M.E. CONSTRUCTION ENGINEERING AND MANAGEMENT

OBJECTIVES:
- To train the students with the latest and the best in the rapidly changing fields of Construction Engineering, Technology and Management.
- To prepare the students to be industry leaders who implement the best engineering and management practices and technologies in the construction industry.
- To continually work with industry to enhance the program's effectiveness and the opportunities for innovation in the construction industry.
- To conduct research to develop advanced technologies and management approaches.

OUTCOMES:
On successful completion of the programme, the students will
- Be able to apply theoretical and practical aspects of project management techniques to achieve project goals.
- Possess organizational and leadership capabilities for effective management of construction projects.
- Be able to apply knowledge and skills of modern construction practices and techniques.
- Have necessary knowledge and skills in accounting, financing, risk analysis and contracting.
- Be capable of using relevant software packages for planning, scheduling, executing and controlling of construction projects.
UNIVERSITY DEPARTMENTS
ANNA UNIVERSITY :: CHENNAI 600 025
REGULATIONS 2013
M.E CONSTRUCTION ENGINEERING AND MANAGEMENT
CURRICULUM AND SYLLABUS I TO IV SEMESTERS (FULL TIME)

**SEMESTER I**

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OBJECTIVE:

- To study and understand the various types of equipments used for earthwork, tunneling, drilling, blasting, dewatering, material handling conveyors and its applications in construction projects.

UNIT I  CONSTRUCTION EQUIPMENTS AND MANAGEMENT  9

UNIT II  EQUIPMENT FOR EARTHWORK  9

UNIT III OTHER CONSTRUCTION EQUIPMENT  9

UNIT IV ASPHALT AND CONCRETE PLANTS  9

UNIT V MATERIALS HANDLING EQUIPMENT  9
Forklifts and related equipment - Portable Material Bins – Material Handling Conveyors – Material Handling Cranes- Industrial Trucks.

OUTCOME:

- At the end of this course students will be able to know various types of equipments to be used in the constructions projects.

REFERENCES:
UNIT I  SPECIAL CONCRETES  9
Concretes, Behaviour of concretes – Properties and Advantages of High Strength and High
Performance Concrete – Properties and Applications of Fibre Reinforced Concrete, Self
compacting concrete, Alternate Materials to concrete on high performance & high Strength
concrete.

UNIT II  METALS  9
Types of Steels – Manufacturing process of steel – Advantages of new alloy steels – Properties
and advantages of aluminium and its products – Types of Coatings & Coatings to reinforcement –
Applications of Coatings.

UNIT III  COMPOSITES  9
Types of Plastics – Properties & Manufacturing process – Advantages of Reinforced polymers –
Types of FRP – FRP on different structural elements – Applications of FRP.

UNIT IV  OTHER MATERIALS  9
Types and properties of Water Proofing Compounds – Types of Non-weathering Materials and its
uses – Types of Flooring and Facade Materials and its application.

UNIT V  SMART AND INTELLIGENT MATERIALS  9
Types & Differences between Smart and Intelligent Materials – Special features –Case studies
showing the applications of smart & Intelligent Materials.

TOTAL : 45 PERIODS

OUTCOME:
- On completion of this course the students will have the knowledge of modern construction
materials to be used in the field.

REFERENCES:
1. ACI Report 440.2R-02, “Guide for the design and construction of externally bonded RP
systems for strengthening concrete structures”, American Concrete Institute, 2002.
3. Ashby, M.F. and Jones,D.R.H.H. "Engineering Materials 1: An introduction to Properties,
4. Deucher, K.N, Korfiatis, G.P and Ezeldin, A.S, "Materials for civil and Highway Engineers",
5. Mamlouk, M.S. and Zaniewski, J.P., "Materials for Civil and Construction Engineers",

CN8103  PROJECT FORMULATION AND APPRAISAL  L T P C
3 0 0 3

OBJECTIVE:
- To study and understand the formulation, costing of construction projects, appraisal,
finance and private sector participation.

