

**AFFILIATED INSTITUTIONS
ANNA UNIVERSITY, CHENNAI
REGULATION - 2009**

**M.E. CONSTRUCTION ENGINEERING AND MANAGEMENT
II TO IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS**

SEMESTER II

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	CN 9221	<u>Advanced Construction Techniques</u>	3	0	0	3
2	CN 9222	<u>Contract Laws and Regulations</u>	3	0	0	3
3	CN 9223	<u>Construction Planning, Scheduling and Control</u>	3	0	0	3
4	CN 9224	<u>Computer Applications in Construction Engineering and Planning</u>	2	0	2	3
5		Elective III	3	0	0	3
6		Elective IV	3	0	0	3
PRACTICAL						
7	CN 9225	<u>Advanced Construction Engineering and Computing Techniques Laboratory</u>	0	0	4	2
TOTAL			17	0	6	20

SEMESTER III

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	CN 9231	Practical Training (4 Weeks)	0	0	0	1
2	CN 9232	Project Work (Phase I)	0	0	6	3
3		Elective V	3	0	0	3
4		Elective VI	3	0	0	3
5		Elective VII	3	0	0	3
6	CN 9233	Seminar	0	0	2	1
TOTAL			9	0	8	14

SEMESTER IV

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	CN 9241	Project Work (Phase II)	0	0	30	15
TOTAL			0	0	30	15

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE: 68

ELECTIVES FOR M.E. CONSTRUCTION ENGINEERING AND MANAGEMENT

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	CN 9251	<u>Advanced Concrete Technology</u>	3	0	0	3
2	CN 9252	<u>Shoring, Scaffolding and Formwork</u>	3	0	0	3
3	CN 9253	<u>System Integration in Construction</u>	3	0	0	3
4	CN 9254	<u>Energy Conservation Techniques in Building Construction</u>	3	0	0	3
5	CN 9255	<u>Construction of Pavements</u>	3	0	0	3
6	CN 9256	<u>Construction Project Management</u>	3	0	0	3
7	CN 9257	<u>Quantitative Techniques in Management</u>	3	0	0	3
8	CN 9258	<u>Construction Personnel Management</u>	3	0	0	3
9	CN 9259	<u>Business Economics and Finance Management</u>	3	0	0	3
10	CN 9260	<u>Quality Control and Assurance in Construction</u>	3	0	0	3
11	CN 9261	<u>Resource Management and Control in Construction</u>	3	0	0	3
12	CN 9262	<u>Project Safety Management</u>	3	0	0	3
13	CN 9263	<u>Management Information Systems</u>	3	0	0	3
13	CN 9264	<u>Energy-Efficient Buildings</u>	3	0	0	3
14	ST 9257	<u>Maintenance and Rehabilitation of Structures</u>	3	0	0	3

OBJECTIVE:

- To study and understand the latest construction techniques applied to engineering Construction

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

Vacuum dewatering of concrete flooring – concrete paving technology – techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – launching techniques – suspended form work – erection techniques of tall structures, large span structures – launching techniques for heavy decks – insitu prestressing in high rise structures, aerial transporting handling erecting lightweight components on tall structures.

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 PERIODS

REFERENCES:

1. Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 1995.
2. Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 1992.
3. Jerry Irvine, Advanced Construction Techniques, CA Rocketr, 1984
4. Peter.H.Emmons, "Concrete repair and maintenance illustrated", Galgotia Publications Pvt. Ltd., 2001.
5. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008.

OBJECTIVE:

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

UNIT I CONSTRUCTION CONTRACTS 10

Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts

UNIT II TENDERS 10

Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Tamilnadu Transparency in Tenders Act.

UNIT III ARBITRATION 5

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

UNIT IV LEGAL REQUIREMENTS 10

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

UNIT V LABOUR REGULATIONS 10

Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations – Workmen's Compensation Act – Indian Factory Act – Tamilnadu Factory Act – Child Labour Act - Other Labour Laws.

TOTAL: 45 PERIODS**REFERENCES:**

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M.Tripathi Private Ltd., Bombay, 1982
2. Jimmie Hinze, Construction Contracts, McGraw Hill, 2001
3. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
4. Kwaku, A., Tenah, P.E. Jose M.Guevara, P.E., Fundamentals of Construction Management and Organisation, Printice Hall, 1985.
5. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited, 2006.

