### ANNA UNIVERSITY OF TECHNOLOGY MADURAI
### MADURAI – 625002
### REGULATIONS 2010
### CURRICULUM & SYLLABI
### M.E CONSTRUCTION ENGINEERING AND MANAGEMENT

#### SEMESTER I

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**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 68**

**ELECTIVES FOR M.E. CONSTRUCTION ENGINEERING AND MANAGEMENT**

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UNIT I  ONE DIMENSIONAL RANDOM VARIABLE  9+3


UNIT II  ESTIMATION THEORY  9+3


UNIT III  TESTING OF HYPOTHESES  9+3

Sampling distributions - Type I and Type II errors - Tests based on Normal, t, \( \chi^2 \) and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT IV  DESIGN OF EXPERIMENTS  9+3

Analysis of variance – One-way and two-way classifications – Completely randomized design – Randomized block design – Latin square design.

UNIT V  QUEUEING MODELS  9+3


TOTAL (L: 45+T: 15): 60

REFERENCES:
UNIT I SPECIAL CONCRETES

Concretes, Behaviour of concretes - High Strength and High Performance Concrete – Fibre Reinforced Concrete, Self compacting concrete, Alternate Materials to concrete

UNIT II METALS

Steels - New Alloy Steels – Aluminum and its Products – Coatings to reinforcement – Applications.

UNIT III COMPOSITES

Plastics – Reinforced Polymers – FRP – Applications

UNIT IV OTHER MATERIALS

Water Proofing Compounds – Non-weathering Materials – Flooring and Facade Materials

UNIT V SMART AND INTELLIGENT MATERIALS

Smart and Intelligent Materials for intelligent buildings - Special features

TOTAL: 45

REFERENCES:

5. Aitkens , High Performance Concrete, McGRaw Hill, 1999
8. ACI Report 440.2R-02, “Guide for the design and construction of externally bonded RP systems for strengthening concrete structures”, American Concrete Institute, 2002.
UNIT I CONSTRUCTION EQUIPMENT MANAGEMENT 10

UNIT II EQUIPMENT FOR EARTHWORK 10

UNIT III OTHER CONSTRUCTION EQUIPMENTS 10

UNIT IV MATERIALS HANDLING EQUIPMENT 5
Forklifts and related equipment - Portable Material Bins – Conveyors - Hauling Equipment

UNIT V EQUIPMENT FOR PRODUCTION OF AGGREGATE AND CONCRETING 10
Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Hauling, Pouring and Pumping Equipment – Transporters

TOTAL: 45

REFERENCES:

UNIT I  PROJECT FORMULATION  10


UNIT II  PROJECT COSTING  10

Project Cash Flows – Time Value of Money – Cost of Capital

UNIT III  PROJECT APPRAISAL  15


UNIT IV  PROJECT FINANCING  5

Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators - Ratios

UNIT V  PRIVATE SECTOR PARTICIPATION  5

Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer

REFERENCES:

2. Joy P.K., Total Project Management - The Indian Context, New Delhi, MacMillan India Ltd., 1992

TOTAL: 45
UNIT I SUB STRUCTURE CONSTRUCTION 15
Box jacking - pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - piling techniques - driving well and caisson - sinking cofferdam - cable anchoring and grouting - driving diaphragm walls, sheet piles - laying operations for built up offshore system - shoring for deep cutting - large reservoir construction - well points - dewatering and stand by plant equipment for underground open excavation.

UNIT II SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS 10

UNIT III CONSTRUCTION OF SPECIAL STRUCTURES 10
Erection of lattice towers and rigging of transmission line structures – construction sequence in cooling towers, silos, chimney, sky scrapers, bow string bridges, cable stayed bridges – launching and pushing of box decks – Advanced construction techniques for offshore structures – construction sequence and methods in domes and prestress domes – support structure for heavy equipment and conveyor and machinery in heavy industries – erection of articulated structures, braced domes and space decks.

UNIT IV REHABILITATION TECHNIQUES 6
Mud jacking grout through slab foundation - micropiling for strengthening floor and shallow profile - pipeline laying - protecting sheet piles, screw anchors - sub grade water proofing, underpinning, crack stabilization techniques.