UNIT I  PROJECT FORMULATION  9
Project – Concepts – Capital investments - Generation and Screening of Project Ideas - Project
identification – Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Pre-
Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report,
Detailed Project Report – Different Project Clearances required.
UNIT II PROJECT COSTING

UNIT III PROJECT APPRAISAL

UNIT IV PROJECT FINANCING

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

OUTCOME:
- On completion of this course the students will be able to know the formulations of projects, projects costing, appraisal and financing.

REFERENCES:

MA8161 STATISTICAL METHODS FOR ENGINEERS

OBJECTIVES:
- To study and understand the concepts of Statistical methods and its applications in Engineering.
- To study the effect of estimation theory, testing of hypothesis, correlation and regression, randomized design, and multivariate analysis.

UNIT I ESTIMATION THEORY

UNIT II TESTING OF HYPOTHESIS
Tests based on Normal, t, $X^2$ and F distributions for testing of means, variance and proportions – Analysis of $r x c$ tables – Goodness of fit.

UNIT III CORRELATION AND REGRESSION
Multiple and Partial Correlation – Method of Least Squares – Plane of Regression – Properties of Residuals – Coefficient of multiple correlation – Coefficient of partial correlation – Multiple correlation with total and partial correlations – Regression and Partial correlations in terms of lower order co-efficient.
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  MULTIVARIATE ANALYSIS  9+3

OUTCOME:
• On completion of this course the students will be able to solve various problems in the field of engineering employing probability and statistical methods.

REFERENCES:

CN8201 ADVANCED CONSTRUCTION ENGINEERING AND COMPUTING TECHNIQUES LABORATORY 0 0 4 2

(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.
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 – Demonstration

OUTCOMES:
• On completion of this laboratory course students will be able to test the concrete mixes designed as per IS, ACI and BS methods.
• Students will also be able to know various tests on hardened concrete.
(B) ADVANCED COMPUTING TECHNIQUES LABORATORY

OBJECTIVE:
- 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.

OUTCOME:
- On completion of this laboratory course the students will be able to do the scheduling of constructions projects using tools primavera and MS projects.

TOTAL : 30 PERIODS

CN8202 ADVANCED CONSTRUCTION TECHNIQUES L T P C 3 0 0 3

OBJECTIVE:
- To study and understand the latest construction techniques applied to engineering construction for sub structure, super structure, special structures, rehabilitation and strengthening techniques and demolition techniques.

UNIT I SUB STRUCTURE CONSTRUCTION 9
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 for underground open excavation.

UNIT II SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS 9
Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in-situ prestressing in high rise structures, Post tensioning of slab- aerial transporting – Handling and erecting lightweight components on tall structures.

UNIT III CONSTRUCTION OF SPECIAL STRUCTURES 9
Erection of lattice towers - 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 – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks.

UNIT IV REHABILITATION AND STRENGTHENING TECHNIQUES 9
UNIT V  DEMOLITION
Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

TOTAL : 45 PERIODS

OUTCOME:
• On completion of this course the students will know the modern construction techniques to be used in the construction of buildings and special structures and also rehabilitation and strengthening techniques and demolition.

REFERENCES:
1. Jerry Irvine, Advanced Construction Techniques, CA Rocketr, 1984

CN8203  COMPUTER APPLICATIONS IN CONSTRUCTION  ENGINEERING AND PLANNING
L T P C  2 0 2 3

OBJECTIVE:
• To study and understand the hardware and software requirements of computer, programming, optimization techniques, inventory models and scheduling techniques applied to construction engineering.

UNIT I  INTRODUCTION
Overview of IT Applications in Construction – Construction process – Computerization in Construction – Computer aided Cost Estimation – Developing application with database software.

UNIT II  OPTIMIZATION TECHNIQUES
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
Deterministic and Probabilistic Inventory Models - Software applications.

UNIT IV  SCHEDULING APPLICATION
PERT and CPM - Advanced planning and scheduling concepts – Computer applications – Case study.

UNIT V  OTHER PROBLEMS
Sequencing problems – Simulation – Enterprises – Introduction to ERP systems.

