant
9.2 Tipper, tractors (wheel and crawler) scraper, bulldozer, dumpers, shovels, grader, roller, dragline
9.3 Asphalt mixer and tar boilers
9.4 Road pavers
10 Airport Engineering :-
10.1 Necessity of study of airport engineering, aviation transport scenario in India.
10.2 Factors to be considered while selecting a site for an airport with respect to zoning laws.

10.3 Introduction to Runways, Taxiways and Apron

PRACTICAL EXERCISES

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

10 A compulsory visit to Ready Mix Concrete plant.

11. Determination of Viscosity of Tar/Bitumen

RECOMMENDED BOOKS

i) Khanna, SK and Justo, CEG, "Highway Engineering", Nem Chand and Bros., Roorkee
ii) Vaswani, NK, "Highway Engineering" , Roorkee Publishing House, Roorkee

RAILWAYS, BRIDGES AND TUNNELS (DCE-503)

Discipline core (DC) : Credit 3(3-0-0)

Objective: 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

COURSE OUTLINE:

PART – I: RAILWAYS

1. Introduction to Indian Railways
2. Railway surveys: Factors influencing the railways route, brief description of various types of railway survey
3. Classification of permanent way describing its component parts
4. Rail Gauge: Definition, types, practice in India
5. Rails – types of rails
6. Rail Fastenings: Rail joints, types of rail joints, fastenings for rails, fish plates, bearing plates
7. Sleepers: Functions of sleepers, types of sleepers, requirements of an ideal material for sleepers.
8. Ballast: Function of ballast, requirements of an ideal material for ballast
9. Crossings and signallings: Brief description regarding different types of crossings/ signallings (Latest electronics operated signal devices)

10. Maintenance of track: Necessity, maintenance of track, inspection of soil, track and fixtures; maintenance and boxing of ballast maintenance gauges, tools
11. Earth work an drainage: Features of rail road, bed level, width of formation, side slopes, drains, methods of construction, requirement of drainage system

PART-II: BRIDGES

12. Introduction Bridge – its function and component parts, difference between a bridge and a culvert
13. Classification of Bridges Their structural elements and suitability:
13.1 According to life-permanent and temporary
13.2 According to deck level – Deck, through and semi-through
13.3 According to material –timber, masonry, steel, RCC, pre-stressed
13.4 According to structural form; - Grade Seperators-Railway Overbridges (ROB), Railway underbridge (RUB)
- Beam type –RCC, T-Beam, steel girder bridges, plate girder and box girder, balanced cantilever, Trussed bridges.
- Arch type – open spandrel and filled spandrel barrel and rib type
- Suspension type – unstiffened and stiffened and table (its description with sketches)
- According to the position of highest flood level submersible and non submersible
13.5 IRC classification
14. Bridge Foundations: Introduction to open foundation, pile foundation, well foundation
15. Piers, Abutments and Wingwalls
15.1 Piers-definition, parts; types –solid (masonry and RCC), open
15.2 Abutments and wing walls – definition, types of abutments (straight and tee), abutment with wing walls (straight, splayed, return and curved)
15.3 Launching of Equipment Bridges
16. Bridge bearings Purpose of bearings; types of bearings – fixed plate, rocker and roller.
17. Maintenance of Bridges
17.1 Inspection of Steel and Equipment bridges
17.2 Routine maintenance

RECOMMENDED BOOKS

1. Vaswani, NK, "Railway Engineering", Publishing House, Roorkee

2. Rangwala, SC, "Railway Engineering", Anand, Charotar Book Stall

QUANTITY SURVEYING AND VALUATION (DCE-504)
Discipline core (DC) : Credit 3(3-0-0)

Objective: 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, and

principles of valuation. Therefore, this subject has great importance for diploma holders in Civil Engineering.

COURSE OUTLINE:

1. Introduction to quantity surveying and its importance. Duties of quantity surveyor
2. Types of estimates

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

3.1 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:

4.1 A small residential building with a flat roof and pitched roof building comprising of

- Two rooms with W.C., bath, kitchen and verandah

4.2 Earthwork for unlined channel

4.3 WBM road and pre-mix carpeting

4.4 Single span RCC slab culvert

5. Calculation of quantities of materials for

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 R.C.C. work in slab, beams

6. Analysis of Rates

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
- RCC in roof slab/beam/lintels/columns
- Brick masonry in cement mortar
- Cement Plaster
- White washing, painting
- Stone masonry in cement mortar

7 Contractor ship

- 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

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

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

RECOMMENDED BOOKS

1. Pasrija, HD, Arora, CL and S. Inderjit Singh, "Estimating, Costing and Valuation (Civil)", New Asian Publishers, Delhi,

REPAIR AND MAINTENANCE OF BUILDINGS (DCE-505)
Open elective (OE): Credit 4(3-0-2)

Objective: 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.

COURSE OUTLINE:

1. Need for Maintenance

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)

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

2.3 Effects of various agencies of deterioration on various building materials i.e. bricks, timber, concrete, paints, metals, plastics, stones

3. Investigation and Diagnosis of Defects

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
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 Column and Beams
4.3.4 Roof and Terraces
4.3.5 Joinery
5. Materials for Repair, maintenance and protection
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
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
6.7Repair of DPC against Rising Dampness
6.7.1Physical methods
6.7.2Electrical methods
6.7.3Chemical methods
6.8Repair of walls
6.8.1Repair of mortar joints against leakage
6.8.2Efflorescence removal
6.9Waterproofing of wet areas and roofs
6.9.1Water proofing of wet areas
6.9.2Water proofing of flat RCC roofs
6.9.3Various water proofing systems and their characteristics
6.10Repair of joints in buildings
6.10.1Types of sealing joints with different types of sealants
6.10.2Techniques for repair of joints
6.10.3Repair of overhead and underground water tanks

PRACTICAL EXERCISES

Identify the different defects in buildings and their remedies as per list given below. Building Maintenance/Different Remedies should be comprised with the technical support of teachers and labour support. For this purpose labour should be hired from open market at government rate on daily basis of expenditure regarding items required for maintenance should be procured from student funds of maintenance. For major maintenance, Expert Masons required, should alsobe hired. Building comprises the residential/non residential/hosteletc.

List of Defects

1. To Identity dampers on walls
2. Cracks on Roof level and on walls
3. Corrosion on iron window and door chaukhats
4. Decay of wooden structures
5. Cracks on R.C.C structures.
6. To perform the anti-termite treatment
7. Removal of damaged or decay plaster and guniting

RECOMMENDED BOOKS

1. Gahlot P.S. and Sanjay Sharma, “Building Defects and Maintenance Management”, CBS Publishers, New Delhi

2. Nayak, BS, "Maintenance Engineering for Civil Engineers", Khanna Publishers, Delhi

Hydraulics-II (DCE-505)
Open elective (OE): Credit 3(3-0-0)

Course Objective

The main aim of this course is to understand the basic theories of open channel flows such as depth-energy relationship, uniform flow and its application to design of efficient channel sections of various shapes, hydraulic jump and its application to the energy dissipation devices, gradually varied flow and its application in computation of typical water surface profiles, unsteady flow and its practical application, model studies and their application in open channel flow etc .

COURSE OUTLINE:

Unit 1 Basic Principles: open channel flow and its classifications, and properties, energy and momentum principles, Critical flow computation and its applications, transitions with sub critical and super critical flows.

Unit 2 Uniform flow, roughness coefficient, computation of uniform flow in prismatic channel, design of non- erodible channels for uniform flow, Most efficient channel section, compound sections.

Unit 3 Gradually varied flow: Theory and analysis, control sections, Analysis of flow profiles, gradually- varied flow computations in prismatic channels. Rapidly varied flow: Theory of hydraulic jump, evaluation of jump elements in rectangular and non-rectangular channel, location of jump on horizontal floor.

Unit 4 Application of model studies to free surface flow problems, waves and their classifications, celerity of a wave, surge formation, equation of motion, rapidly varied unsteady flows.

Text Books and/or Reference Materials

1.Subramanya, “Flow in Open channels”
2. K G Ranga Raju, “Flow through open channel”
3. V.T chow “Open channel Hydraulics”
4. Bakhmeteff, “Hydraulics of open channel”
5. Henderson, “Open channel flow”

Dam Engineering (DCE-505)

Open elective (OE): Credit 3(3-0-0)

Course Objective

The course emphasizes on the basic design principle of the gravity dam, earthen dam, arch and buttress dam, spillways and energy dissipaters etc.

Topics Covered

Unit 1 Types of Dam, merits and demerits, dam site selection, selection of dam, Forces acting on gravity Dam, Methods of analysis of gravity Dam, Modes of failure and stability requirements, Design criteria and factor of safety.

Unit 2 Elementary profile of a gravity dam, Low and high gravity dams, Zoning of dams, Galleries in dams, Temperature control in mass concrete; gravity dams subjected to earthquakes.

Unit 3 Buttress and Arch dams, Types, selection, merits and demerits, Elementary design Principles of Arch and Buttress dams

Unit 4: Earth Dam their component and functions, causes of failure. Factors influencing the design of an earth dam. Design criteria for Earth Dam. Elementary idea of design for spillway and energy dissipaters.

Text Books and/or Reference Materials

1. R.S. Varshney “Concrete Dams”, by 1982, NCB, Roorkee
2. IS: 6512-1984, Is Code for criteria for Design of solid Gravity Dams.
3. Design of Swell Dams, USBR 1960, Calcutta, Oxford and IBH
4. W.P. Creager, J. Justin,.Daud Hinds, “Engineering for Dams” vol.I-III, Wiley, N.Y., USA.

APPLICATIONS AND USES OF VARIOUS SOFTWARE IN CIVIL ENGINEERING (DCE-506)

Discipline core (DC): Credit 4(3-0-2)

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

COURSE OUTLINE:

PRACTICAL EXERCISES

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