

5.1 REINFORCED CONCRETE DESIGN

L T P
Period/Week 6 - -

RATIONALE

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

DETAILED CONTENTS

1. Introduction (03 periods)
 - 1.1 Concept of Reinforced Cement Concrete (RCC)
 - 1.2 Reinforcement Materials:
 - Suitability of steel as reinforcing material
 - Properties of mild steel and HYSD steel
 - 1.3 Loading on structures as per IS: 875
2. Introduction to following methods of RCC design (03 periods)
 - 2.1 Working stress method
 - 2.2 Limit state method
3. Shear and Development Length (05 periods)
 - 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) (12 periods)
 - 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 (09 periods)
 - 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 (11 periods)

- 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 (11 periods)
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) (05 periods)
 9. One Way Slab (11 periods)
Theory and design of simply supported one way slab including sketches showing reinforcement details (plan and section) by Limit State Method. Check for shear, Check for deflection,
 10. Two Way Slab (11 periods)
Theory and design of two-way simply supported slab with corners free to lift, no provisions for torsional reinforcement by Limit State Method including sketches showing reinforcement details (plan and two sections)
 11. Axially Loaded Column (11 periods)
 - 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. Prestressed Concrete (04 periods)
 - 12.1. Concept of pre-stressed concrete
 - 12.2. Methods of pre-stressing : pre-tensioning and post tensioning
 - 12.3. Advantages and disadvantages of prestressing
 - 12.4. Losses in pre-stress

Important Note: Use of BIS:456-2000 is permitted in the examination.

INSTRUCTIONAL STRATEGY

Teachers are expected to give simple problems for designing various RCC structural members. For creating comprehension of the subject, teachers may prepare tutorial sheets, which may be given to the students for solving. It would be advantageous if students are taken at construction site to show form work for RCC as well as placement of reinforcement in various structural members. Commentary on BIS:456 may be referred along with code for relevant clauses.

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
3. Gambhir, M.L., "Reinforced Concrete Design", Macmillan India Limited
4. Singh, Birinder "RCC Design and Drawing", Kaption Publishing House, New Delhi

5. Singh Harbhajan “Design of Reinforced Concrete Structures” Abhishek Publishers Ltd., Chandigarh
6. Mallick, SK; and Gupta, AP; "Reinforced Concrete", Oxford and IBH Publishing Co, New Delhi.
7. Singh Harbhajan “Limit State RCC Design” Abhishek Publishers Ltd., Chandigarh

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	03	03
2	03	03
3	05	05
4	12	10
5	09	10
6	11	12
7	11	12
8	05	5
9	11	12
10	11	12
11	11	12
12	04	04
Total	96	100

5.2 HIGHWAY & AIRPORTS ENGINEERING

L T P
Period/Week 5 - 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

1. Introduction (02 periods)
 - 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 (10 periods)
 - 2.1 Glossary of terms used in road geo-metrics and their importance: Right of way, formation width, road margin, road shoulder, carriage way, side slopes, kerbs, formation levels, camber and gradient
 - 2.2 Average running speed, stopping and 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 (10 periods)
 - 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 (10 periods)

- 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 (12 periods)

- 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

- iii) Open graded premix carpet
- iv) Mix seal surfacing
- v) Semi dense bituminous concrete
- vi) Bituminous Concrete/Asphaltic concrete
- vii) Mastic Asphalt

b) * Methods of constructions as per MORT&H specifications and quality control..

5.6 Rigid Pavements:

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

6. Hill Roads: (06 periods)

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

6.2 Special problems of hill areas

6.2.1 Landslides: Causes, prevention and control measures, use of geogrids, geoflexiles, geo-synthetics

6.2.2 Drainage

6.2.3 Soil erosion

6.2.4 Snow: Snow clearance, snow avalanches, frost

6.2.5 Land Subsidence

7. Road Drainage: (06 periods)

7.1 Necessity of road drainage work, cross drainage 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: (06 periods)

- 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: (08 periods)
- Output and use of the following plant and equipment
- 9.1 Hot mix plant
 - 9.2 Tipper, tractors (wheel and crawler) scraper, bulldozer, dumpers, shovels, grader, roller, dragline
 - 9.3 Asphalt mixer and tar boilers
 - 9.4 Road pavers
- 10 Airport Engineering :- (10 periods)
- 10.1 Necessity of study of airport engineering, aviation transport scenario in India.
 - 10.2 Factors to be considered while selecting a site for an airport with respect to zoning laws.
 - 10.3 Introduction to Runways, Taxiways and Apron

* **An expert may be invited from field/industry for extension lecture on this topic.**

PRACTICAL EXERCISES

1. Determination of penetration value of bitumen
2. Determination of softening point of bitumen
3. Determination of ductility of bitumen
4. Determination of impact value of the road aggregate
5. Determination of abrasion value (Los Angeles') of road aggregate
6. Determination of 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

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", Nem Chand and Bros., Roorkee
- ii) Vaswani, NK, "Highway Engineering" , Roorkee Publishing House, Roorkee,
- 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" S Chand and Co, Delhi
- v) Bindra, SP; "A Course on Highway Engineering" , Dhanpat Rai and Sons, New Delhi
- vi) Sharma, RC; and Sharma, SK; "Principles and Practice of Highway Engineering", Asia Publishing House, New Delhi
- vii) Duggal AK, Puri VP., "Laboratory Manual in Highway Engineering", New Age Publishers (P) Ltd, Delhi,
- viii) NITTTR, Chandigarh "Laboratory Manual in Highway Engineering",
- 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
- xii) Duggal AK "Types of Highway constitution ", NITTTR Chandigarh
- xiii) Rao, "Airport Engineering"
- xiv) Singh,Jagrup, "Highway Engineering", Eagle Publications Jalandhar

IRC Publications

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted	Marks Allotted (%)
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	(Periods)	
1	02	04
2	10	12
3	10	12
4	10	12
5	12	14
6	06	08
7	06	08
8	06	08
9	08	10
10	10	12
Total	80	100

5.3 RAILWAYS, BRIDGES AND TUNNELS

	L	T	P
Period/Week 5	-	-	-

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: RAILWAYS

(35 periods)

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 signalings: Brief description regarding different types of crossings/ signalings (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

(35 periods)

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 Separators-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

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 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 construction of railway track, bridges and tunnel.

RECOMMENDED BOOKS

1. Vaswani, NK, “Railway Engineering”, Publishing House, Roorkee
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, Delhi
6. Rangwala S.C., “Bridge Engineering”, Anand, 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, “Tunnel Engineering”, Dhanpat Rai and Sons, Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	35	43
2	35	43
3	10	14
Total	80	100

5.4 QUANTITY SURVEYING AND VALUATION

L T P
Periods/week 6 - -

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 (02 periods)
2. Types of estimates (03 periods)
 - 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 (03 periods)
 - 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: (28 periods)
 - 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

- 4.5 Earthwork for plain and hill roads
- 4.6 RCC work in beams, slab, column and lintel, foundations
- 4.7 users septic tank - 25 users

- 5. Calculation of quantities of materials for (12 periods)
 - 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 (16 periods)
 - 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 Contractorship (10 periods)
 - 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

- Classification and types of contracting firms/construction companies
- 8 Preparation of Tender Document based on Common Schedule Rates (CSR/SOR) (14 periods)
- Introduction to CSR and calculation of cost based on premium on CSR/SOR
 - 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) Construction of a small house as per given drawing
 - c) RCC works
 - d) Pointing, plastering and flooring
 - e) White-washing, distempering and painting
 - f) Wood work including polishing
 - g) Sanitary and water supply installations
 - h) False ceiling, aluminum (glazed) partitioning
 - i) Tile flooring including base course
 - j) Construction of W.B.M/Concrete road
9. Exercises on preparation of comparative statements for item rate contract (02 periods)
10. Valuation (06 periods)
- 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)", New Asian Publishers, Delhi,

2. Rangwala, S.C, Estimating and Costing”, Anand, Charotar Book Stall
3. Chakraborti, M, “Estimating, Costing and Specification in Civil Engineering”, Calcutta
4. Dutta, BN, “Estimating and Costing
5. Mahajan Sanjay, “Estimating and Costing” Satya Parkashan, Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	02	02
2	03	03
3	03	03
4	28	30
5	12	12
6	16	18
7	10	10
8	14	14
9	02	02
10	06	06
Total	96	100

5.5 REPAIR AND MAINTENANCE OF BUILDINGS

L T P

Period/Week 4 - 2

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 (09 periods)
 - 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) (08 periods)
 - 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 (08 periods)
 - 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 (09 periods)
 - 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

- 4.3.6 Decorative and protective finishes
- 4.3.7 Services
- 4.3.8 Defects caused by dampness

5. Materials for Repair, maintenance and protection (09 periods)

- 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 (21 periods)

- 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

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 also be hired. Building comprises the residential/non residential/hostel etc.

List of Defects

1. To Identify 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

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. and Sanjay Sharma, "Building Defects and Maintenance Management", 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; et al, "Maintenance and Repair of Buildings", Published by Newness – Butterworth

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	09	13
2	08	13
3	08	13
4	09	13
5	09	13
6	21	35
Total	64	100

5.6 APPLICATIONS AND USES OF VARIOUS SOFTWARE IN CIVIL ENGINEERING

L T P
Periods/Week - - 6

RATIONALE

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 softwares in civil engineering.

DETAILED CONTENTS

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 softwares like STAAD-Pro, MS Project or Primavera Project Planner, Auto Civil, MX Road or any other equivalent software for above mentioned software

Note:

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

5.7 MINOR PROJECT WORK

L T P
Period/week - - 8

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

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 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. 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.

A group of students not exceeding 5 may work on any one project. 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 for internal assessment. External examiner will ask the questions on the construction, working, processes observed by the students during their project work: Shortcomings in the works (site) and their remedial measures may be suggested by the students.