TOTAL (L:30+P:30) : 60 PERIODS

OUTCOME:
• On completion of this course the students will know the computer applications in construction, different optimization techniques and sequencing problems.
REFERENCES:

CN8204 CONSTRUCTION PLANNING, SCHEDULING AND CONTROL L T P C
3 0 0 3

OBJECTIVE:
- To study and understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information 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

UNIT V ORGANIZATION AND USE OF PROJECT INFORMATION 9

TOTAL : 45 PERIODS

OUTCOME:
- On completion of this course the students will know the development of construction planning, scheduling procedure and controls.
REFERENCES:

CN8205 CONTRACT LAWS AND REGULATIONS

OBJECTIVES:
- To study the various types of construction contracts and their legal aspects and provisions.
- To study the of tenders, arbitration, legal requirement, and labour regulations.

UNIT I CONSTRUCTION CONTRACTS

UNIT II TENDERS

UNIT III ARBITRATION

UNIT IV LEGAL REQUIREMENTS

UNIT V LABOUR REGULATIONS

TOTAL : 45 PERIODS

OUTCOME:
- On completion of this course the students will know different types of contracts in construction, arbitration and legal aspect and its provisions.

REFERENCES:
1. Gajaria G.T., "Laws Relating to Building and Engineering" Contracts in India,

CN8311 PRACTICAL TRAINING

OBJECTIVES:
- To train the students in the field work so as to have a firsthand knowledge of practical problems related to Construction Management in carrying out engineering tasks.
- To develop skills in facing and solving the problems experiencing in the field.

SYLLABUS:
The students individually undertake training in reputed engineering companies doing construction during the summer vacation for a specified duration of four weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

CN8312 PROJECT WORK PHASE I

OBJECTIVES:
- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To develop the methodology to solve the identified problem.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

SYLLABUS:
The student individually works on a specific topic approved by the head of the division under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of construction engineering and management. The topic may be theoretical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 180 PERIODS

OUTCOME:
- At the end of the course the students will have a clear idea of his/her area of work and they are in a position to carry out the remaining phase II work in a systematic way.

CN8313 SEMINAR

OBJECTIVES:
- To work on a specific technical topic in Construction Engineering and Management in order to acquire the skills of oral presentation.
- To acquire technical writing abilities for seminars and conferences.
SYLLABUS:
The students will work for two hours per week guided by a group of staff members. They will be asked to talk on any topic of their choice related to construction engineering and management and to engage in dialogue with the audience. A brief copy of their talk also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will also answer the queries on the topic. The students as audience also should interact. Evaluation will be based on the technical presentation and the report and also on the interaction during the seminar.

TOTAL: 30 PERIODS

CN8411 PROJECT WORK PHASE II

OBJECTIVES:
- To solve the identified problem based on the formulated methodology.
- To develop skills to analyze and discuss the test results, and make conclusions.

SYLLABUS:
The student should continue the phase I work on the selected topic as per the formulated methodology under the same supervisor. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 360 PERIODS

OUTCOME:
- On completion of the project work students will be in a position to take up any challenging practical problems in the field of construction engineering and management and find better solutions to it.

CN8001 CONSTRUCTION PERSONNEL MANAGEMENT

OBJECTIVE:
- To study the various aspects of manpower management such as man power planning, organization, human relations, welfare and development methods in construction.

UNIT I MANPOWER PLANNING

UNIT II ORGANISATION

UNIT III HUMAN RELATIONS AND ORGANISATIONAL BEHAVIOUR
Basic individual psychology – Approaches to job design and job redesign – Self managing work teams – Intergroup – Conflict in organizations – Leadership-Engineer as Manager – al aspects of decision making – Significance of human relation and organizational – Individual in organization – Motivation – Personality and creativity – Group dynamics, Team working – Communication and negotiation skills.
UNIT IV  WELFARE MEASURES  9

UNIT V  MANAGEMENT AND DEVELOPMENT METHODS  9

TOTAL : 45 PERIODS

OUTCOME:
- On completion of this course the students will know various processes in manpower planning, organizational and welfare measures.

REFERENCES:
UNIT IV  LABOUR, MATERIAL AND EQUIPMENT UTILIZATION  9

UNIT V  COST ESTIMATION  9

OUTCOME:
- On completion of this course the students will be able to know the modern trends in project management viz. design, construction, resource utilisation and cost estimation.

