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

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Code</th>
<th>Subject</th>
<th>Hours / Week</th>
<th>Credits</th>
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**SEMESTER – III**

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**SEMESTER – IV**

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# LIST OF ELECTIVE SUBJECTS

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<tr>
<td>CE921</td>
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<td>CE922</td>
<td>Advanced Bridge Construction Engineering</td>
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<td>CE923</td>
<td>Composite Construction Methods</td>
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<td>CE924</td>
<td>Deterioration Processes in Reinforced Concrete</td>
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<td>CE925</td>
<td>Energy Conservation Techniques in Building Construction</td>
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<td>CE926</td>
<td>Environmental Impact Assessment</td>
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<td>CE927</td>
<td>Highway Construction Methods</td>
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<td>Information Technology for Construction Engineering</td>
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<td>Maintenance and Rehabilitation of Structures</td>
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<td>CE930</td>
<td>Prefabrication and Construction Techniques</td>
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<td>Quality Control and Quality Assurance in Construction</td>
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<td>Resource Management and Control in Construction</td>
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<td>Scaffolding and Formworks for Construction</td>
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<tr>
<td>CE934</td>
<td>Structural Appraisal and Evaluation Engineering</td>
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</table>
CE 901 MODERN MATERIALS OF CONSTRUCTION

Unit – I

Unit-II

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:
5. Vedhikizen Van Zanten, R., (Ed), Gerotextiles and Geomembranes in Civil Engineering.
UNIT-I

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

REFERENCES:

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


UNIT-IV


UNIT-V


REFERENCES:

UNIT - I


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:

2. Joy P.K., Total Project management - The Indian Context (Chapters 3-7), New Delhi, Macmillan India Ltd., 1992.
CE 905 CONTRACT LAWS AND REGULATIONS

Unit - I


Unit – II


Unit - III


Unit – IV


Unit – V


References:

CE 906  SAFETY PRACTICES IN CONSTRUCTION

UNIT – I


UNIT – II


UNIT – III


UNIT – IV


UNIT – V


REFERENCES

CE 907  COMPUTING TECHNIQUES LABORATORY

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

introduction to C language

Spreadsheet 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

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
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


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.

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 requiremets - 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 - Codal 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:

2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, Fifth Edition, American Concrete Institute, Detroit, 1983.
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


UNIT – II


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


UNIT – V


REFERENCES

CE 930 PREFERENCES 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:

UNIT – I

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:


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


UNIT – III


UNIT – IV


UNIT – V


REFERENCES:

2. S. Champion, Failure and Repair of Concrete Structures, John Wiley & Sons.
7. R.N. Raikar, Diagnosis and Treatment of Structures in Distress, Structwel D & C Pvt. Ltd.
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

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:
UNIT – I

UNIT – II

UNIT – III

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

REFERENCES:
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
3. Frederick S. Merritt, Standard Handbook for Civil Engineers (Third Edition), 1986
CE 932 RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION

UNIT – I


UNIT – II


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:

2. Glenn, A. Sea’s and Reichard, H Clough, Construction Project Management, John Willey and Sons, Inc. 1979.
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:

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
CE 934 STRUCTURAL APPRAISAL AND EVALUATION ENGINEERING

UNIT – I: Condition Assessment


UNIT – II: Non-Destructive Testing


UNIT – III: Electro-chemical Methods


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


References:

2. R. Holland., Appraisal & Repair of Reinforced Concrete, Thomas Telford
UNIT-I: Physical Damage

UNIT-II: Rebar Corrosion

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

UNIT-V: Blemishes and Defects in Concrete

References:
2. Pietro Pedoferri, Rob B. Polder, Corrosion of Steel in Concrete Prevention, Diagnosis, Repair, Wiley – VCH
3. G. Jorv, Concrete under severe conditions, Spon Press (UK)
5. R.K. Dhir, Challenges of Concrete Construction, Pt. 1, V. 4, Thomas Telford