ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
REGULATIONS - 2009
M.E. CONSTRUCTION ENGINEERING AND MANAGEMENT
I TO VI SEMESTERS (PART TIME) CURRICULUM AND SYLLABUS

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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OBJECTIVE:
- To study and understand the concepts of statistical methods and queuing theory and its applications

UNIT I
**ONE DIMENSIONAL RANDOM VARIABLE**

UNIT II
**ESTIMATION THEORY**

UNIT III
**TESTING OF HYPOTHESES**
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**
Analysis of variance – One-way and two-way classifications – Completely randomized design – Randomized block design – Latin square design.

UNIT V
**QUEUEING MODELS**

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

REFERENCES:
UNIT II METALS 10
Steels - New Alloy Steels – Aluminum and its Products – Coatings to reinforcement – Applications.

UNIT III COMPOSITES 10
Plastics – Reinforced Polymers – FRP – Applications

UNIT IV OTHER MATERIALS 10
Water Proofing Compounds – Non-weathering Materials – Flooring and Facade Materials

UNIT V SMART AND INTELLIGENT MATERIALS 5
Smart and Intelligent Materials for intelligent buildings - Special features

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.

TOTAL: 45 PERIODS

CN 9202 CONSTRUCTION EQUIPMENT L T P C 3 0 0 3

OBJECTIVE:
- To study and understand the various types of equipment and its applications in construction project

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

REFERENCES:

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 waterproofing, underpinning, crack stabilization techniques.

TOTAL: 45 PERIODS
UNIT V DEMOLITION
Advanced techniques and sequence in demolition and dismantling.

REFERENCES:

CN 9222 CONTRACT LAWS AND REGULATIONS

OBJECTIVE:
- To study the various types of construction contracts and their legal aspects and provisions

UNIT I CONSTRUCTION CONTRACTS

UNIT II TENDERS

UNIT III ARBITRATION

UNIT IV LEGAL REQUIREMENTS

UNIT V LABOUR REGULATIONS

TOTAL: 45 PERIODS
REFERENCES:

CN 9223 CONSTRUCTION PLANNING, SCHEDULING AND CONTROL L T P C
3 0 0 3

OBJECTIVE:
- To study and understand the concept of scheduling and the techniques necessary for construction project

UNIT I CONSTRUCTION PLANNING 9

UNIT II SCHEDULING PROCEDURES AND TECHNIQUES 9

UNIT III COST CONTROL, MONITORING AND ACCOUNTING 9

UNIT IV QUALITY CONTROL AND SAFETY DURING CONSTRUCTION 9
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 9
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 PERIODS
REFERENCES:

CN 9203 PROJECT FORMULATIONS AND APPRAISAL

OBJECTIVE:
- To study and understand the formulation, costing of construction projects and techniques of project appraisal.

UNIT I PROJECT FORMULATION

UNIT II PROJECT COSTING
- Project Cash Flows – Time Value of Money – Cost of Capital

UNIT III PROJECT APPRAISAL

UNIT IV PROJECT FINANCING
- Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators - Ratios

UNIT V PRIVATE SECTOR PARTICIPATION
- Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer

TOTAL: 45 PERIODS

REFERENCES:
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan India Ltd., 1992
OBJECTIVE:

- To study and understand the hardware and software requirements of computer, programming and scheduling techniques applied to construction engineering.

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 PERIODS

REFERENCES:

(A) ADVANCED CONSTRUCTION ENGINEERING LABORATORY

OBJECTIVE:

- This course provides a thorough knowledge of material selection through the material testing based on specification.

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 PERIODS
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)

(B) ADVANCED COMPUTING TECHNIQUES LABORATORY

OBJECTIVE:
1. This course gives an exposure to students in utilizing the sophisticated Spread sheets programs, Estimation Software and other package programs

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 PERIODS

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

CN 9251 ADVANCED CONCRETE TECHNOLOGIES L T P C
3 0 0 3

OBJECTIVE:
- To study the properties of materials, tests and mix design for concrete.

UNIT I CONCRETE MAKING MATERIALS 9

UNIT II CONCRETE 9
UNIT III MIX DESIGN
Principles of concrete mix design, Methods of concrete mix design, Testing of Concrete. Statistical quality control- sampling and acceptance criteria.

UNIT IV SPECIAL CONCRETE

UNIT V CONCRETING METHODS

TOTAL : 45 PERIODS

REFERENCES:

CN 9252 SHORING, SCAFFOLDING AND FORMWORK

OBJECTIVE:
- To study and understand the various types of scaffolding, formworks, shoring methods and techniques

UNIT I PLANNING AND SITE EQUIPMENT & PLANT FOR FORM WORK
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

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  9

REFERENCES:
2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996

TOTAL: 45 PERIODS
UNIT II  ENVIRONMENTAL FACTORS  9

UNIT III  SERVICES  9
Plumbing – Electricity – Vertical circulation and their interaction - HVAC

UNIT IV  MAINTENANCE  9
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  9
Ability of systems to protect fire – Preventive systems – fire escape system design – Planning for pollution free construction environmental – Hazard free Construction execution.

REFERENCES:

CN 9254  ENERGY CONSERVATION TECHNIQUES IN BUILDING CONSTRUCTION  L T P C  3 0 0 3

OBJECTIVE:
• To study the various energy saving and management techniques applied to building and construction with relevance to environment

UNIT I  INTRODUCTION  6

UNIT II  ENVIRONMENTAL  7
UNIT III  DESIGN

UNIT IV  SERVICES

UNIT V  ENERGY MANAGEMENT

TOTAL: 45 PERIODS

REFERENCES:

CN 9255  CONSTRUCTION OF PAVEMENTS  L T P C
3 0 0 3

OBJECTIVE:
- To study the properties of flexible and rigid pavement

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  8
Road making machineries – Road formation, bituminous constructions - Road surface evaluation

UNIT V  LATEST ADVANCEMENTS  7

TOTAL: 45 PERIODS

REFERENCES:

CN 9256  CONSTRUCTION PROJECT MANAGEMENT  L T P C
3 0 0 3

OBJECTIVE:
- To study the various management techniques for successful completion of construction project

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-Builders 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

REFERENCES:

CN 9257  QUANTITATIVE TECHNIQUES IN MANAGEMENT  L T P C  3 0 0 3

OBJECTIVE:
- To study the various quantitative methods applied to the elements of management

UNIT I  OPERATIONS RESEARCH  12
Introduction to Operations Research - Linear Programming – Graphical and Simplex Methods, Duality and Post – Optimality Analysis – Transportation and Assignment Problems

UNIT II  PRODUCTION MANAGEMENT  12
Inventory Control - EOQ - Quantity Discounts - Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control

UNIT III  FINANCIAL MANAGEMENT  7

UNIT IV  DECISION THEORY  7
Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory

UNIT V  MANAGERIAL ECONOMICS  7
Cost Concepts – Break-even analysis – Pricing Techniques – Game theory Applications

REFERENCES:
OBJECTIVE:

- To study the various aspects of manpower management in construction

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

UNIT II ORGANISATION

UNIT III HUMAN BEHAVIOUR
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

UNIT V MANAGEMENT AND DEVELOPMENT METHODS

REFERENCES:

TOTAL: 45 PERIODS
UNIT II  CONSTRUCTION ECONOMICS  10

UNIT III  FINANCING  13

UNIT IV  ACCOUNTING METHOD  6
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  6

REFERENCES:

CN 9260  QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION  L T P C 3 0 0 3

OBJECTIVE:
- To study the concepts of quality and assurance and control techniques in construction

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 PERIODS

REFERENCES:

CN 9261  RESOURCE MANAGEMENT AND CONTROL  L T P C
IN CONSTRUCTION  3 0 0 3

OBJECTIVE:
- To study the management of various resources involved in construction

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.

REFERENCES:

CN 9262 PROJECT SAFETY MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:
- To study and understand the various safety concepts, requirements applied to construction projects

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 OWNER’S AND DESIGNER’S OUTLOOK 5
Owner’s responsibility for safety – Owner preparedness – Role of designer in ensuing safety – Safety clause in design document.

TOTAL: 45 PERIODS
REFERENCES:
3. Tamilnadu Factory Act, Department of Inspectorate of factories, Tamil Nadu.

**CN 9263** MANUFACTURING INFORMATION SYSTEM **L T P C** 3 0 0 3

**OBJECTIVE:**
- To study the concepts of information systems and their general applications

**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

**REFERENCES:**
OBJECTIVE:
To study the design of energy efficient buildings which balances all aspects of energy, lighting, space conditioning and ventilation by providing a mix of passive solar design strategies and to learn the use of materials with low embodied energy.

UNIT I  INTRODUCTION

UNIT II  PASSIVE SOLAR HEATING AND COOLING

UNIT III  DAYLIGHTING AND ELECTRICAL LIGHTING

UNIT IV  HEAT CONTROL AND VENTILATION

UNIT V  DESIGN FOR CLIMATIC ZONES

TOTAL: 45 PERIODS

REFERENCES:
ST 9257 MAINTENANCE AND REHABILITATION OF STRUCTURES

OBJECTIVE:

- To study the damages, repair and rehabilitation of structures.

UNIT I MAINTENANCE AND REPAIR STRATEGIES

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

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

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

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

UNIT V DEMOLITION OF STRUCTURES

Engineered demolition techniques for structures - case studies

TOTAL: 45 PERIODS

REFERENCES:

The Scotch Whisky Regulations 2009 (Citation 2009, No. 2890; SWR) is a Statutory Instrument that regulates the production, labelling, advertising and packaging of Scotch whisky. The regulations were laid before the Parliament of the United Kingdom on 30 October 2009, and came into force on 23 November 2009. A blended whiskey (or blended whisky) is the product of blending different types of whiskeys and sometimes also neutral grain spirits, colorings, and flavorings. Commission Regulation (EC) No 29/2009 of 16 January 2009 laying down requirements on data link services for the Single European Sky - text published in the Official Journal of the European Union. The Regulation aims to improve the efficiency of communications between pilots and controllers by establishing requirements for the coordinated introduction of data link services in Europe based on air-ground point-to-point data communications. The Scotch Whisky Regulations 2009 (Citation 2009, No. 2890) is a Statutory Instrument that regulates the production, labelling, advertising and packaging of Scotch whisky. The regulations were laid before the Parliament of the United Kingdom on 30 October 2009, and came into force on 23 November 2009. A friar named John Cor was the distiller at Lindores Abbey in the Kingdom of Fife, many Scotch whisky drinkers will refer to a unit for drinking as a dram. As of 23 November