REFERENCES:

CN8003  DESIGN OF ENERGY EFFICIENT BUILDINGS  L T P C
                                                3 0 0 3

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  9

UNIT II  PASSIVE SOLAR HEATING AND COOLING  9
UNIT III  DAYLIGHTING AND ELECTRICAL LIGHTING  9

UNIT IV  HEAT CONTROL AND VENTILATION  9

UNIT V  DESIGN FOR CLIMATIC ZONES  9

TOTAL : 45 PERIODS

OUTCOME:
- On completion of this course the students will be able to know various components which makes the building energy efficient such as lighting, space conditioning, heat control and energy efficient.

REFERENCES:

CN8004  ECONOMICS AND FINANCE MANAGEMENT IN CONSTRUCTION  L T P C
3 0 0 3

OBJECTIVE:
- To study the concepts of Construction Economic and Finance such as comparing alternatives proposals, evaluating alternative investments, management of funds, and management of accounting.

UNIT I  BASIC PRINCIPLES  9
Time Value of Money – Cash Flow diagram – Nominal and effective interest- continuous interest. Single Payment Compound Amount Factor (P/F, F/P) – Uniform series of Payments (F/A, A/F, F/P, A/P)– Problem time zero (PTZ)- equation time zero (ETZ). Constant increment to periodic payments – Arithmetic Gradient(G), Geometric Gradient (C).
UNIT II  COMPARING ALTERNATIVES PROPOSALS  
Comparing alternatives- Present Worth Analysis, Annual Worth Analysis, Future Worth Analysis, Rate of Return Analysis (ROR) and Incremental Rate of Return (IROR) Analysis, Benefit/Cost Analysis, Break Even Analysis.

UNIT III  EVALUATING ALTERNATIVE INVESTMENTS  
Real Estate - Investment Property, Equipment Replace Analysis, Depreciation – Tax before and after depreciation – Value Added Tax (VAT) – Inflation.

UNIT IV  FUNDS MANAGEMENT  

UNIT V  FUNDAMENTALS OF MANAGEMENT ACCOUNTING  

TOTAL : 45 PERIODS

OUTCOME:
• On completion of this course the students will be able to know the concepts in economics and finance in constructions.

REFERENCES:

CN8005  MANAGEMENT INFORMATION SYSTEMS  L T P C  3 0 0 3

OBJECTIVE:
• To study the concepts of information systems and their applications, system development and information systems, implementation and control, and system audit.

UNIT I  INTRODUCTION  

UNIT II  SYSTEM DEVELOPMENT  

UNIT III  INFORMATION SYSTEMS  
UNIT IV IMPLEMENTATION AND CONTROL

UNIT V SYSTEM AUDIT

OUTCOME:
- On completion of this course the students will be able to know the various applications of information systems in management.

REFERENCES:

CN8006 PROJECT SAFETY MANAGEMENT

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<td>To study and understand the various safety concepts and requirements applied to construction projects.</td>
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<td>To study the of construction accidents, safety programmes, contractual obligations, and design for safety.</td>
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UNIT I CONSTRUCTION ACCIDENTS

UNIT II SAFETY PROGRAMMES

UNIT III CONTRACTUAL OBLIGATIONS
Safety in Construction Contracts – Substance Abuse – Safety Record Keeping.

UNIT IV DESIGNING FOR SAFETY

UNIT V OWNERS’ AND DESIGNERS’ OUTLOOK
Owner’s responsibility for safety – Owner preparedness – Role of designer in ensuring safety – Safety clause in design document.

TOTAL : 45 PERIODS
OUTCOME:
- On completion of this course the students will be able to know various constructions safety concepts.

REFERENCES:
2. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and

CN8007 QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION

OBJECTIVES:
- To study the concepts of quality assurance and control techniques in construction.
- To study the of design philosophy, design of special elements, flat slabs and yield line based design, and ductile detailing.

UNIT I QUALITY MANAGEMENT

UNIT II QUALITY SYSTEMS

UNIT III QUALITY PLANNING

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 – Reliability testing, reliability coefficient and reliability prediction.

UNIT V QUALITY IMPROVEMENT TECHNIQUES
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

OUTCOME:
- On completion of this course the students will be able to know the quality control aspects in planning, systems, management, assurance and improvement techniques.

REFERENCES:

CN8008 QUANTITATIVE TECHNIQUES IN MANAGEMENT

OBJECTIVES:

- To study the various quantitative methods applied to the elements of management.
- To study the effect of production management, finance management, decision theory and managerial economics.

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

UNIT III FINANCIAL MANAGEMENT

UNIT IV DECISION THEORY

UNIT V MANAGERIAL ECONOMICS

TOTAL : 45 PERIODS

OUTCOME:

- On completion of this course the students will be able to know operations research, production management, financial management and cost concepts.

REFERENCES:
OBJECTIVES:
- To study the management and control of various resources involved in construction.
- To study the effect of resource planning, labour management, material and equipment, time management, and resource allocation and resource leveling 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 LABOUR MANAGEMENT
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
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
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

OUTCOME:
- On completion of this course the students will be able to know resource planning, management, allocation and resource leveling in construction.

REFERENCES:
4. Oxley Rand Poslcit, "Management Techniques applied to the Construction"
UNIT I  PLANNING, SITE EQUIPMENT & PLANT FOR FORM WORK
9
Introduction - Forms for foundations, columns, beams walls etc., General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples. Overall Planning - Detailed planning - Standard units - Corner units - Pass units - Calculation of labour constants - Formwork hours - Labour Requirement - Overall programme - Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant - Formwork beams - Scaffold frames - Framed panel formwork - Formwork accessories.

UNIT II  MATERIALS ACCESSORIES PROPRIETARY PRODUCTS & PRESSURES
9

UNIT III  DESIGN OF FORMS AND SHORES
9
Basic simplification - Beam formulae - Allowable stresses - Deflection, Bending - Lateral stability - Shear, Bearing - Design of Wall forms - Slab forms - Beam forms - Column forms - Examples in each. Simple wood stresses - Slenderness ratio - Allowable load vs length behaviour of wood shores - Form lining Design Tables for Wall formwork - Slab Formwork - Column Formwork - Slab props - Stacking Towers - Free standing and restrained - Rosett Shoring - Shoring Tower - Heavy Duty props.

UNIT IV  BUILDING AND ERECTING THE FORM WORK
9
Carpentry Shop and job mill - Forms for Footings - Wall footings - Column footings - Sloped footing forms - Strap footing - Stepped footing - Slab form systems - Sky deck and Multiflex - Customized slab table - Standard Table module forms - Swivel head and uniportal head - Assembly sequence - Cycling with lifting fork - Moving with table trolley and table prop. Various causes of failures - ACI - Design deficiencies - Permitted and gradual irregularities.

UNIT V  FORMS FOR DOMES AND TUNNELS, SLIP FORMS AND SCAFFOLDS
9
Hemispherical, Parabolic, Translational shells - Typical barrel vaults Folded plate roof details - Forms for Thin Shell roof slabs design considerations - 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 - Bulk head method - Pressures on tunnels - Continuous Advancing Slope method - Form construction - Shafts. Slip Forms - 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 - Types of scaffolds - Putlog and independent scaffold -Single pole scaffolds - Truss suspended - Gantry and system scaffolds.

TOTAL: 45 PERIODS

OUTCOME:
- On completion of this course the students will be able to know the detailed planning of framework, design of forms and erection of form work.

REFERENCES:
2. Hurd, M.K., "Formwork for Concrete", Special Publication No.4, American Concrete Institute, Detroit, 1996.
OBJECTIVE:
- To study and understand the construction system integration, environmental factors, services, maintenance and safety systems.

UNIT I  STRUCTURAL INTEGRATION  9

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.

OUTCOME:
- On completion of this course the students will be able to know various Structural systems, Services, Safety and Maintenance requirements in construction.

REFERENCES:

OBJECTIVE:
- To study the properties of concrete making materials, tests, mix design, special concretes and various methods for making concrete.

UNIT I  CONCRETE MAKING MATERIALS  9
UNIT II TESTS ON CONCRETE

UNIT III MIX DESIGN

UNIT IV SPECIAL CONCRETE

UNIT V CONCRETING METHODS

TOTAL : 45 PERIODS

OUTCOME:
• On completion of this course the students will know various tests on fresh, hardened concrete, special concrete and the methods of manufacturing of concrete.

REFERENCES: