

**Teaching Schedule and Study Scheme**

*of*

**Master of Technology (M. Tech.)**

*in*

**Construction Technology and  
Management**

**Punjab Technical University  
Jalandhar**

**January 2004**

**Teaching Schedule and Study Scheme of M.Tech.(Construction Technology and Management)**

**Ist Semester**

Sr. No.	Subject Code	Title of the Subject	Teaching Load/Week			Total Hrs/week	Evaluation Marks		Total
			L	T	P/D		Theory	Sessional	
1.	CT-501	Construction Management and Equipment	3	1	-	4	100	50	150
2.	CT-502	Concrete Construction Technology	3	1	-	4	100	50	150
3.	CT-503	Computational Techniques	3	1	-	4	100	50	150
4.	CT-504	Building Planning and Design	3	1	-	4	100	50	150
5.	CT-	Elective-I	3	1	-	4	100	50	150
		<b>Total</b>	<b>15</b>	<b>5</b>	<b>-</b>	<b>20</b>	<b>500</b>	<b>250</b>	<b>750</b>

**Elective-I**

1. CTM-509 Environment Engineering & Management
2. CTM-510 Bridge Engineering

**IInd Semester**

Sr. No.	Subject Code	Title of the Subject	Teaching Load/Week			Total Hrs/week	Evaluation Marks		Total
			L	T	P/D		Theory	Sessional	
1.	CT-505	Foundation Design and Construction	3	1	-	4	100	50	150
2.	CT-506	Maintenance of Building Structures	3	1	-	4	100	50	150
3.	CT-507	Computer Aided Design	3	1	-	4	100	50	150
4.	CT-508-	Building Cost and Quality Management	3	1	-	4	100	50	150
5.	CT-	Elective-II	3	1	-	4	100	50	150
		<b>Total</b>	<b>15</b>	<b>5</b>	<b>-</b>	<b>20</b>	<b>500</b>	<b>250</b>	<b>750</b>

**Elective-II**

1. CT-511 Rural Construction Technology
2. CT-512 Pavement Design, Construction and Maintenance

**IIIrd Semester**

Sr. No.	Subject Code	Title of the Subject	Teaching Load/Week			Total Hrs/week	Evaluation Marks		Total
			L	T	P/D		Theory	Sessional	
1.	CT-	Elective-III	3	1	-	4	100	50	150
2.	CT-	Elective-IV	3	1	-	4	100	50	150
3.	CT-590	Project	-	-	-	-	50	50	100
4.	CT-591	Seminar	2	-	-	2	-	100	100
		<b>Total</b>	<b>8</b>	<b>2</b>	<b>-</b>	<b>10</b>	<b>250</b>	<b>250</b>	<b>500</b>

**Elective-III**

**1.CT-513 Advance Structural Design and Detailing**

**2.CT-514 Composite Materials**

**Elective-IV**

**1.CT-515 Disaster Reduction and Management**

**2.CT-516 Construction Costing and Financial Management**

**IVth Semester**

Sr. No.	Subject Code	Title of the Subject	Teaching Load/Week			Total Hrs/week	Evaluation Marks		Total
			L	T	P/D		Theory	Sessional	
1.	CT-500	Dissertation	-	-	-		-		
					-				

- (i) Each theory paper examination will be of three hours duration.
- (ii) Seminars will be an independent study on the related topic and will be evaluated internally.
- (iii) Thesis will be evaluated by the external examiner and the internal guide. The candidate is required to make presentation of his thesis work and viva voce will be held.

**CT-501 CONSTRUCTION MANAGEMENT AND EQUIPMENT**

1. **ENGINEERING ECONOMY:** Principle of Engineering Economy, Minimum cost point analysis, Break even point analysis, Depreciation and depletion.

2. **SAFETY IN CONSTRUCTION:** Causes, classification, cost and measurement of an accident, safety programme for construction, protective equipment, accident report, safety measure:

(a) For storage and handling of building materials.

(b) Construction of elements of a building

(c) In demolition of buildings

Safety lacuna in Indian scenario.

3. **Construction Planning:** Need of construction planning, Constructional Resources, construction team, stages in construction, preparation of construction schedule, Job layout, inspection and quality control.

4. **GENERAL MANAGEMENT:** Introduction and characteristics of management, Principle and function of management, Scientific management.

5. **Materials Management:** Scope, Objective and functions of material management, Procurement and store management, Materials handling management, Inventory control and management. Disposal of Surplus Materials

6. **Earth Moving Equipment**

Crawler and wheel tractors their functions, types and specifications; Gradability Bull dozers and their use; tractor pulled scrapers, their sizes and output; effect of grade and rolling resistance on the output of tractor pulled scrapers Earth loaders; Placing and compacting earth fills.

Power shovels-functions, selection, sizes, shovel dimension and clearances, output, Draglines-functions, types sizes, output clamshells; Safe lifting capacities and working ranges cranes; Hoes, Trenching machine types and production rate calculation of producing rates of equipment ; examples.

7. **Hauling Equipment :**

Trucks; Bottom dump wagons; capacities of trucks and wagons Balancing the capacities of hauling units with the size excavator; effect of grade, rolling resistance and altitude on the cost/performance of hauling equipment; balancing excavating hauling equipment examples.

8. **Drilling, Blasting and Tunneling Equipment :**

Definition of terms, bits, Jackhammers, Drifters, wagon drills, che drills, piston drills, blast hole drills, shot drills, diamond drills, tunneling equipment, selecting the drilling method equipment; selecting drilling pattern; Rates for drilling rock, compressors.

9. **Pile Driving Equipment :**

Pile hammers, selecting a pile hammer, loss of energy due to impact, Energy losses due to causes other than impact.

**Books**

1. Construction equipment and its planning and application Dr. Mahesh Verma.

2. Construction Planning equipment and Methods by RL Peuripo Tata McGraw Hill.

3. Heavy construction planning equipment and methods -Jagman Singh Oxford and IBH.

4. Rock Engineering-Ry John A Franklin and Maurice B Dusseault, Tata McGraw Hill.

5. Mangement Machines and Methods in Civil Engineering-John, Christan, John Wiley and Sons.

6. Modern Construction Equipment and Methods.

Frank harris

John Wiley and Sons.