UNIT V DEMOLITION 4
Advanced techniques and sequence in demolition and dismantling.

TOTAL: 45

REFERENCES:
UNIT – I CONSTRUCTION CONTRACTS

UNIT – II TENDERS

UNIT – III ARBITRATION

UNIT – IV LEGAL REQUIREMENTS

UNIT – V LABOUR REGULATIONS

TOTAL: 45

REFERENCES:
UNIT – I CONSTRUCTION PLANNING


UNIT – II SCHEDULING PROCEDURES AND TECHNIQUES


UNIT – III COST CONTROL, MONITORING AND ACCOUNTING


UNIT – IV QUALITY CONTROL AND SAFETY DURING CONSTRUCTION

Quality and Safety Concerns in Construction - Organizing for Quality and Safety - Work and Material Specifications - Total Quality Control - Quality Control by Statistical Methods - Statistical Quality Control with Sampling by Attributes - Statistical Quality Control with Sampling by Variables - Safety

UNIT – V ORGANIZATION AND USE OF PROJECT INFORMATION

Types of Project Information - Accuracy and Use of Information - Computerized Organization and Use of Information - Organizing Information in Databases - Relational Model of Databases - Other Conceptual Models of Databases - Centralized Database Management Systems - Databases and Applications Programs - Information Transfer and Flow.

TOTAL: 45
REFERENCES:

UNIT I  INTRODUCTION 9

Introduction to System Hardware – Languages – Feasibility study and analysis – procurement, training, implementation and system management – procedural language - developing application with spread sheet - developing application with files and database software.

UNIT II  OPTIMIZATION TECHNIQUES 9

Linear, Dynamic and Integer Programming - Branch and Bound Techniques – Application to Production Scheduling, Equipment Replacement, Material Transportation and Work Assignment Problems – Software applications

UNIT III  INVENTORY MODELS 9

Deterministic and Probabilistic Inventory Models - Software applications

UNIT IV  SCHEDULING APPLICATION 9

PERT and CPM - Advanced planning and scheduling concepts – Computer applications – case study.

UNIT V  OTHER PROBLEMS 9

Estimating – project planning and scheduling- accounting and cost engineering – Enterprises – Introduction to ERP systems - operations simulation

TOTAL: 45

REFERENCES:

(A) ADVANCED CONSTRUCTION ENGINEERING LABORATORY

LIST OF EXPERIMENTS

1. Mix design of concrete as per IS, ACI & BS methods for high performance concrete.
2. Flow Characteristics of Self Compacting concrete
3. Effect of minerals and chemical admixtures in concrete at fresh and hardened state with relevance to workability, strength and durability.
4. NDT on hardened concrete - UPV, Rebound hammer and core test.
5. Permeability tests on hardened concrete

TOTAL: 30

LIST OF EQUIPMENTS REQUIREMENTS:

1. Concrete making equipments.
2. Equipments for self-compacting concrete.
3. Workability and slump equipments for HPC & SCC.
4. Equipments for compression testing with very high precision with automated graph
5. NDT equipments - UPV, rebound hammer, core cutting machine (electrically operated)
6. Permeability apparatus
7. Oven (Range 0 to 600 degree C)
**LIST OF EXPERIMENTS**

1. Quantity takeoff, Preparation and delivery of the bid or proposal of an engineering construction project.
2. Design of a simple equipment information system for a construction project.
3. Scheduling of a small construction project using Primavera scheduling systems including reports and tracking.
4. Scheduling of a small construction project using tools like MS project scheduling systems including reports and tracking.
5. Simulation models for project risk analysis.

   **TOTAL: 30**

**LIST OF EQUIPMENTS / SOFTWARES / TOOLS REQUIREMENTS**

1. MS OFFICE
2. QE PRO
3. MS OFFICE SUIT
4. PRIMAVERA POWER USER
5. PRIMAVERA CONTRACTOR STANDARD
6. PERT MASTER
7. PRIMAVERA MONTE CARLO SIMULATION
8. PRIMAVERA EXPEDITION
UNIT I  CONCRETE INGREDIENTS  15
Composition of OPC – Manufacture – Modified Portland Cements – Hydration
Process of Portland Cements – Structure of Hydrated Cement Pastes
Mineral Admixtures – Slags – Pozzolanas and Fillers – Chemical Admixtures –
Soutes – Retarders – Air Entraining Agents – Water Proofing Compounds –
Plasticizers and Super Plasticizers
Aggregates – Properties and testing of fine and course aggregates – combining of
aggregates – Substitute material for aggregates – recent advancements.

UNIT II  SPECIAL CONCRETES  5
Fibre Reinforced Concrete – Self Compacting Concrete – Polymer Concrete – High

UNIT – II  CONCRETE MIX DESIGN  10
Mix Proportioning – Mixes incorporating Fly ash, Silica fume, GGBS – Mixes for High
Performance Concrete – High strength concrete – variations in concrete strength.

UNIT IV  MECHANICAL PROPERTIES OF CONCRETE  7
Interfacial Transition Zone – Fracture Strength – Compressive strength – Tensile
strength - Impact strength - Bond strength.

UNIT V  DURABILITY OF CONCRETE  8
Factors affecting durability – Chemical Attack – Permeability – chloride penetration –
water absorption – creep – Shrinkage.

TOTAL: 45

REFERENCES:
1. Santhakumar.A.R., Concrete Technology, Oxford University press, New
Delhi. 2007.
2. Gambhir.M.L., Concrete Technology – Tata McGraw Hill Book Co. Ltd.,Delhi,
2004.
4. Metha P.K.and Montreio P.J.M., Concrete Structure Properties and
5. Gupta.B.L. and Amit Gupta, Concrete Technology, Standard Publishers
Distributor, New Delhi, 2004.
UNIT I  PLANNING AND SITE EQUIPMENT & PLANT FOR FORM WORK  9

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.


UNIT II  FORM MATERIALS  9


UNIT III  DESIGN OF FORMS AND SHORES  9

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.


UNIT IV  FORMWORK FOR BUILDINGS  9

Location of job mill – Storage – Equipment – Footings – Wall footings – Column footings Sloped footing forms – Curb and gutter forms – Wall forms –Prefabricated panel systems – Giant forms curved wall forms – Column heads – Beam or girder forms – Beam pockets – Suspended forms – Concrete joint construction – Flying system forms.

UNIT V FORMS FOR DOMES AND TUNNELS, SLIP FORMS AND SAFETY

PRACTICES FOR SCAFFOLDS


TOTAL: 45

REFERENCES:

2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996
UNIT I  STRUCTURAL INTEGRATION  

UNIT II  ENVIRONMENTAL FACTORS  
Qualities of enclosure necessary to maintain a specified level of interior environmental quality – weather resistance – Thermal infiltration – Acoustic Control – Transmission reduction – Air quality – Illumination – Relevant systems integration with structural systems.

UNIT III  SERVICES  
Plumbing – Electricity – Vertical circulation and their interaction - HVAC

UNIT – IV  MAINTENANCE  
Component longevity in terms of operation performance and resistance to deleterious forces - Planning systems for least maintenance materials and construction – access for maintenance – Feasibility for replacement of damaged components – equal life elemental design – maintenance free exposed and finished surfaces.

UNIT – V  SAFETY  
Ability of systems to protect fire – Preventive systems – fire escape system design – Planning for pollution free construction environmental – Hazard free Construction execution.

REFERENCES:


TOTAL: 45
UNIT I INTRODUCTION


UNIT II ENVIRONMENTAL


UNIT III DESIGN


UNIT IV SERVICES


UNIT V ENERGY MANAGEMENT


TOTAL: 45
REFERENCES:

UNIT I ROAD MAKING MATERIALS FOR FLEXIBLE AND RIGID PAVEMENTS

Classification, testing and applications of road making aggregates – Road binders – Bitumen - Cement

UNIT II PROPERTIES OF BITUMINOUS MIXTURES

Resistance of bituminous mixtures to permanent deformation – Flexibility and brittleness - Common mechanical tests – Permeability characteristics – Weathering of bituminous road surfacing – Adhesion of bituminous binders to road aggregates – Effect of aggregate size in bituminous courses – Temperature susceptibility of bituminous courses – Design of bituminous mixes.

UNIT III PROPERTIES OF PAVEMENT QUALITY CONCRETE MIXURES AND CONSTRUCTION PRACTICE

Properties of fresh and hardened concrete – laboratory tests – Design of concrete mixes for Pavement Quality Concrete.

Construction of various layers in rigid and flexible pavements – Quality assurance during construction – sampling and analysis.

UNIT IV MACHINERIES

Road making machineries – Road formation, bituminous constructions - Road surface evaluation

UNIT V LATEST ADVANCEMENTS


TOTAL: 45

REFERENCES:

UNIT I THE OWNERS' PERSPECTIVE 9


UNIT II ORGANIZING FOR PROJECT MANAGEMENT 9

Project Management – modern trends - Strategic Planning - 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

UNIT III DESIGN AND CONSTRUCTION PROCESS 9

Design and Construction as an Integrated System - Innovation and Technological Feasibility - Innovation and Economic Feasibility - Design Methodology - Functional Design - Construction Site Environment

UNIT – IV LABOUR, MATERIAL AND EQUIPMENT UTILIZATION 9


UNIT V COST ESTIMATION 9


TOTAL: 45
REFERENCES:

UNIT I  SOIL – POLLUTANT INTERACTION  8


UNIT II  SITE SELECTION AND SAFE DISPOSAL OF WASTE  10


UNIT III  TRANSPORT OF CONTAMINANTS  8


UNIT IV  WASTE STABILIZATION AND DISPOSAL  10


UNIT V  REMEDIATION OF CONTAMINATED SOILS  9


TOTAL: 45
REFERENCES:

UNIT I OPERATIONS RESEARCH

Introduction to Operations Research - Linear Programming – Graphical and Simplex Methods, Duality and Post – Optimality Analysis – Transportation and Assignment Problems

UNIT II PRODUCTION MANAGEMENT

Inventory Control - EOQ - Quantity Discounts - Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control

UNIT III FINANCIAL MANAGEMENT


UNIT IV DECISION THEORY

Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory

UNIT V MANAGERIAL ECONOMICS

Cost Concepts – Break-even analysis – Pricing Techniques – Game theory Applications

TOTAL: 45

REFERENCES:

UNIT I MANPOWER PLANNING    10
Manpower Planning, Organising, Staffing, directing, and controlling – Personnel Principles

UNIT II ORGANISATION    10

UNIT III HUMAN BEHAVIOUR    10
Introduction to the field of people management - basic individual psychology; motivation - Job design and performance management - Managing groups at work - self-managing work teams - intergroup behaviour and conflict in organisations – Leadership - Behavioural aspects of decision-making; and communication for people management

UNIT IV WELFARE MEASURES    5

UNIT V MANAGEMENT AND DEVELOPMENT METHODS    10

TOTAL: 45

REFERENCES:

UNIT I  ECONOMICS


UNIT II  CONSTRUCTION ECONOMICS


UNIT III  FINANCING


UNIT IV  ACCOUNTING METHOD

General Overview – Cash basis of a accounting – Accrual basis of accounting – Percentage completion method – Completed contract method – Accounting for tax reporting purposes and financial reporting purposes – Accounting Standards

UNIT V LENDING TO CONTRACTORS


TOTAL: 45

REFERENCES:

UNIT I QUALITY MANAGEMENT 9


UNIT II QUALITY SYSTEMS 9


UNIT III QUALITY PLANNING 9


UNIT IV QUALITY ASSURANCE AND CONTROL 9

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 - Reliability testing, reliability coefficient and reliability prediction.

UNIT V QUALITY IMPROVEMENT TECHNIQUES 9

Selection of new materials - Influence of drawings, detailing, specification, standardization - Bid preparation - Construction activity, environmental safety, social and environmental factors - Natural causes and speed of construction - Life cycle costing - Value engineering and value analysis.

TOTAL: 45
REFERENCES:

UNIT I  BUCKLING OF COLUMNS  12

UNIT II  BUCKLING OF BEAM-COLUMNS AND FRAMES  9
Theory of beam column - Stability analysis of beam column with single and several concentrated loads, distributed load and end couples Analysis of rigid jointed frames with and without sway - Moment distribution - Slope deflection and stiffness method.

UNIT III  TORSIONAL AND LATERAL BUCKLING  9
Torsional buckling - Torsional and flexural buckling - Local buckling. Buckling of Open Sections. Numerical solutions.Lateral buckling of beams, pure bending of simply supported beam and cantilever,

UNIT IV  BUCKLING OF PLATES  9
Governing differential equation - Buckling of thin plates, various edge conditions - Analysis by equilibrium and energy approach - Approximate and Numerical techniques

UNIT V  INELASTIC BUCKLING  6
Double modulus theory - Tangent modulus theory - Shanley’s model - Eccentrically loaded inelastic column. Inelastic buckling of plates - Post buckling behaviour of plates

TOTAL: 45

REFERENCES:
UNIT I RESOURCE PLANNING 10
Resource Planning, Procurement, Identification, Personnel, Planning for material, Labour, time schedule and cost control, Types of resources, manpower, Equipment, Material, Money, Time.

UNIT II LABOUR MANAGEMENT 5
Systems approach, Characteristics of resources, Utilization, measurement of actual resources required, Tools for measurement of resources, Labour, Classes of Labour, Cost of Labour, Labour schedule, optimum use Labour.

UNIT III MATERIALS AND EQUIPMENT 10
Material: 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 MANAGEMENT 10
Personnel time, Management and planning, managing time on the project, forecasting the future, Critical path measuring the changes and their effects - Cash flow and cost control

UNIT V RESOURCE ALLOCATION AND LEVELLING 10
Time-cost trade off, Computer application - resource leveling, resource list, resource allocation, Resource loading, Cumulative cost - Value Management.

TOTAL: 45

REFERENCES:
UNIT I  CONSTRUCTION ACCIDENTS  10

Accidents and their Causes – Human Factors in Construction Safety - Costs of Construction Injuries – Occupational and Safety Hazard Assessment – Legal Implications

UNIT II  SAFETY PROGRAMMES  10


UNIT III  CONTRACTUAL OBLIGATIONS  5

Safety in Construction Contracts – Substance Abuse – Safety Record Keeping

UNIT IV  DESIGNING FOR SAFETY  15


UNIT V  OWNERS’ AND DESIGNERS’ OUTLOOK  5

TOTAL: 45

REFERENCES:

3. Tamilnadu Factory Act, Department of Inspectorate of factories, Tamil nadu.
UNIT I  INTRODUCTION  7


UNIT II  SYSTEM DEVELOPMENT  8

Modern Information System - System Development Life Cycle - Structured Methodologies - Designing Computer Based Methods, Procedures, Control - Designing Structured Programs.

UNIT III  INFORMATION SYSTEMS  10


UNIT IV  IMPLEMENTATION AND CONTROL  10


UNIT V  SYSTEM AUDIT  10


TOTAL: 45

REFERENCES:

UNIT I MAINTENANCE AND REPAIR STRATEGIES 8

Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.

UNIT II SERVICEABILITY AND DURABILITY OF CONCRETE 8

Quality assurance for concrete construction concrete properties- strength, permeability, thermal properties and cracking. - Effects due to climate, temperature, chemicals, corrosion - design and construction errors - Effects of cover thickness and cracking

UNIT III MATERIALS AND TECHNIQUES FOR REPAIR 15

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement and polymers coating for rebars loadings from concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels and cathodic protection.

UNIT IV REPAIRS TO STRUCTURES 10

Repair of structures distressed due to earthquake – Strengthening using FRP-Strengthening and stabilization techniques for repair.

UNIT V DEMOLITION OF STRUCTURES 4

Engineered demolition techniques for structures - case studies

TOTAL: 45

REFERENCES: