

**M.Tech. in CIVIL ENGINEERING (ADVANCED CONSTRUCTION
TECHNOLOGY)**

CURRICULUM AND SYLLABUS

(Effect from the Academic Year 2007 – 08)

PONDICHERRY UNIVERSITY

PUDUCHERRY – 605014.

M.TECH IN CIVIL ENGINEERING (ADVANCED CONSTRUCTION TECHNOLOGY)

COURSE CURRICULUM AND SCHEME OF EXAMINATION

(Minimum Credit Requirement for the completion of the Programme: 72)

ELIGIBILITY :

M.Tech. in Civil Engineering (Advanced Construction Technology): Candidates for admission to the first semester of the four semester M.Tech. Course in Civil Engineering with specialisation in Advanced Construction Technology should have passed B.E/B.Tech in Civil Engineering (or) an examination of any University or Authority accepted by the Pondicherry University as equivalent thereto, with at least 55% marks in the degree examination or equivalent CGPA.

SEMESTER – I

Sl. No	Code	Subject	Hours / Week			Credits	Evaluation (marks)		
			L	T	P		Internal	External	Total
1.	CE 901	Modern Materials of Construction	3	1	0	4	40	60	100
2.	CE 902	Construction Methods and Equipment	3	1	0	4	40	60	100
3.	CE 903	Construction Management	3	1	0	4	40	60	100
4.	CE 904	Project Formulation and Appraisal	3	1	0	4	40	60	100
5.		Elective – I	3	0	0	3	40	60	100
6.	CE 907	Computing Techniques Laboratory	1	0	3	2	50	50	100
						21	250	350	600

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SEMESTER – II

Sl. No	Code	Subject	Hours / Week			Credits	Evaluation (marks)		
			L	T	P		Internal	External	Total
1.	CE 905	Contract Laws and Regulations	3	1	0	4	40	60	100
2.	CE 906	Safety Practices in Construction	3	1	0	4	40	60	100
3.		Elective – II	3	0	0	3	40	60	100
4.		Elective – III	3	0	0	3	40	60	100

5.		Elective –IV	3	0	0	3	40	60	100
6.		Elective – V	3	0	0	3	40	60	100
7.	CE 908	Seminar	0	0	3	2	100		100
						22	340	360	700

SEMESTER – III

Sl. No.	Code	Subject	Hours / Week			Credits	Evaluation (marks)		
			L	T	P		Internal	External	Total
1.		Elective – VI	3	0	0	3	40	60	100
2.		Elective – VII	3	0	0	3	40	60	100
3.	CE 961	Directed Study	0	0	6	3	100	---	100
4.	CE 909	Dissertation Project (Phase I)	0	0	24	8	200	100	300
						17	380	220	600

SEMESTER – IV

Sl. No.	Code	Subject	Hours / Week			Credits	Evaluation (marks)		
			L	T	P		Internal	External	Total
1.	CE 910	Dissertation Project (Phase II)	0	0	36	12	250	150	400
						12	250	150	400

LIST OF ELECTIVE SUBJECTS

CE921	Acoustics, Lighting and Ventilation Engineering
CE922	Advanced Bridge Construction Engineering
CE923	Composite Construction Methods
CE924	Deterioration Processes in Reinforced Concrete
CE925	Energy Conservation Techniques in Building Construction
CE926	Environmental Impact Assessment
CE927	Highway Construction Methods
CE928	Information Technology for Construction Engineering
CE929	Maintenance and Rehabilitation of Structures
CE930	Prefabrication and Construction Techniques
CE931	Quality Control and Quality Assurance in Construction
CE932	Resource Management and Control in Construction
CE933	Scaffolding and Formworks for Construction
CE934	Structural Appraisal and Evaluation Engineering

CE 901 MODERN MATERIALS OF CONSTRUCTION

Unit – I

Properties and specifications of concrete making material – cement – aggregates. Properties of fresh concrete. Modern techniques in handling- compacting and curing concretes – Properties of hardened concrete- mechanical properties and durability aspects.

Unit-II

Additives and admixtures of concrete. Hot and cold weather concreting – materials and methods underwater concreting: materials and methods - mass concrete - high strength and high performance concretes - Polymer concrete composites- fibre reinforced concrete- GFRP- Ready mixed concrete.

Unit-III

Use of waste products and industrial by-products in concrete making- Appropriate building materials – Geo-textiles and geo-synthetics – applications in Civil Engineering

Unit-IV

Thermal insulation and acoustic absorption materials- Water proofing materials and compounds- Flooring materials.

Unit-V

Concrete mix design- basic consideration-influencing factors. Mix design of concrete by IS, BS and ACI methods.

REFERENCES:

1. Neville, A.M., Properties of concrete, Pearson Education Asia (P) Ltd, England, 2000.
2. Mehta, P.K and Monteiro. P.J., Concrete- Microstructure, Properties and Materials, ICI, 1997.
3. Jackson, N., Civil Engineering Materials, Elsevier, 1983.
4. Diamant, R.M.E., Thermal and Acoustic Insulation, Butterworths, 1986.
5. Vedhikizhen Van Zanten, R., (Ed), Geotextiles and Geomembranes in Civil Engineering.
6. Koerner, R.M., Construction and Geotechnical Methods in Foundation Engineering, McGraw Hill Co., 1985.
7. Rosen, H.J., Construction Materials for Architecture, John Wiley, 1985.
8. Flinn, R.A and Trojan, P.K., Engineering Materials and their Applications, Jaico Publications House, Delhi, 1999.

CE 902 CONSTRUCTION METHODS AND EQUIPMENT

UNIT-I

Modern Construction Methods: Open excavation, shafts and tunnels, pile, pier and caisson foundations. Basement construction – construction methods - supporting the excavations – control of ground water - shoring and underpinning – basement waterproofing.

UNIT-II

Construction Method for: Bridges, roads, railways, dams, harbours, river works and pipelines.

UNIT-III

Construction equipment and techniques for: Earth moving, excavating, drilling, blasting, tunneling and hoisting and erection.

UNIT-IV

Equipment for: Dredging, tunneling, dewatering. Equipment for Flooring-dewatering and floors finishing.

UNIT-V

Equipment for production of aggregate and concrete: Crushers – feeders – screening equipment – batching and mixing equipment – hauling, pouring and pumping equipment – transporters.

REFERENCES:

1. Antil J.M., Civil Engineering Construction, McGraw Hill Book Co., 1982.
2. Peurifoy, R.L., Ledbette. W.B., Construction Planning, Equipment and Methods, McGraw Hill Co., 2000.
3. Ratay, R.T., Hand Book of Temporary Structures in Construction, McGraw Hill, 1984.
4. Koerner, R.M., Construction & Geotechnical Methods in Foundation Engineering, McGraw Hill, 1984.
5. Varma, M., Construction Equipment and its Planning & Applications, Metropolitan Book Co., 1979.
6. Smith, R.C, Andres, C.K., Principles and Practice of Heavy Construction, Prentice Hall, 1986.

CE 903 CONSTRUCTION MANAGEMENT

UNIT-I

The Owner's Perspective: Role of Project Managers- Types of Construction- Selection of Professional Services- Construction Contractors- Financing of Constructed Facilities- Legal and Regulatory Requirements.

UNIT-II

Organizing for Project Management: Trends in Modern Management- Strategic Planning and Project Programming- Effects of Project Risks on Organization- Organization of Project Participants- Traditional Designer- Constructor Sequence- Professional Construction Management- Owner- Builder Operation- Turnkey Operation- Leadership and Motivation for the Project Team- Interpersonal Behavior in Project Organizations- Perceptions of Owners and Contractors.

UNIT-III

The Design and Construction Process: Design and Construction as an integrated system- Innovation and Technological Feasibility- Design Methodology- Functional Design- Physical Structures- Geo-technical Engineering Investigation- Construction Site Environment- Value Engineering- Construction Engineering- Industrialized Construction and pre-fabrication.

UNIT-IV

Labor, Material and Equipment Utilization: Labor Productivity- Factors Affecting Job- Site Productivity- Labor Relations in Construction- Problems in Collective Bargaining- Materials Management- Material Procurement and Delivery- Inventory Control- Tradeoffs of Costs in Materials Management- Construction Equipment- Choice of Equipment and Standard Production Rates- Construction Process Queues and Resource Bottle- Necks.

UNIT-V

Cost Estimation: Costs Associated with Constructed facilities- Approaches to cost Estimation- type of construction Cost Estimates- Effects of Scale on Construction Cost- Unit cost Method of Estimation- Methods for Allocation of Joint Costs- Historical Cost Data- Cost Indices- Applications of Cost Indices to Estimating- Estimate based on Engineer's List of Quantities- Allocation of Construction Costs Over Time- Computer Aided Cost Estimation- Estimation of Operating costs.

REFERENCES:

1. Chris Hendrickson and Tung Au, Project Management for Construction-Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh,2000.
2. Chitkara, K. K. Construction Project Management: Panning, Scheduling and Control, Tata Mc Graw Hill Publishing Company, New Delhi, 1998.

CE 904 PROJECT FORMULATION AND APPRAISAL

UNIT - I

Project Formulation: Generation and Screening of Project Ideas - Project identification - Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Feasibility Report and its Clearance, Project Estimates and Techno -Economic Feasibility Report, Detailed Project Report- Clearances required for project approval

UNIT - II

Project Costing - Project Cash Flows- Time Value of Money - Cost of Capital

UNIT III

Project Appraisal: NPV- BCR - IRR - ARR - Urgency -Pay Back Period - Assessment of various Methods -Indian Practice of Investment Appraisal - International Practice of Appraisal- Analysis of Risk - Different Methods - Selection of a project and Risk Analysis in Practice

UNIT – IV

Project Financing: Means of Finance- Financial Institutions -Special Schemes - Key Financial Indicators.

UNIT – V

Private Sector Participation: Private sector participation in Infrastructure Development Projects - BOX, BOLT, BOOT -Technology Transfer and Foreign Collaboration -Scope of Technology Transfer.

REFERENCES:

1. Prasanna Chandra, Projects -Planning Analysis Selection Implementation & Review Fourth Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi. 1995.
2. Joy P.K., Total Project management - The Indian Context (Chapters 3-7), New Delhi, Macmillan India Ltd., 1992.
3. Barcus, S.W. and Wilkinson. J.W., Hand Book of Management Consulting Services, McGraw Hill, New York, 1986.

CE 905 CONTRACT LAWS AND REGULATIONS

Unit - I

Construction Contracts: Indian Contracts Act - Elements of Contracts - Types of Contracts - Features - Suitability - Design of Contract Documents - International Contract document - Standard Contract Document - law of torts

Unit – II

Tenders: Prequalification -Bidding - Accepting - Evaluation of tender and Interpretation - Potential Contractual Problems - World Bank Procedures and Guidelines

Unit - III

Arbitration: Comparison of Actions and Laws -Agreements - Subject Matter - Violations -Appointment of Arbitrators - Conditions of Arbitration - Powers and Duties of Arbitrator - Rules of Evidence -Enforcement of Award – Costs.

Unit – IV

Legal Requirements: Insurance and Bonding -Laws Governing Sale, Purchase and Use of Urban and Rural Land -Land Revenue Codes - Tax Laws - Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs -Legal Requirements for Planning - Property Law - Agency Law -Local Government Laws for Approval - Statutory Regulations

Unit – V

Labour Regulations: Social Security - welfare Legislation - Laws relating to Wages, Bonus and Industrial disputes, Labour Administration - Insurance and Safety Regulations - Workmen's Compensation Act -other labour Laws

References:

1. Gajaria, G.T., Laws Relating to Building and Engineering Contracts in India, M.M. Tripathi Private Ltd., Bombay , 1982
2. Jimmie Hinze, Construction Contracts, 2nd Edition , McGraw Hill, 2001
3. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, 6th Edition, McGraw Hill, 2000.

CE 906 SAFETY PRACTICES IN CONSTRUCTION

UNIT – I

Construction accidents - Construction Safety Management: Importance - causes of accident, safety measures- Environmental issues in construction-Construction industry related laws. human factors in safety – legal and financial aspects of accidents in construction – occupational and safety hazard assessment.

UNIT – II

Safety Programmes - Construction Safety - Elements of an Effective Safety Programmes - Job-site assessment - Safety Meetings - Safety Incentives. Contractual Obligations - Safety in construction contracts- Substance Abuse - safety Record Keeping.

UNIT – III

Designing for Safety - Safety Culture - Safe Workers- Safety and First Line Supervisors - Safety and Middle Managers - Top Management Practices, Company Activities and Safety - Safety Personnel - Sub-contractual Obligation - Project Coordination and Safety Procedures - Workers Compensation

UNIT – IV

Accident prevention-cost of accidents-Safety and productivity-safety provision in the factories act-accident reporting investigation and statistics-total loss control and damage control-Safety sampling- safety audit - critical incident technique-safety equipment - planning and site preparation- safety system of storing construction materials-Excavation - blasting- timbering-scaffolding- safe use of ladders- safety in welding.

UNIT – V

Safety in hand tools- Safety in grinding- Hoisting apparatus and conveyors- Safety in the use of mobile cranes-Manual handling-Lessons to be learnt (Accident Causes)- Asbestos cement roofs-Safety in demolition work- Trusses, girders and beams- First- aid- Fire hazards and preventing methods-Interesting experiences at the construction site against the fire accidents.

REFERENCES

1. Jimmy W. Hinze, *Construction Safety, Prentice Hall Inc., 1997*
2. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, *Construction Safety and Health Management, Prentice Hall Inc., 2001.*
3. Hand Book on Construction Safety Practices, SP 70, BIS 2001.

CE 907 COMPUTING TECHNIQUES LABORATORY

Concepts of computing – introduction to computer hardware and software – programming languages.

introduction to C language

Spreadsheets applications.

Use of packages programmes like, PRIMAVERA/MSPROJECT, STAAD, SAP.

CE 931 QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION

UNIT - I

Construction Organisation -Types of organisations - inspection, control and enforcement - quality management systems and method - responsibilities and authorities in quality assurance and quality control, architects, engineers, contractors, and special consultants, quality circle.

UNIT – II

Quality Planning: Quality policy, objectives and methods in construction industry - consumers satisfaction -ergonomics - time of completion - statistical tolerance.

UNIT – III

Taguchi's concept of quality - codes and standards - documents - contract and construction programming - inspection procedures -processes and products - total QA / QC programme and cost implication.

UNIT - IV

Quality Assurance and Control - Objectives - regularity agent, owner, design, contract and construction oriented objectives/ methods - techniques and needs of QA/QC - different aspects of quality - appraisals, factors influencing construction quality - critical, major failure aspects and failure mode analysis, - stability methods and tools, optimum design.

UNIT – V

Reliability testing, reliability coefficient and reliability prediction - selection of new materials - influence of drawings, detailing, specification, standardization - bid preparation - construction activity, environmental safety and social factors -natural causes and speed of construction - life cycle costing - value engineering and value analysis.

REFERENCES

1. James, J.O Brian, Construction Inspection Handbook - Quality Assurance and Quality Control, Van Nostrand, New York, 1989.
2. Kwaku, A., Tenah, Jose, M. Guevara, Fundamentals of Construction Management and Organization, Reston Publishing Co., Inc., Virginia, 1985.
3. Juran Frank, J.M. and Gryna, F.M, Quality Planning and Analysis, Tata McGraw Hill, 1982.
4. Hutchins.G, ISO 9000, Viva Books, New Delhi, 1993.
5. Clarkson H. Ogiesby, Productivity Improvement in Construction, McGraw-Hill, 1989.

CE 933 SCAFFOLDING AND FORMWORKS IN CONSTRUCTION

UNIT – I

Planning: Overall Planning - detail planning - Standard units - Corner units - Schedule for column formwork - Formwork elements - Planning at Tender stage - Development of basic system - Planning for maximum reuse - Economical form construction - Planning examples - Crane size, effective scheduling estimate - Recheck plan details - Detailing the forms.

Site Equipment & Plant: Crane arrangements - Site layout plan - Transporting plant - Formwork beams - Formwork ties - Wales and ties - scaffold frames from accessories - Vertical transport table form work.

UNIT – II

Pressures on Formwork: Concrete density - Height of discharge - Temperature - Rates of Placing - Consistency of concrete - Live loads and wind pressure - Vibration Hydrostatic pressure and pressure distribution - Examples - Vertical loads - Uplift on shores - Adjustment for non-standard conditions.

Materials, Accessories Proprietary Products: Lumber - Types - Finish - Sheathing boards working stresses - Repetitive member stress - Plywood - Types and grades - Textured surfaces and strength - Reconstituted wood - Steel - Aluminum Form lining materials - Hardware and fasteners - Nails in Plywood - Bolts lag screws and connectors - Bolt loads.

UNIT – III

Form Design: Basic simplification - Beam formulas - Allowable stresses - Deflection bending lateral stability - Shear, Bearing - Examples in wall forms - Slab forms - Beam forms - Ties, Anchors and Hangers - Column forms - Examples in each.

Shores: Simple wood stresses - Slenderness ratio - Allowable load - Tubular steel shores patented shores - Site Preparation, Size and spacing - Steel Tower Frames - Safety practices - Horizontal shores - shoring for high-rise buildings.

UNIT – IV

Building and Erecting the Formwork: Location of job mill - Storage - Equipment - Footings - Wall footings - Column footings sloped footing forms - Slab on grade and paving work - Highway and airport paving - curb and gutter forms - wall forms - External vibration - Prefabricated panel systems - 3 ant forms curved wall forms - Wall openings Joints - Tolerance for walls - Erection practices - Column heads - Beam or girder forms - Beam pockets - Suspended forms - Suggested Tolerances - Concrete joint construction - Flying system forms.

Failures of Formwork: Causes of failures - Inadequate shoring inadequate bracing of members - improper vibration - Premature stripping - Errors in design - Failure to follow codes - How formwork affects concrete quality - ACI - Case studies - Planning for safety - Achieving economy - Finish of exposed concrete design deficiencies - Safety factors - Reshore installation - Prevention of rotation - Stripping sequence - Advantages of reshoring -Material properties.

UNIT – V

Domes Forms and Tunnel Forms: Hemispherical, Parabolic, Translational typical barrel vaults, Hyperbolic Folded plates - Shell form design considerations loads - Inserts , Anchors bolts - Building the forms- Placing concrete - Form removed - Strength requirements - Tunnel forming components - Curb forms invert forms - Arch forms - Concrete placement methods -Cut and cover construction - General design considerations influence of placing equipment - Tolerances - Form construction - Shafts.

Slip Forms and Safety Practices For Scaffolds: Principles - Types - advantages - Functions of various components - Planning -Desirable characteristics of concrete - Common problems faced - Safety in slip forms special structures built with slip form Technique - Code provisions - Types of scaffolds - Putlog and independent scaffold - Single pole scaffolds - Fixing ties -Spacing of ties plan - bracing - knots - safety net - General safety requirements -precautions against particular hazards - Truss suspended - Gantry and system scaffold

REFERENCES:

1. Robert L. Peurifoy and Garold D. Oberlender, Formwork For Concrete Structures, McGraw - Hill, 1996.
2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, Fifth Edition, American Concrete Institute, Detroit, 1983.
3. Michael P. Hurst, Construction Press, London & New York, 1983.
4. Austin, C.K., Formwork for Concrete, Cleaver- Hume Press Ltd., London, 1986.
5. Tudor Dinescu and Constantin Radulescu, Slip Form Techniques, Abacus Press, Turn Bridge Wells, Kent, 1982.
6. Guide for Concrete Formwork, American Concrete Institute, Box.No.19150, Detroit, Michigan, 48219.
7. Safety Requirements for Scaffolding, American National Standards Institute, 1430 Broadway, New York, 10018.

CE 925 ENERGY CONSERVATION TECHNIQUES IN BUILDING CONSTRUCTION

UNIT – I

Introduction: Fundamentals of energy - Energy Production Systems - Heating, Ventilating and air conditioning -Solar Energy and Conservation - Energy Economic Analysis - Energy conservation and audits -Domestic energy consumption - savings -Energy use in buildings - Residential - commercial buildings.

UNIT - II

Environmental: Energy and Resource conservation - Design of green buildings - Evaluation tools for building energy - Embodied and operating energy - Peak demand - Comfort and Indoor air quality - Visual and acoustical quality - Land, water and materials - Airborne emissions and waste management.

UNIT – III

Design: Natural building design consideration - Energy efficient design strategies - Contextual factors - Longevity and process Assessment -Renewable energy sources and design-Advanced building Technologies - Smart buildings - Economies and cost analysis.

UNIT – IV

Services: Energy in building design - Energy efficient and environment friendly building - Thermal phenomena - thermal comfort - Indoor Air quality - Climate, sun and Solar radiations -Psychometrics - passive heating and cooling systems - Energy Analysis - Active HVAC systems -Preliminary Investigation - Goals and policies - Energy audit - Types of energy audit - Analysis of results - Energy flow diagram - Energy consumption/ Unit production - Identification of wastage -Priority of conservative measures - Maintenance of management programme.

UNIT – V

Energy Management: Energy management of electrical equipment - Improvement of power factor - management of maximum demand - Energy savings in pumps - Fans - Compressed air systems - Energy savings in Lighting systems - Air conditioning systems - Applications.

REFERENCES

1. Moore F., *Environmental Control System McGraw Hill, Inc., 1994.*
2. Brown, G Z, *Sun, Wind and Light: Architectural design strategies, John Wiley, 1985.*
3. Cook, J, *Award - Winning passive Solar Design, McGraw Hill, 1984.*

CE 930 PREFABRICATION AND CONSTRUCTION TECHNIQUES

UNIT-I

Materials, admixtures, pigments - Modular co-ordination, standardization and tolerances-system of prefabrication. Pre-cast concrete manufacturing techniques, Moulds –construction design, maintenance and repair.

UNIT-II

Pre-casting techniques - Planning, analysis and design considerations - Handling techniques -Transportation Storage and erection of structures.

UNIT-III

Joints -Curing techniques including accelerated curing such as steam curing, hot air blowing etc., -Test on precast elements - skeletal and large panel constructions - Industrial structures.

UNIT-IV

Pre-cast and pre-fabricating technology for low cost and mass housing schemes. Small pre-cast:

products like door frames, shutters, Ferro-cement in housing - Water tank service core unit.

UNIT-V

Quality control - Repairs and economical aspects on prefabrication.

REFERENCES:

1. Levitt. M., Precast concrete - Materials, Manufacture Properties and Usage, Applied Science Publs. 1982,
2. Konex.T., Handbook of Pre-cast Construction, Vol..1.2&3.
3. Richardson,J.G., Pre-cast concrete Production, Cement and Concrete Association, London, 1973.
4. Madhava Rao.A-G., Modern Trends in Housing in Developing Countries, Oxford & UBH Publishing co., 1985. -
5. Lewicki.B., Building with Large Pre-fabrications, Elsevier Publishers.
6. Large Panel Prefabricated Constructions, Proc. of Advance Course conducted by SERC, Madras.
7. Bruggeling.A.S.G., & Huyghe.G.F., Prefabrication with Concrete, A.s.A., Balkema Publishers,

Netherland, 1991.

CE 923 COMPOSITE CONSTRUCTION METHODS

UNIT – I

Introduction to steel - concrete composite construction - theory of composite structures -Introduction to steel - concrete - steel sandwich construction.

UNIT – II

Design of Composite members.- Behaviour of composite beams, columns, design of composite beams, steel composite columns -design of composite trusses.

UNIT – III

Design of Connections: Types of connections, Design of connections in the composite structures - shear connections-Design of connections in composite trusses.

UNIT – IV

Composite Box Girder Bridges: Introduction - behaviour of box girder bridges - design concepts.

UNIT – V

Case studies: Case studies on steel-concrete composite construction in buildings - Seismic behaviour of composite structures.

REFERENCES:

1. Johnson R.P, *Composite structures of steel and concrete*, Blackwell Scientific Publications (Second Edition), UK, 1994.
2. Owens, G.W. and Knowels.P, *Steel Designers manual* (Fifth edition), Steel Concrete Institute (UK), Oxford Blackwell Scientific Publications, 1992.

CE 929 MAINTENANCE AND REHABILITATION OF STRUCTURES

UNIT – I

Maintenance, repair and rehabilitation, Facets of maintenance- various aspects of inspection. Assessment procedure for evaluating a damaged structure - causes and agencies causing deterioration- durability of materials - types of problems in components such as foundations, roofs, floors, walls, etc - safety evaluation of existing structures -failure patterns and controls.

UNIT – II

Durability and Deterioration of concrete: Plastic Shrinkage - Plastic Settlement - Drying Shrinkage - Thermal Movement – Freezing and thawing -Weathering - Carbonation - Sulphate Action - Alkali-Aggregate Reaction - Acids - Cracking -Honey Combing - Popouts - Creep - Abrasion - Erosion and Cavitation - Fire - Sub-grade Movement - Formwork Movement - Premature Removal of Forms / Shores - Rebar Corrosion -Poor Design Details - Errors in Design.

UNIT – III

Investigation and Diagnosis: General Considerations - Observation - Questioning - Field and Laboratory Testing - Destructive Testing - Non-Destructive Testing - Rebound Hammer - Ultrasonic Pulse Velocity - Pachometer -Semi-Destructive Testing - Probe Test - Pull-Out Test - Pull-Off Test - Break-Off Test - Core Test - Half-Cell Potential Measurements - Resistivity Measurements - Carbonation Depth Testing - Tests for determining cement content, chloride content and sulphate content.

UNIT – IV

Repair Materials: Patching Materials - Resurfacing Materials - Sealing Materials - Water-Proofing Materials -Admixtures - Substrate Preparation.

Corrosion of steel reinforcement: Factors influencing corrosion - corrosion protection of steel structure - masonry deterioration.

Construction methods for termite proof in buildings -Biocide treatment and use of preservatives - factors influencing deterioration of wood, timber preservation.

UNIT - V

Refurbishment and Protection Techniques - Routing and Sealing - Stitching - External Stressing - Resin Injection - Grouting - Blanketing -Overlays - Sprayed Concrete - Prepacked Concrete - Dry packing - Jacketing - Plate Bonding -Protective Coatings - Autogenous Healing - Vacuum Impregnation - Chloride Extraction - Cathodic Protection.

Maintenance: Bridge maintenance techniques-factors affecting deterioration of dams, detection methods, remedial measures Maintenance of various buildings and structures – Components of pavement management system – pavement maintenance measures – pavement preservation techniques.

REFERENCES:

1. Peter H. Emmons, Concrete Repair and Maintenance, Galgotia Publishers.
2. S. Champion, Failure and Repair of Concrete Structures, John Wiley & Sons.
3. Ted Kay, Assessment and Renovation of Concrete Structures, Longman Scientific & Technical.
4. R.T.L. Allen and S.C.Edwards, Repair of Concrete Structures, Blackie & Son, 1987.
5. Sidney M. Johnson, Deterioration, Maintenance and Repair of Concrete Structures, McGraw-Hill Book
6. P.H. Perkins, Repair, Protection and Waterproofing of Concrete Structures, E & FN Spon.
7. R.N. Raikar, Diagnosis and Treatment of Structures in Distress, Structwel D & C Pvt. Ltd.
8. Ransem.W.H., Building Failures, E&F.N, SPON Ltd, 1981.
9. Ralph Haas, Ronald Hudson and Zaneiswki, Modern Pavement Management, , Kreiger Publications.

CE 928 INFORMATION TECHNOLOGY FOR CONSTRUCTION ENGINEERING

UNIT – I

Introduction: Operating Systems: Introduction to various Operating Systems- Windows 2000- Linux Emerging operating systems- their role in IT data base - Structures and data base design

UNIT – II

Internet: A review of the internet, Role of internet in constructional problem solving - free modules -available for modeling- Construction engineering Systems - Web introduction -languages HTML -JAVA- Web design.

UNIT – III

Relational data base management systems: Introduction to ORACLE- Sequel languages- Primary keys-concepts-Visual basic Forms-Applications for construction engineering database management- Analysis- and decision making

UNIT – IV

Geographical Information Systems: Geographic information systems, Introduction- thematic layers- Analysis- Data base structures -Application to construction engineering management

UNIT – V

Global Positioning Systems: Introduction to Global Positioning Systems - satellite systems- coordinate determination- three point problem- Applications

REFERENCES:

1. Horstmann, Computing Concepts with Java essentials, 2nd edition, Wiley Publications, New York, 1999
2. Brian Jipson and Joan Peckham, Database Application Programming with LINEX Wiley Publications, New York, 2000.

CE 922 ADVANCED BRIDGE CONSTRUCTION ENGINEERING

UNIT – I

Construction of Substructure for Bridges: Pile foundations – site investigation – depth of exploration – in-situ testing- soil exploration techniques. Piling methods – pile types – pile driving methods – non-displacement piles – micro piles – durability problems in pile construction – integrity testing – pile testing. spacing of Piles - size of concrete piles - tolerance in pile alignment - pile cap - load tests on piles. Pile concreting under various soil conditions.

UNIT – II

Caissons or well foundations: Caisson construction and sinking methods - construction of well curb (shoe) - towing a floating caisson to sinking site - bed preparation - supporting structures - lowering caissons - sinking open Well caissons - excavation method - de-watering for freeing a 'hanging' caisson. Sand Blow -jetting and lubrication - rectifying tilt in wells - skin friction in caissons - construction details of pneumatic sinking of caissons - construction methods of steining and bottom plugging

UNIT – III

Construction of superstructure - reinforced concrete superstructure- prestressed concrete superstructure - composite and steel superstructure - special superstructures. Geometrical alignment - lighting - Drainage - traffic lane width, road width, footpaths, and clearance for vehicles / boats - road kerb, crash barrier, parapet and handrail - expansion and roadway joints -super-elevation.

UNIT – IV

Slab, T-beam and Box girder deck slab construction: Slab type, T-beam and box-girder bridges Decks Construction methods. Span lengths -deck and stiffening system.

UNIT – V

Segmental Construction, Cantilever Construction and Successive Launching- Precast segmental construction for long-span bridges- cables and their profiling - deck section - soffit surface -deflection and pre-camber - expansion joint - bearings - aesthetics. Cable-stayed bridge construction - Construction methods - cable configuration - towers - multi span cable stayed bridges - stay tendons - aerodynamic stability.

REFERENCES:

1. Chew Yit Lin, Michael, Construction Technology for Tall Buildings (2nd Ed.), Singapore University Press, World Scientific, Hong Kong, 2001.
2. Victor.D.J, Essentials of Bridge Engineering, Oxford IBH, 2001
3. Ponnuswamy,S, Bridge Engineering, Tata McGraw Hill, 1989.
4. Raina V.K. Concrete Bridge practice, Tata McGraw Hill Publishing Co., 1991
5. Derrick Beckett, An Introduction to Structural Design of Concrete Bridges, Surrey University Press, Oxford Shire, 1973.
6. Fleming. W. G. K., et al., Piling Engineering, Surrey University Press, London, 1985.

CE 921 ACOUSTICS, LIGHTING AND VENTILATION ENGINEERING

UNIT – I

Acoustics: Sound - Velocity of sound - frequency and intensity of sound - reflection of sound -reverberation - absorption of sound - sabin's equation - absorption materials - conditions for good acoustics.

UNIT – II

Acoustical design of an auditorium- defects in an auditorium and their remedies- acoustics of studies -noise and its effects - type of noises- transmission of noise -sound insulation -transmission loss -acceptable noise levels

UNIT – III

Methods of sound insulation – materials used for sound insulation. – measurement of acoustical level – methods of acoustical improvement for existing structures.

UNIT – IV

Lighting: Day lighting (or) Natural lighting - design of windows - orientation of buildings - lighting for industrial structures - supplementary illumination - artificial illumination -summary.

UNIT – V

Ventilation: Ventilation due to wind - ventilation due to stack effect - ventilation due to combined effect -infiltration - ventilation of industrial building - calculation of natural ventilation - mechanical ventilation - examples - building regulation -air conditioning -summary

REFERENCES:

1. Percy L.Marks, A handbook for Architects and Engineers, 1940
2. Leo. L., Beranek, Music, Acoustics & Architecture, 1962.
3. Frederick S. Merritt, Standard Handbook for Civil Engineers (Third Edition), 1986
4. Hopkinson R.G., Architectural Physics Lighting, 1963.
5. George A.Hool S.B & Nathan, Handbook of Building Construction, 1929

6. Andrews F.T., Building Mechanical Systems, 1966.

CE 932 RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION

UNIT – I

Resource Planning: Resource Planning, Procurement, identification, Personnel, Planning for material, Labour, time schedule and cost control. Types of resources, manpower, Equipment, Material, Money, Time.

UNIT – II

Resources: Systems approach in resource management, characteristics of resources, Resources, Utilization, measurement of actual resources required. Tools for measurement of resources, Labour, classes of Labour, Cost of Labour, Labour Schedule, optimum use of labour.

UNIT - III

Materials: Time of purchase, Quantity of material, sources, Transportation, Delivery and Distribution.

Equipment: Planning and selecting by optimistic choice with respect to cost, Time, Source and handling.

UNIT – IV

Time: Personnel time, Management and planning, Managing time on the project, forecasting the future, Critical path measuring the changes and their effects. Cost control: Cash flow and cost control, objectives of cost, Time and Quality.

UNIT V

Resource allocation and leveling: Time-cost trade of, Computer application in resource leveling examples, resource list, resource allocation graph, Resource loading, Cumulative cost ETC - Value Management.

REFERENCES:

1. Andrew, D, Szilagg, Hand Book of Engineering Management, 1982.
2. Glenn, A. Sea's and Reichard, H Clough, Construction Project Management, John Willey and Sons, Inc. 1979.
3. Harvey, A. Levine, Project Management using Micro Computers, Obsome-McGraw Hill C.A. Publishing Co., Inc. 1988,
4. James, A., Adrain, Qauntitative Methods in Construction Management, American Elsevier Publishing Co., Inc. 1973.

5. Oxley Rand Poslcit, Management Techniques applied to the Construction Industry Granda Publishing Ltd., 1980.

CE 927 HIGHWAY CONSTRUCTION METHODS

UNIT – I

Equipment in highway construction: Various types of equipment for excavation, grading and compact ion - their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement, stabilised soil road construction.

Subgrade: Earthwork grading, compaction and construction of embankments and cuts for roads, problems in embankment construction on weak and compressible foundation, Preparation of subgrade, quality control tests as per MoRTH specifications.

UNIT – II

Flexible Pavements: Specifications of materials, construction methods and field control checks for various types of flexible pavement materials in sub-base, base, binder and surface course layers and their choice.

Cement Concrete Pavement Layers: Specifications and method of cement concrete pavement construction; Compaction of interlocking block pavements, Quality control tests; Construction of various types of joints.

UNIT - III

Soil Stabilized Pavement Layers: Principles of gradation/proportioning of soil-aggregate mixes and compaction; Design factors, mix design, construction control and quality control checks for mechanical, soil-cement, soil-bitumen and soil-lime stabilisation methods. Use of additives, Numerical problems on mix design and application of Rothfutch method.

UNIT – IV

Hill Roads: Special problems in construction and maintenance of hill roads; land slides, cause, investigation and remedial measures, protection of embankment and cut slopes, Numerical problems on slope stability.

UNIT V

Drainage: Design and construction of surface and sub-surface drainage system for highways and airports. Drainage materials, design procedures and IRC Guidelines for Drainage of Urban Roads and maintenance of drainage system. Methods of maintenance of different types of pavements; Special problems in high rainfall areas.

REFERENCES:

1. Sharma, S. K., Principles and Practice of Design of Highway Engineering, S. Chand & Co., New Delhi.

2. MoRTH & H, IV Rev. 2000 IRC, New Delhi.
3. Justo, C. E., and Khanna, S. K., Highway Engineering, Nem Chand & Bros., Roorkee.
4. Kadiali, L. R., Principles of Highway Engineering, Khanna Publishers, New Delhi.
5. Agg, T. R., The Construction of Roads and Pavements, McGraw Hill Book Co., New York.
6. American Highway Practice, V. I & II, John Wiley & Sons Inc., New York.
7. Peurify, R. L., Construction, Planning, Equipments & Methods, McGraw Hill, New York.
8. Krebs, R. D. and Walker, R. D., Highway Materials, McGraw Hill, New York.
9. Wallace, H. A., Asphalt Pavement Engineering, McGraw Hill, New York.

CE 926 ENVIRONMENTAL IMPACT ASSESSMENT

UNIT – I

Concepts of environmental impact analysis - key features of the National Environmental Policy Act and its implementation, screening in the EIA process, role of the USEPA, environmental protection and EIA at the national level, utility and scope of the EIA process Planning and management of environmental impact studies.

Environmental impact - factors for consideration in assessing the impacts of water related projects, power projects, waste water treatment facilities etc.

Concepts and terms in the impact assessment process, Socioeconomic impact analysis.

UNIT – II

Simple methods for impact identification - matrices, net works and checklists. Description of the environmental setting Environmental indices and indicators for describing the affected environment.

UNIT – III

Prediction and assessment of the impact on surface water, soil, groundwater, air, water quality, vegetation and wild life and biological environments. Case studies and examples.

UNIT – IV

Prediction and assessment of visual impacts and impacts on the socio-economic setting, decision methods for evaluation of alternatives, public participation in decision-making Preparing the EIA document

UNIT – V

Environmental monitoring - Environmental management plan - Post project monitoring -Environmental Audit- Life cycle assessment - EMS'. - case studies in EIA Physical observation based detection of internal and external defects and cracks in buildings - repairs and rehabilitation - Case studies

Reference books

1. Larry W Canter, Environmental Impact Assessment, McGraw Hill, Inc., 1996
2. Betty Bowers Marriot, Environmental Impact Assessment A Practical Guide, McGraw Hill, Inc., 1997.

3. C.J. Barrow, *Environmental & Social Impact Assessment - An Introduction*, Edward Arnold, 2002.
4. Evan. K. Paleologos and Ian Lerche, *Environmental Risk Analysis*, McGraw Hill Inc., 2001
5. Peter Morris (ed.) and Riki Therivel (ed.), *Methods of Environmental Impact Assessment*, Routledge, 2001.

CE 934 STRUCTURAL APPRAISAL AND EVALUATION ENGINEERING

UNIT – I: Condition Assessment

Introduction – Procedure for the condition assessment of concrete structures – walk over Survey – collation information – Establishment of in-service conditions – field visits – inspection – sampling – structural capacity – load testing – condition assessment of structures and health monitoring.

UNIT –II: Non-Destructive Testing

Strength Tests - Rebound Hammer – Ultrasonic Pulse Velocity Measurement – Pull-out test – Pull-off test – Break-off test – Windsor Probe test – Core cutting.

UNIT –III: Electro-chemical Methods

Half-Cell Potential measurements - Resistivity – Permeability – Cover survey – tests for rebar corrosion assessment – Abrasion resistance test.

UNIT- IV: Chemical Analysis

Chemical analysis for cement content and type – Depth of carbonation – original water content – Chloride content – Sulphate content.

UNIT –V Performance and Integrity Tests

Radiography – Radar – Resonant Frequency method – Acoustic Emission – Impact echo method – Dynamic Response.

References:

1. Basheer, P. A. M., Proceedings of a Special Technical Session on “Near-surface Testing for Strength and Durability of Concrete”, Fifth CANMET/ACI International Conference on Durability of Concrete, Barcelona, Spain, 4-9 June 2000.
2. R.Holland., Appraisal & Repair of Reinforced Concrete, Thomas Telford
3. Michael Stratton, Structure and Style, E& FN Spon.
4. Recommendations for inspection, maintenance and management of Car Park structure- Institution of Civil Engineers – 2202, Typeset by Gray Publishers, Thomas Telford James Douglas, Building Adaptation, Elsevier.

CE 924 DETERIORATION PROCESSES IN REINFORCED CONCRETE

UNIT-I: Physical Damage

Plastic Settlement –Drying Shrinkage- Thermal Effects – Freez and Thaw-Abrasion – Creep-Erosion and Cavitation –Shock Waves- Fire.

UNIT –II: Rebar Corrosion

Types of Corrosion – Corrosion of reinforcement exposed to atmosphere – Corrosion of reinforcement embedded in concrete –Mechanisms of Corrosion – Factors influencing Construction Practices - Protective Coating for concrete surfaces - Protective Coatings for Reinforcement bar – Cathodic Protection.

UNIT- III: Chemical Attack on Concrete

Sulphate attack –Seawater damage –Salt weathering-Carbonation –Acid attack –attack of soft water. Alkali –Silica reaction –Alkali –Carbonate reaction –unsound Cement –Biological attack.

UNIT – IV: Construction and Design Defects

Settlement of Sub-grade –Internal Settlement of Concrete Suspension – Movement of Formwork- Premature removal of forms/shores – Vibrations – Re-entrant Corners – Improper Placement of reinforcing steel bars – Poor Detailing joints – Inadequate – Drainage –Design errors –Deflecti0n – Settlement of foundation.

UNIT – V: Blemishes and Defects in Concrete

Honey Combing –Pop outs –Crazing – Efflorescence –Scaling and Spalling – Cold Joints –Discoloration -Bleeding -Curling.

References:

1. Mark Richardson – Technology, Fundamentals of Durable Reinforced Concrete-Spon press (UK)
2. Pietro Pedferri, Rob.B. Polder, Corrosion of Steel in Concrete Prevention, Diagnosis, Repair, Wiley – VCH
3. G. Jorv, Concrete under severe conditions, Spon Press (UK)
4. Ravindra K. Dhir, Michael, J. Mearthy, Concrete Durability & Repair Technology, Thomas Telford.
5. R.K.Dhir,Challenges of Concrete Construction, Pt.1, V.4, Thomas Telford