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**CT-502 CONCRETE CONSTRUCTION TECHNOLOGY**

L	T/P
2	4

1. Introduction of Concrete materials, Admixtures, Fly Ash, Polymers, Early Age Properties, Strength, Permeability & Durability.
2. Principles of Concrete mix design, Concrete Mix Design procedure by: IS/ACI/British Standards.
3. Concreting Operations-Practices and Equipment, Batching; Mixing; Transporting; Placing and Compacting; curing.
4. Properties and technique of construction for concrete, Fiber reinforced concrete, light weight concrete, Heavy weight concrete, Foam concrete, High performance Concrete.
5. Special concrete operations, shot Crete, grouting, Grunting, under water concreting, hot and cold weather concrete, pumpabale concrete.
6. Construction techniques for reinforced concrete elements-materials, Principles and procedures for beams, slabs, columns, Foundations, walls and tanks, design and fabrication of form work for R.C.C elements.
7. Prestressed concrete construction-Principle, methods, materials, Tools and equipment for the construction of a prestressed bridge.
8. Inspection and Quality Control of Concrete Construction-Stages, Principles, Checklist, Statistical Controls, procedures.

**Practical Exrecises:**

1. Testing of aggregates-fine and coarse as per BIS procedure.
2. Testing of cement with reference to IS specifications and Cement Grade.
3. Concrete Mix Design for desired grade from given materials.
4. a) Design and testing of workability of concrete for a given C.C. proportion.
- b) Design and determination of Cube Strength with given materials and proportions.
- c) Design of Concrete Mix proportions.
5. Study of effect of compaction of strength of concrete.
6. Study of effect of plasticixers on workability of concrete.
7. Study of permeability of concrete.
8. Conduct chemical analysis of hardened concrete to determine the cement content.
9. Inspection of a concrete construction site and preparation of report showing correct and incorrect practices.

**BOOKS RECOMMENDED:**

1. Concrete Technology by M.L. Gambhir
2. Concrete Technology, by Neville and Brooks
3. Properties of Concrete by Neville.
4. Concrete Microstructure, Properties and Materials  
P.K. Mehta and PJM Monteiro
5. Concrete Technology – M.S. Shetty.

CT-503 COMPUTATIONAL TECHNIQUES

L	T/P
3	1

1. Equations: Roots of Algebraic, Transcendental equations, Solution of linear simultaneous Equations by different methods using - Elimination, Inversion, Gauss - Jordan methods. Homogeneous Problems and Eigen Value Problems. Nonlinear Equations, Interpolation.
2. Finite Difference Technique : Initial and Boundary Value Problems of Ordinary and Partial differential equations, Solution of Various types of Plates.
3. New Marks Method : Solution of determinate and indeterminate Structures by using NewMark's Procedure.
4. Statistical Methods : Method of Correlation and Regression Analysis.
5. Initial Value Problems : Galerkin's Method of Least Square, Initial Value problem by Collocation points, Runga Kutta Method.
6. Newmark's Implicit and Explicit Solutions for Non Linear Problems and Convergence Criteria.

**Books Recommended:**

1. Numerical Methods, Problems, and Solutions by M.K. Jain, S.R.K.Iyenger, R.K. Jain
2. Numerical Methods by Dahlquist, G. and Bjorck, A.
3. Numerical Recipes in Fortran by W.H. Press, S.A. Tenkolsky, W.T. Vellerling, B.P. Flannery.
4. Computer Programming & Numerical Analysis, by Syal & Gupta

**CT-504-BUILDING PLANNING AND DESIGN**

L-3, T-1

The final paper shall be set out covering 20% marks from Section A, 40% marks from Section B and 40 % marks from Section C

**Section A-Architecture**

- 1) Land Acquisition Act 1894 ( short titles, extent & definitions ONLY)
- 2) Municipality act 1911 (short titles, extent & definitions only , Power of committee for making bylaws, for punishment ,to sanction)
- 3) Architectural Planning and Layout : Principles of planning a building, Factors affecting selection of site for building , Sun & the building

**Section B-SOIL**

Soil formation, particle size analysis, Indian Standard Soil Classification, time-settlement curve, Proctor test, compaction of sand, factors affecting compaction, field compaction methods, calculation of Bearing Capacity of soil by Standard Penetration Test, soil investigation report, types of shear failures, effect of water table on B.C., Settlement cases, calculation of B.C. by Plate Load Test.

Note: IS : 6403 is allowed in Exam

**Section –C Structure**

- 1) Earthquake: Hazardous effects on structures & Ground, General guidelines for earthquake resistance buildings. Liquefaction, factors affecting liquefaction & prevention,
- 2) Various Loading Conditions and Analysis of Multistoreyed Complex (Kani's Method for vertical loads and Portal Method for Lateral loads)
- 3) Structural Design of Beams, Columns, Slabs, Foundations and Stairs.
- 4) Structural Drawings

**Books Recommended:**

1. Soil Mechanics and Foundation Engg – Dr K R Arora – Standard Publishaers.
2. Building planning designing and scheduling – Gurcharan Singh
3. Construction equipment and its planning and application Dr. Mahesh Verma.
4. Construction Planning equipement and Methods by RL Peurify Tata McGraw Hill.
5. IS- 1888 (1978 ): Plate Load Test
6. IS – 6403 (1981): Bearing capacity of shallow Foundation

**CT-505 FOUNDATION DESIGN AND CONSTRUCTION**  
(Core Course)

1. General principle of foundation Design.

Functions of foundations, Essential requirements of a good foundation, Types of foundations, Principal modes of failure, Estimation of allowable bearing pressures, calculation of ultimate bearing capacity by theoretical and empirical methods : Terzaghi's Method, Skempton's analysis for clays, Mayerhof's analysis BIS Method (IS:6403) settlement of foundations, Factors to be considered in foundation design; Environmental considerations.

2. Shallow Foundations :

Introduction, Essential requirements Type and depth of footings, contact Pressure below footing strip footing, Isolated footing or Pad footing, Eccentrically loaded footings, Grillage foundations; Design features and construction details of combined footing, Strap footing or Cantilever footing Problem of frost heave, its causes and prevention effect of ground water Raft footing.

3. Pile Foundations :

Purpose/Uses of pile foundations, Classification of piles based on different criteria, Details of Timber, Concrete, Steel Piles their advantages and disadvantagesw selection of Pile Type, Pile action behaviour of pile and pile groups under load. Definition of failure load.

Estimation of carrying capacity : Single driven pile in cohesionless soils-methods based of on SPT and CPT, ultimate load on Driven and cast-in-place piles and Bored and cast-in place piles in cohesionless soils. Factors affecting pile capacity.

Ultimate capacity of single pile driven in cohesive soils. modification for driven and cast-in-place piles and Bored and Cast-in-place piles.

Carrying capacity of piles on rocks.

Piles in fills-negative skin friction.

Carrying capacity of Pile groups in cohesive soil and cohesionless soils, efficiency of pile group.

piles subjected to horizonatal or inclued loads.

4. Soil Stability.

Retaining walls-Types Elements for design, construction of cantilever and counterfort retaining walls.

Unbraced excavations, Braced excavations.

Sheet Piles and Bulkheads-Types and design of cantilever and Anchored sheet piles; Anchors and Tie backs.

Shorting and Underpinning-Necessity and methods.

5. Improvement of Foundation Soils.

Purpose:

a) Improvement of Granular Soils : Terms used to describe degree of compactness-Relative Density, Density Ratio and Degree of Compaction ;

Methods- Viobration at ground surface, factors influencing, roller compaction; Dep Dynamic Compaction, Vibro compaction, Impact at depth.

b) Improvement of Cohesive soils : Preloading or Dewatering, Methods of installing sand drains, drain wicks, Electrical and Thermal methods.

c) Grouting : Purpose, Functions Types of grouts; Soil Bentonite-cement mix, cement mix, emulsions, solutions : Grout Injection methods.



d) Geosynthetics : Types, Functions, Manufactureing of geotextiles, Classification of geotextiles.

Specific Applications : Bearing capacity improvement, Reinforcement, Retaining walls, Embankment etc. Testing of geosynthetics usage in India and a case study.

6. Special Considerations in Foundation Design and construction :

Elementary Principles of design and construction of foundations subjected to earthquake ordynamic loads Special measures for foundations constructed under water.

7. Practical Exercises :

1. Conduct of standard Penetration Test and estimation of bearing capacity.

2. Determination of shear strength characteristics by field tests like insitu vane shear test, pocket penetrometer etc.

3. Computation of bearing capacity and settlement for given conditions of soil depth and type of foundation and loading.

4. Recommend a field investigation programm to obtain design data.

5. Design of a shallow foundations.

6. Recommend suitable dimensions. depth and spacing of pile/pile group for given loading conditions.

#### References.

1. Tomlinson Mj. Foundation Design and Construction, ELBS Longman,6, 1996.
2. Bowles Joseph E, Foundation Analysis and Design, McGraw Hill, 4 e,1988.
3. Brahma, SP Roundation Engineering, Tata McGraw Hill 1985.
4. Koerner, Robert M, Construction and Geotechnical Methods in Foundation Engineering McGraw Hill, 1985.
5. Dinesh Mohan, Pile foundations, oxford & IBH,1998.
6. Kurian, N.P. Modern Foundations, Tata McGraw Hill, 1982.
7. Fang H.Y. Foundation Engineering Handbook, Van Nostrand Reinhold,2e,1991.
8. Kaniraj Shenbaga R, Design Aids in Soil Mechanics and Foundation Engineering, Tata McGraw Hill,1988.
9. Fleming etal, Pilling Engineering, Surrey Univ. Press/John Wiley and Sons,1985.
10. Chellis, Robert D, Pile Foundations, McGraw Hill, 1961.
11. Tomlinson MJ, PileDesign and Construction Practice,a view point Publication, 3e,1981.
12. Peck, Hanson, Thornburn, Foundation Engineering, wiley Eastern Ltd. 2e,1980.
13. Powers J Patrick, Construction Dewatering, John Wiley,1981.
14. CBRI Roorkee, Application Potential of Geosynthetics in Civil Engineering,Proceedings of Workshop Jan. 4-6,1989 Tata McGraw Hill.
15. Alam Singh & G.R. Chowdhry, Soil Engineering in Theory and practice, CBS Publishers, 2e, 1990.
16. Ramana et-al-soil sampling and Testing, TTTI, Chandigarh.

#### LIST OF B.I.S. CODES

Title	I.S.No.
1. Code of practice for design and construction of pile foundations : Part 1 Concrete Piles, Section	2911(Part-1-Section 1979)

- |     |  |                           |
|-----|--|---------------------------|
|     | Driven cast in-situ concrete piles<br>(first revision)(With Amendment No.2)  |                           |
| 2.  | Code of practice for design and<br>construction of pile foundations :<br>Part 1 concrete piles, Section 2<br>Bored cast-in-situ piles (first revision)<br>(With Amendment No.3)      | 2911(Part 1-Section 1979) |
| 3.  | Code of practice for design and<br>construction of pile foundations :<br>Part-1 concrete piles, Section 3<br>Driven precast concrete piles.<br>(first revision)(With Amendment No.3) | 2911(Part 1-Section 1979) |
| 4.  | Code of practice for design and<br>construction of pile foundations :<br>Part-1 concrete piles, Section 4<br>bored precast concrete pile(With<br>Amendment No.-1)                    | 2911(Part 1-Section 1984) |
| 5.  | Code of practice for design and<br>construction of pile foundations:<br>Part-4 Load test of piles (first<br>revision) (With Amendment No.1)  | 2911 (Part 4) 1985        |
| 6.  | Code of practice for design and<br>construction of pile foundations :<br>Part-2 Timber piles (first revision<br>(With Amendment No.-1)   | 2911(Part-2) 1980         |
| 7.  | Guide for lateral dynamic load<br>test on piles  | 9716:1981                 |
| 8.  | Guidelines for selection of ground<br>13094:1992 improvement techniques<br>for foundation in weak soils.   | 13094:1992                |
| 9.  | Glossary of terms for geosynthetics :<br>Part 1 Terms used in materials and properties   | 13321 (Part 1) : 1992     |
| 10. | Method of test for the determination<br>of tensile properties of extruded polymer<br>geogrids using the wide strip.  | 13325:1992                |
| 11. | Method of test for the evaluation<br>of interface friction between geosynthetics<br>and soil Part 1 modified direct shear technique  | 13326(Part 1) :1992       |
| 12. | Code of practice for design and construction<br>of foundations for transmission line towers and<br>poles (first revision)  | 1080:1986                 |
| 13. | Code of practice for design and<br>construction of foundations in<br>soils: general requirements<br>(third revision)   | 1904:1986                 |
| 14. | Code of practice for determination<br>of bearing capacity of shallow<br>foundations (first revision) (With<br>Amendment No.1)  | 6403:1981                 |

15. Code of practice for calculation of settlement of foundations : Part 1 8009(Part 1) ;1976

**CT-506 MAINTENANCE OF BUILDING STRUCTURES :**

L	T/P
3	1

UNIT-I

1. Principles of Maintenance : Importance of Maintenance, Deterioration and durability, Factors affecting decision to carryout maintenance, Maintenance and GNP Agencies causing deterioration, effect of deterioration agencies on materials.

2. Design and economic consideration in Maintenance :

Factors to reduce maintenance at design stage, Consideration of maintenance aspects in preparing tender document and specifications, Sources of error in design which enhances maintenance, Importance of working drawings and schedules Provision of access for maintenance and its importance at design stage.

Economic consideration in Maintenance: Physical life, Functional life, Economic life of different types of buildings, Discounting technique for assessment of economic life.

3. Maintenance Management :

Definition, Organisation structure, work force for Maintenance, Communication needs, Building inspections, Maintenance budget and estimates, Property inspections and reports, Specification for maintenance jobs, Health and safety in maintenance, Quality in Maintenance, maintenance Manual and their importance.

4. Materials for maintenance :

Compatibility of repair materials, Durability and maintenance. Types of materials, their specification and application, Criteria for selection of material, Use of Commercial available materials in maintenance.

5. Investigation and diagnosis for Repair of structures :

Basic Approach to investigations, Physical inspection, Material Tests, Non destructive testing for diagnosis, Estimation of actual, loads and environmental effects, Study of design and construction practices used in original construction, Retrospective analysis, Confirmation and repair steps.

6. Building Defects and Remedial Measures :

6.1 Nature, types of problems, their causes, remedial measures and special treatment for building elements.

- Foundation,
- Basements
- D.P.C.
- Walls
- Wall finishes
- Chimney, stacks and shafts
- Columns and beams
- Roof and roof terraces
- Floor and floor finishes
- Joinery work
- Decorative/decorative finishes
- Services
- Materials
- Dampness

Unit -II

1. Acoustics :

Basic problems criteria and terminology, Transmission of sources in rooms, speech privacy between offices, co-efficient of source absorption, noise reduction co-efficient, classification selection of accoustical materials, design and installation of accoustical Treatment for of auditorium, schools religion buildings.

2. Air Conditioning Heating and Ventilation :

Different types of heating equipment viz radiation converters, electric radiant panel heaters, requirements comfort conditions, temperature control, humidity control Mechanical ventilation plenum system, exhaust system fans, airfilters of different types, air conditioning plants layout of ducts for cinema auditoriums and offices etc.

3. Fire Fighting :

Fire regultions and requirements, cause of fire, fire resistance of materials, fire tests, fire-resistance of elements, layout excape means for Multi storeyed buildings, Fire Training equipment different methods of fire fighting fire protection.

4. Electrical Services :

General distribution of electric power : Sub-stations for small schemes and industrial units, meter-roms, electrical instllations in buildings, Fuses and Circuit breakers, various types of conduits, earthing, switches and outlet, lamp holder electrical wiring -different materials employed specifications, electrical appliances and electrical service bye-laws pertianing to electrical installations. Different types of artificial lighting systems, lighting systems for residential buildings, public buildings, hotels, cinemas, hospitale exhibition, halls, libraries, schools, college, scientific laboratories etc.

5. Lifts and Escalators :

Classification types of lifts, lift codes and rules.Traffic analysis and selection of lifts, Quantity of service, Quality service, Car speed. Provision form fire safety Angle Arrangements of lifts, Details of information to be given to manufacturers, Escalators, Types and their installation.

Reference Books :

1. IVOR H. Seeley, Building Technology Mac Millian.
2. Chudley, Building Finishes, fittings and domestic sercie longman, Scientific and Technical.
3. Fred Hall,Building Services & Equipment ,Longman Scientific and Technical.
4. Lee Smith, Harry Slecter, Plumbing Technology, Design and installation Delmar Publisher INC.
5. Fred Hall, Plumbing Cold water supplies, Drainage and Sanitation, Longman Scientific & Technical.
6. Roger Greeno, Building Services, Technology and Design, Longman.
7. Norbert Lechner, Heating Cooling, Lighting John Wiley & Sons.
8. Maintenance of Buildings  
A.C. Panchadari New age international (P) limited Publishers
9. Building finishes, fittings and demestic services R.Chudley.
10. Foundation Failures  
G. SZECHY, D.Sc. Concrete Publcations limited 14 Dartmouth street london.
11. Building Construction materials and types of construction WHITNEY CLARK HUNTINGTON PROBERT E. MICKADEIT Allan Hancock College.
12. Common Defects in Buildings

- H.J.Eidridge, Her Majesty's Stationery Office, London
13. Building Failures : Diagnosis and Avoidance  
W.H. Ransom
  14. Housing defects reference Manual  
The Building Research Establishment E & F.N.SPON
  15. Appraising building defects : Properties on stability and hygro-thermal performances,  
Geoffrey K.Cook  
Dr. A John Hinks Longman Scientific & Technical.
  16. Repair of Concrete damaged by reinforcement Corrosion Report of working party.  
The concrete society
  17. The maintenance and adaption of buildings R Chudley Longman Technical Services.
  18. Common building defects - Diagnosis & Remedy  
Compiled by National Building Agency
  19. Maintenance and Repair of Buildings and their internal environment  
B.D.HUTCHINSON.  
J.Barton.  
N.Ellis.
  20. Maintenance of Buildings  
A.C. Panchdheri

**CT-507 COMPUTER AIDED DESIGN METHODS**

L -3, T -1

1. Introduction to CAD and its scope simple description of computer hardware.
  - Micro, mini etc.
  - memory, processor
  - Peripheral devices-disks, printer. Video terminals. Graphic floater, graphic screen digitizer.
2. Computer Graphics: introduction, point plotting techniques, line drawing displays, two-three dimensional transformation, clipping and windowing, segmentation geometric modeling. Three dimensional graphics, curves and surfaces, hidden surface elimination, shading. Graphic input devices. Graphic input technique, input functions. Raster graphic fundamentals, interactive raster graphics, raster graphic systems.
3. Computer aided linkage displays and synthesis, interactive acceleration analysis. Appreciation of graphic packages.
4. Matrix methods of structural analysis and associated computer programme assembly of matrices. Solution of equilibrium equations. Flow charts. Typical listing as illustrations. Introduction to interactive computer programme for the design detailing of simple structural elements: RCC slab, beams, columns, isolated footings etc. Steel typical members and connections.
5. Data base management , storing and retrieving of data

**References:**

1. Principles of interactive computer graphics by William M. Newman & Robert F.Sproul.
2. Programming in Finite Element by Hunton and owan
3. Principles of Computer Aided design by Joe Rooney & Philips Steadman
4. Computer Fundamentals-P.K.Sinha, BPB Publications
5. CAD/CAM-Mikell T.Groover.

**CT-508 BUILDING COST AND QUALITY MANAGEMENT**

L	T
3	1

1. Estimation of quantities for R.C.C. multistoreyed complex viz. earthwork, concrete in foundation, D.P.C., R.C.C. work, flooring and roofing, plastering and pointing etc., wood work, white washing.
2. Analysis of rates for multistoreyed building works – Brick work in foundations and Superstructure, cement concrete, R.C. C., Plastering, Flooring, Timber work etc.
3. Checking of construction quality – various tests for bricks, cement, concrete, aggregates, and steel as per IS codes.
4. Preparation of bills for payment, measurement book, mode of payment, running account bill. Ledger and Cash book details, Arbitration.
5. Estimation of building services viz. water supply works, electrification, sanitary fitting etc, and their cost analysis.
6. Completion report of the project; Checking of Plan, Details of various works, and issue of completion report of the project.

**Instructions to the Examiner:** Total eight questions are to be set out of which the students are required to attempt any five questions.

**BOOKS RECOMMENDED**

1. Estimating and Costing by B.N. Dutta
2. Estimating and Costing by G.S. Birdie
3. Estimating and Costing by Chakaraborty

**CT-509 ENVIRONMENTAL ENGINEERING & MANAGEMENT**  
(Elective Course)

L     T/P  
3     1

1.     **Environement & Ecology :**  
Definition and understanding of concepts. Ecosystem, Energy folw in ecosystem, water, carbon and nitrogen cycle community's inter-relationships in and ecosystem.
2.     **Type of Pollutants and Protection of Environment :**
  - 2.1     **Environmental Protection**  
Importance of clean Environment, Control of Enviroment pollution w.r.t. air, land and water.
  - 2.2.     **Water polloution :**  
Sources, causes and measurment of water pollution surface water and underground water, water Quality criteria for various uses of fresh water, river basis studies for surface water pullution control biochemical oxygen demand, effect of oxygen demanding wastes on rivers.
  - 2.3     **Domestic and industrial wastes :**  
Sources, standards for disposal of waste water Industrial effluents, Basic unit operation incontrol of waste water pollution, design features for treatment for disposal of sewage effluents ; guidelines of CPCB for abatement of industrial pollution technilogies for control of water pollution from industries.
  - 2.4     **Air and Noise pollution :**  
definition Principle materials causing pollutiontypes of air contaminants. their sources and effects on living and nonliving materials permissible limits. Air pollution control-Basis preinciples, natural self cleansing,pollution control methods and various engineering devices to control particulate and gaseous pollutants, controlling and pollution from automobiles.  
**Noise Pollution :**  
Definition,sources of noise and its units, adverse effects of noise pollution, sound pressure level and its measurement, octave hand and its importance; noise pollution control measures.
3.     **Land damage due to Mining : Open cast mining and its ill effects, Environmental protection practices in Mining and Environment Management Plans.**
4.     **City and Housing Environment :**  
Introduction, stage of Housing/city environment, Environmental consideration in town-planning, Measures for improving city environment.
5.     **Current issues in Environmental Engineering :**  
Global warming Ozone depletion, Acid Rain, Oil pollution, Radiation Hazard and control,Role of non-convention sources of energy in environment.
6.     **Acts/Legislation Provisions :**  
Need for laws various acts, Rules and notifications. Salient features of various acts : The water (Prevention and Controlof pollution) Act 1974. The water (prevention and Control of pollution) Cess Act, 1977. Air (Prevention and control of Pollution) Act 1981. The Environment (Protection) Act 1986,The Public liability insurance Act, 1991. The forest Act 1927, The wild life (Protection) Act 1927, The Forest (Conservation) Act,11980, various other Rules and notification for control of pollution.
7.     **Environmental Impact Assessment :**  
Definition and its importance for Environment Management, Constitutents of Environment Impact Assessment Report, Steps involved in preparing EIA,EIA methodologies Projects under EIA,



Environment Impact Statment, Constraint in implementation of EIA. Impact prediction water, Resources Projects and other relevant case studies.

9. Application of Biotechnology for Environmental Mangement :

Basic concepts and techniques, Application for industrial effluent : Solid waste management, Bio-fertilizers and Bio-pesticides; Plant tissue culture in forestry. Bio safety aspects, Bio-remedials.

**Laboratory Work/Field Tasks :**

1. Testing of water for various parameters such as pH, DO, conductivity.
2. Determination of BOD for Domestic Waste/Industrial Waste.
3. Determination of MPN of given sample.
4. Air sampling to particulate matter and other gaseous contaminants.
5. Determination of concentration of Metallic pollutants by using Atomic Absorption spectrometer.
6. Monitoring of vehicular pollution emission.
7. Determination of noise levels for indoor and outdoor noise levels.
8. Visit and submission of Report for treatment of waste water plant of any industry.

**REFERENCE BOOKS :**

1. Peavy, Rowe, Tchobanoglous, Environmental Engg. MacGrawHill.
2. Mackenzie L Davis, Environmental Engg. Tata MacGrawHill.
3. Baljeet Kapors Environmental Engg. An overview, Publishers.
4. Gilbert H. Msters, Environmental Engineering and Sc Prentice Hall of India Pvt. Ltd.
5. GN Panday, GC Carney Environmental Engineering MacGrawHill.
6. P.D. Sharma , Ecology and Environment Rastogi Publication.
7. Ray P.A. Lcances Environmental Impact Assesment Hand National Environmental Protection Council, Manile.

**CT-510 BRIDGE ENGINEERING**

(Elective Course)

L	T
3	1

1. **Introduction:** Definition and components of a bridge, Classification of bridges, Choice of a bridge type.
2. **Investigation for Bridges:** Need for investigation, Selection of bridge site, Determination of design discharge for river bridge, Linear waterway, Economical span, Vertical clearance, Scour depth, Afflux, Traffic projection.
3. **Standard Specifications for Road Bridges:** Indian Road Congress Bridge Code, Width of carriageway, Clearances, Loads to be considered; Dead load, I.R.C. standard live loads, Impact effect, Application of Live load on decks, Wind load, Longitudinal forces, Centrifugal forces, Horizontal forces due to water current, Buoyancy effect, Earth pressure, Deformation stresses, Erection stresses, Temperature effects, and Seismic force.
4. **Reinforced Concrete Bridges:** General, Types of bridges; Balanced cantilever bridges, Continuous girder bridges, Rigid frame bridges, Portal Frame and Arch bridges. Detailed design of solid slab and T-beam bridges,
5. **Steel Bridges:** General, Type of Steel bridges; Plate girder bridges, Box girder bridges, Truss bridges, Cantilever bridges, Cable stayed bridges, and Suspension bridges.
6. **Sub-structure and Foundation :** Design of piers and abutments (Masonry & R.C.C.). Types of foundations; Shallow, Pile, and Well foundations including their construction details.
7. **Bearings & Appurtenances:** Different types of bearings, joints and handrails.
8. **Construction and Maintenance of Bridges:** Methods of construction of concrete bridges. Causes of Bridge failures, Inspection and maintenance.

**Instructions to the Examiner:** Total eight questions are to be set, covering the complete syllabus, out of which, the students are required to attempt any five questions.

**BOOKS RECOMMENDED**

1. Essentials of Bridge Engineering by Johnson Victor.
2. A text book of bridge Construction by Khadilkar.
3. Bridge Engg. by Rangwala.
4. Concrete Bridge Design SP-23 (ACI Publication)
5. Concrete bridges Handbook by Raina.
6. Bridge Engineering by S. Ponnuswamy
7. Bridge Engineering by Rakshit

**CT-511 RURAL CONSTRUCTION TECHNOLOGY**

(Elective Course)

1. Rural Development Planning and Concept of Appropriate Technology.  
Scope, Development Plans; Various approaches to rural development planning Concept of Appropriate technology; Role of Civil Engineering in Rural Development; Organizational structures & management rural development programmes/projects.
2. Rural Housing :  
Low cost construction materials for housing low cost housing designs-architectural considerations for individual and group housing ; composite material-ferrocement & flay ash, Autoclaved Calcium silicate bricks and soil-stabilized unburnt brick; Plinth protection of Mud Walls; Design Consideration and Construction of: Non-erodable Mud Plaster, water-proof and fire-retardent roof treatment for thatch roofs, Precast stone Masonry Block walling scheme; rat-trap bond for walls; Prefab Brick Panels for roof, ferrocement flooring /roofing units, Thin R.C.Ribbed slab fon floors & roofs, Precast R.C. Channel Unit for flooring/roofing scheme, Precast R.C. cored unit for flooring/roofing scheme, Precast R.C. Plank flooring/roofing scheme, L-Pan roofing scheme; Glued Plywood Web Beams and Roof Panels; manual & Power Scaffold hoist, lifting device for prefab components; solar passive building design; Building economics and management.
3. Wate Supply and Rural Sanitation :  
Epidemiology sources of water, BIS & WHO wate standards. Quality, Storage and distribution for rural water supply works; Basic Design principles of treatment-Low Cost water treatment technologies; Handpumps-types, installation operation, and maintenance of Mark-II hand pumpsp; Conservation of wate; Rainwater, Harvesting; Drainage in rural areas, Design of low cost waste disposal systems; Design and constructions of low cost latrines: 2 pit pour flush wate seal VIP latrines, septic tank etc; Biogas technology: Low cost community & individual Garbage disposal systems, Recycling of organic/agricultural wastes: Development of village ponds; ferrocement water storage tanks & latrines. Cattle shed management; Sewage farming-standards for disposal and use for irrigation.
4. Low Cost Roads and Transport :  
Low cost pavement materials-testing suitability criteria processing materials; factors affecting pavement thickness & composition of various layers; CRR I Design for rural roads-Traffic Index, strength Index,CBR curve Intermediate Technology & Technology options for specify areas.Labour intensive techniques of road construction Mechanical stabilization; lime stabilization; water bou Macadam Construction; urilization of wastein rural construction one/two coat surface dressing;bitumine premix carpet; low cost improved transport system rural areas.
5. Low Cost irrigation :  
Design & Constructionof Tubewell, Drip & Sprink irrigation systems; Water logging Reclamation land watershed and catchement area development-problem and features of watershed Management ManagementPlans watershed structures and their basic design catchment treatment and Rehabilitation Plans; Types of M Hydel Plants, site selection, Advantages of Mini & Mi Hydel projects, structures required for plants.
  - i) Field visits to any 3-4 of the following to arranged and prepare the reprot of the visit.
    - CBRI Rookee UP.
    - CDC, Govt. Polytechnic, Sundernagar,HP.
    - CDC,Thapar Polytechnic, Patials,Pb.
    - Bunga villages and Sukhomajri Villages (HR).
    - Central Soil-water Management Research and Trail. Institute, Sector 27, Chandigarh. UT.
    - Central Road Research Institute (CRR I), Mathura Delhi, UT.

- SERC, Gaziabad UP
- Villages around Chandigarh.
- ii) Drawing and Design Exercises on the following to be done.
  - Rural Housing ;
  - Water supply project (Safe drinking water treatment, storage and distribution scheme.
  - Rural Latrines.
  - X-sections of Rural Roads.
  - Methods of Irrigation and water shed Projects.
- iii) Laboratories :
  - Testing of construction materials for Housing.
  - Testing of construction materials for Roads.
  - Testing of construction materials for Ferrocement.

**Reference Books :**

1. A.G.Madhov Rao, D.S. Ramachandra Murthy, Apprority Technologies for low cost Housing oxford and IBH Pblishing Co. Pvt. Ltd.
2. CBRI, Roorkee Advances in building Materials Construction.
3. C.Satyanarayan Murthy, Design of Minor Irrigation and Canal Structures, Wiley Eastern Ltd.
4. K.Park Preventive and Social Medicine, M/s banarsi Bhnot.
5. yash Pal Bedi, A Hnad Book of Preventive and Soc Medicine; Atam Ram & Sons, Delhi.
6. Document on Rural Road Development in India Volume Central Road Research Institute, New Delhi.
7. SB Watt, Ferrocement water tanks and their construction Intermediate Technology publications Ltd, London.
8. Ariane Van Bureu, A Chinese Biogas Manual Publications ,London.
9. KC Khandelwal and SS Mahdi, biogas Technology-A Practice Handbook, Volume 1+2. Tata McGraw Hil Publishing Com Ltd. New Delhi.
10. GB Rai, Non-Conventional Energy Sources, Khanna Publisher New Delhi.
11. Biogas Slurry utilisation ; Consortium on Rural Technology (CORT), New Delhi.
12. Sandy Cahircross and Richard G Feachen Environmental He Engineering in the topics ; John Wiley U Sons, New York.
13. Bindeshwas Pathak, Sulabh Shauchalays-Hand Flush Water Latrine; Sulabh Internationa, Patna.
14. Bindeshwas Pathak. Sulabh Shauchalaya-Astudy of Direct Chough: Sulabh International; Gandhi Marg, Patna.
15. Ettler + Steel Muncipal & Rural Sanitation, McGraw Book Inc. Company N.York.

**CT-512 PAVEMENT DESIGN, CONSTRUCTION AND MAINTENANCE**

(Elective Course)

L	T/P
3	2

1. **Introduction:** Types of pavement structure. Functions of pavement components, Factors affecting pavement design. Design wheel load, Strength characteristics of pavement materials.
2. **Design of Flexible Pavements:** General design considerations, Methods for design of flexible pavements; Group Index method, California Bearing Ratio (CBR) method, California Resistance Value method, Triaxial Test method, Burmister method, McLeod's method.
3. **Design of Rigid Pavements:** General design considerations, Methods for design of rigid pavements; Westergard's method, F.A.A. method, IRC recommendations for design of concrete pavements, method, Types of joints and their design in cement concrete pavements. Thickness design for Airport pavement, LCN system of pavement design, design of airport pavement overlays.
4. **Highway Construction :** Types of highway construction and their selection, materials for construction, construction procedure of different highways: Earth roads, Gravel roads, WBM roads, Bituminous pavements, Cement concrete pavements, Low cost roads, Introduction to various equipment used for highway construction.
5. **Highway Maintenance:** Need for highway maintenance, Pavement failures their causes and remedial measures. Typical flexible and rigid pavement failures, Types of highway maintenance: Routine, periodic and special type, materials used for maintenance of different pavements, Strengthening of existing pavements, Maintenance management system.

**Practical Exercises :**

- i) Determination of CBR value of subgrade soils.
- ii) Determination of Ductility of bituminous materials.
- iii) Determination of Stripping value of road aggregate.
- iv) Determination of Marshall stability value of bituminous mix.
- v) Field visit for study of Batching and Mixing plant for bituminous construction of roads.

**Instructions to the Examiner:** Total eight questions are to be set, covering the complete syllabus, out of which, the students are required to attempt any five questions.

**BOOKS RECOMMENDED**

1. Principals of Pavement Design by E.J. Yoder
2. Highway Engineering by Khanna and Justo
3. Principles, Practice and Design of Highway Engineering by S.K. Sharma
4. Handbook of Road Technology by M.G. Lay
5. Pavement Analysis and Design by Yang and Huang
6. The Design and Performance of Road Pavements by D. Croney and P. Croney
7. Planning and Design of Airports by Horenjeff

**CT-513 ADVANCED STRUCTURAL DESIGN AND DETAILING**

(Elective Course)

L	T/P
3	1

1. Introduction Introduction to limit state method of design, provisions in the Indian standard codes for loading wind loads and seismic loads, design and detailing of concrete structures.
2. BIS Handbook for design, Examples of design using handbook.
3. Design of Structures as per I.S. 1893 for Earthquake Resistant Design Construction.
4. Design and Detailing Requirements as per 4326-1993.
5. Design and Detailing of Earthen Buildings as per 13827-1993.
6. Design and Detailing of Masonry Structures as per I.S. 13828-1993
7. Design and Ductile Detailing of R.C.C. Structures as per I.S. 13920-1993
8. Repair and Seismic Strengthening of Buildings as per I.S. 13935-1993.

**Books**

1. Dayaratnam, P. Reinforced Concrete Structure
2. Jain, A.K. Reinforced Concrete, Limit State Method of Design.
3. Punmia, B.C. Reinforced Concrete Structures, Vol II
4. Jain and jaikrishna Plain and Reinforced Concrete Vol II.
5. Design of Steel Structures by P.Dayaratnam
6. Design of Steel Structures by S.K. Duggal
7. B.I.S. Codes 1893, 4326, 13827, 13828, 13920, 13935

**CT 514-COMPOSITE MATERIALS**  
**(Elective Course)**

1. **FIBRE REINFORCED CONCRETE** : Properties of Constituent Materials, Mix Proportions, Mixing and Casting Procedures, Properties of Freshly mixed FRC, Mechanics and properties of Fibre reinforced concrete, Composite Material approach, Application of fibre reinforced concrete.
2. **FLY ASH CONCRETE** : Classification of Indian Flyashes, Properties of Flyash, Reaction Mechanism, Proportioning of Flyash concretes, Properties of Flyash concrete in fresh and hardened state, Durability of flyash concrete.
3. **POLYMER CONCRETE** : Terminology used in polymer concrete, Properties of constituent materials, Polymer impregnated concrete, Polymer modified concrete, Properties and applications of polymer concrete and polymer impregnated concrete.
4. **FERRO CEMENT** : Constituent materials and their properties, Mechanical properties of ferro cement, Construction techniques and application of ferro cement.
5. **HIGH PERFORMANCE CONCRETE** : Materials for high performance concrete, Supplementary cementing materials, Properties and durability of high performance concrete, Introduction to silica fume concrete, Properties and applications of silica fume concrete.
6. **SULPHUR CONCRETE AND SULPHUR INFILTRATED CONCRETE** : Process technology, Mechanical properties, Durability and applications of sulphur concrete, Sulphur infiltrated concrete, Infiltration techniques, Mechanical properties, Durability and applications of sulphur infiltrated concrete.
7. **LIGHT WEIGHT CONCRETE** : Properties of light weight concretes, Pumice concrete, Aerated cement mortars, No fines concrete, Design and applications of light weight concrete.

**Books Recommended:**

1. Concrete, its Properties and Microstructure by P.K. Mehta, and P.J.M. Monteiro.
2. Ferrocement by B.K. Paul, and R.P. Pama
3. Fibre Reinforced Concrete by Bentur and Mindess
4. Flyash in Concrete by Malhotra and Ramezaniyanpour

**CT-515 DISASTER REDUCTION AND MANAGEMENT**

**1. Disaster Reduction**

Earthquake resistant design of structures, Response spectra and design earthquake parameters, Principles and philosophies, Codal provisions, Factors affecting damage to structures, Enforcement of codal provisions, Strong motion instrumentation and data processing, Effective rescue operation, General planning and design aspects, Conventional earthquake resistant design, Seismic base isolation method, retrofitting, Training and lecturing at various levels, Preparedness to meet earthquake disaster, Programmes for public awareness, demonstrations and exhibitions, Information management (Safety, emergencies, management and planning, design, response, user experience problems and case studies), Proper land use practices, long term disaster preparedness measures.

Precautions after a major earthquake, Preparedness for medical supply Emergency care ( First aid, Home remedies), Disposal of dead bodies (Human and Cattle) , Care for old and orphans.

**2. Indirect Damages**

Damage due to ground failures, Landslides, rockslides, liquefaction, fire, floods, tsunamis, release of hazardous material like poisonous gas, nuclear radiation.

**3. Disaster Management**

Management cell, Central crisis management core group, damage reconnaissance, Management of relief and rehabilitation ( Infrastructure rehabilitation, Housing rehabilitation, Social rehabilitation ), Role of volunteers, Emergency operation centres, Information system, Danger zone restrictions, Cooperation with local authority, Coordination for international relief, Role of government, NGO's, Bussiness and donors, Role of remote sensing in relief operations, Information management and related technologies in engineering and disaster management.

The design and management of Disaster Information Resource Network, Asian Disaster Preparedness Centre, Regional data base, Contacts and Sources, CD - ROM Library for Natural Disaster Management, Regional Disaster Documentation Centre, Non Governmental Organisations.

**Books Recommended:**

1. Disaster Mitigation Experiences & Reflectios by Pardeep Sahni, Alka Dhameja, and Uma Medury.
2. Disaster Management Report by Department of Agriculture and Cooperation, Govt. of India.



**CT-516 CONSTRUCTION COSTING AND FINANCIAL MANAGEMENT**

(Elective Course)

1. Construction Costing : Costing of construction Works, different methods of costing, cost elements in a project, Analysis of rates, Non-scheduled items of work, Cost estimation for a small construction job, Purpose, methods and stages of cost control, cost monitoring, cost forecasting methods, variations in individual items of work and their effect on total contract price, valuation of variations.
2. Cash flow: Determining the funds required for a construction job, preparing cash flow statements, Cash inflow and outflow during contract period, Project expectations and performance models.
3. Cash and payment of works; Precautions in custody of cash, imprest account and temporary advance, Maintenance of temporary advance and advance account, different types of payment, first running advance and final payments.
4. Material Management : Objectives and scope of material management classification, codification, ABC analysis, standardization and substitution, Introduction to inventory control, Stores management organization and lay out, receipt, inspection and issue, care and safety, store records and store accounting.
5. Financial Management : Meaning and scope financial statement analysis, funds flow analysis, Capital budgeting, cost benefit analysis.

**Practical Exercise ;**

- i) Filling up of prescribed treasury challan form and imprest account form with given data.
- ii) Preparation of cash flow statement for a small construction project with given data.
- iii) Filing up of Daily labour report on prescribed form with given data.
- iv) Recording measurement in M.B. for different work components.
- v) Preparation of analysis of rates for different items of work.
- vi) Preparation of cost estimates for a small project.
- vii) Material statement and material analysis.
- viii) Carry out financial statement analysis, ratio analysis and funds flow analysis for projects from given case studies.

**Books :**

- i) Mueller, F.W. Integrated cost and schedule control for construction projects.
- ii) Gobourne: Cost control in the construction industry.
- iii) Schedule of rates, specification manuals etc from PWD.
- iv) Chris hendrickson and Tung Au: project Management for construction.
- v) Datta: material Management procedures, Text and Cases, 2e. Prentice Hall
- vi) Gopalakrishanan, P, Sundaresan, M Material Management- an Integrated Approach, Prentice Hall
- vii) Dobbler and Bart: Purchasing and supplies Management, Text and Cases, 6e.
- viii) Chitkara, K.K. Construction Project Mangement, Tata-McGraw Hill.