OBJECTIVE:

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

UNIT I CONSTRUCTION PLANNING 9

Basic Concepts in the Development of Construction Plans - Choice of Technology and Construction Method - Defining Work Tasks - Defining Precedence Relationships among Activities - Estimating Activity Durations - Estimating Resource Requirements for Work Activities - Coding Systems

UNIT II SCHEDULING PROCEDURES AND TECHNIQUES 9

Construction Schedules - Critical Path Method – Scheduling Calculations - Float - Presenting Project Schedules - Scheduling for Activity-on-Arrow and with Leads, Lags, and Windows - Scheduling with Resource Constraints and Precedences - Use of Advanced Scheduling Techniques - Scheduling with Uncertain Durations - Calculations for Monte Carlo Schedule Simulation - Crashing and Time/Cost Tradeoffs - Improving the Scheduling Process.

UNIT III COST CONTROL, MONITORING AND ACCOUNTING 9

The Cost Control Problem - The Project Budget - Forecasting for Activity Cost Control - Financial Accounting Systems and Cost Accounts - Control of Project Cash Flows - Schedule Control - Schedule and Budget Updates - Relating Cost and Schedule Information.

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:

1. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
2. Calin M. Popescu, Chotchai Charoenggam, Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications, Wiley, New York, 1995.
3. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
4. Willis, E. M., Scheduling Construction Projects, John Wiley & Sons, 1986.
5. Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.

CN 9224	COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING	L T P C 2 0 2 3
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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: 60 PERIODS

REFERENCES:

1. Billy E.Gillet., Introduction to Operations Research – A Computer Oriented Algorithmic Approach, Tata Mc Graw Hill, 1990
2. Paulson, B.R., Computer Applications in Construction, Mc Graw Hill, 1995
3. Feigenbaum,L., Construction Scheduling with Primavera Project Planner Prentice Hall Inc., 2002
4. Ming Sun and Rob Howard, “Understanding I.T. in Construction, Spon Press, Taylor and Francis Group, London and New York, 2004.

CN 9225	ADVANCED CONSTRUCTION ENGINEERING AND COMPUTING TECHNIQUES LABORATORY	L T P C 0 0 4 2
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(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:

- 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

Aggregates classification, IS Specifications, Properties, Grading, Methods of combining aggregates, specified gradings, Testing of aggregates. Cement, Grade of cement, Chemical composition, Testing of concrete, Hydration of cement, Structure of hydrated cement, special cements. Water Chemical admixtures, Mineral admixture.

UNIT II CONCRETE

9

Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and shrinkage, Variability of concrete strength, durability of concrete.

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

UNIT IV SPECIAL CONCRETE 9
Light weight concrete, Fly ash concrete, Fibre reinforced concrete, Sulphur impregnated concrete, Polymer Concrete, Super plasticised concrete, hyper plasticized concrete, Epoxy resins and screeds for rehabilitation - properties and applications - high performance concrete. High performance fiber reinforced concrete, self-compacting-concrete.

UNIT V CONCRETING METHODS 9
Process of manufacturing of concrete, methods of transportation, placing and curing. Extreme weather concreting, special concreting methods. Vacuum dewatering - underwater concrete, special form work.

TOTAL : 45 PERIODS

REFERENCES:

1. Neville, A.M., Properties of Concrete, Prentice Hall, 1995, London.
2. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2003.
3. A.R.Santhakumar ;"Concrete Technology",Oxford University Press,2007.
4. Rudhani G. Light Weight Concrete Academic Kiado, Publishing Home of Hungarian Academy of Sciences, 1963.

CN 9252 SHORING, SCAFFOLDING AND FORMWORK L T P C
3 0 0 3

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 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.

Overall Planning – detail planning – Standard units – Corner units – Schedule for column formwork – Formwork elements – Planning 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 FORM MATERIALS 9
Lumber – Types – Finish – Sheathing boards working stresses – Repetitive member stress – Plywood – Types and grades – Textured surfaces and strength – Reconstituted wood – Steel – Aluminum Form lining materials – Hardware and fasteners – Nails in Plywood

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

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.

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 multistories – More concentrated shore loads T- heads – Tow Tier wood shores – Ellis shores – Dayton sure grip and Baker Roofs shores – Safeway Symons shores – Beaver – advance shores Dead shore – Raking and Flying shores.

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.

Causes of failures – Inadequate shoring inadequate bracing of members – improper vibration – Premature stripping – Errors in design – Failure to follow codes – How formwork affects concretes quality – ACI – Case studies – Finish of exposed concrete design deficiencies – Safety factors – Prevention of rotation – Stripping sequence – Advantages of reshoring.

UNIT V FORMS FOR DOMES AND TUNNELS, SLIP FORMS AND SAFETY PRACTICES FOR SCAFFOLDS 9

Hemispherical, Parabolic, Translational typical barrel vaults, Hyperbolic Folded plates – Shell form design considerations loads – Inserts , Anchors bolts – Building the forms-Placing concrete – Form removed – Strength requirements – Tunnel forming components – Curb forms invert forms – Arch forms – Concrete placement methods – Cut and cover construction – Tolerances – 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 – 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 scaffolds.

TOTAL: 45 PERIODS

REFERENCES:

1. Robert L. Peurifoy and Garold D. Oberlender, Formwork For Concrete Structures, McGraw – Hill , 1996.
2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996
3. Michael P. Hurst, Construction Press, London & New York, 2003
4. Austin, C.K., Formwork for Concrete, Cleaver – Hume Press Ltd., London, 1996.

**CN 9253 SYSTEM INTEGRATION IN CONSTRUCTION L T P C
3 0 0 3**

OBJECTIVE:

- To study and understand the construction system integration

UNIT I STRUCTURAL INTEGRATION 9

Structural System, Systems for enclosing Buildings, Functional aesthetic system, Materials Selection and Specification.

UNIT II	ENVIRONMENTAL FACTORS	9
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	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.		

TOTAL: 45 PERIODS

REFERENCES:

1. William T. Mayer, Energy Economics and Building Design , McGraw-Hill Book Company, 1983.
2. Peter R. Smith and Warren G. Julian, Building Services, Applied Science Publishers Ltd., London, 1993.
3. A.J.Elder and Martiz Vinden Barg, Handbook of Building Enclosure, McGraw-Hill Book Company, 1983.
4. Jane Taylor and Gordin Cooke, The Fire Precautions Act in Practices, 1987.
5. David V.Chadderton, Building Services Engineering, Taylar and Francis, 2007.

CN 9254	ENERGY CONSERVATION TECHNIQUES IN BUILDING	L T P C
	CONSTRUCTION	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
Fundamentals of energy- Energy Production Systems-Heating, Ventilating and Air-conditioning – Solar Energy and Conservation – Energy Economic Analysis – Energy conservation and audits – Domestic energy consumption – savings - challenges – primary energy use in buildings - Residential – Commercial – Institutional and public buildings – Legal requirements for conservation of fuel and power in buildings.		
UNIT II	ENVIRONMENTAL	7
Energy and resource conservation – Design of green buildings – Evaluation tools for building energy – Embodied and operating energy – Peak demand – Comfort and Indoor Air quality – Visual and acoustical quality – Land, water and materials - Airborne emissions and waste management.		

UNIT III DESIGN 8
 Natural building design consideration – Energy efficient design strategies – Contextual factors – Longevity and process Assessment – Renewable Energy Sources and design – Advanced building Technologies – Smart buildings – Economies and cost analysis.

UNIT IV SERVICES 12
 Energy in building design – Energy efficient and environment friendly building – Thermal phenomena – thermal comfort – Indoor Air quality – Climate, sun and Solar radiation, - Psychometrics – passive heating and cooling systems - Energy Analysis – Active HVAC systems - Preliminary Investigation – Goals and policies – Energy audit – Types of Energy audit – Analysis of results – Energy flow diagram – Energy consumption / Unit Production – Identification of wastage- Priority of conservative measures – Maintenance of energy management programme.

UNIT V ENERGY MANAGEMENT 12
 Energy management of electrical equipment - Improvement of power factor – Management of maximum demand – Energy savings in pumps – Fans – Compressed air systems – Energy savings in Lighting systems – Air conditioning systems – Applications – Facility operation and maintenance – Facility modifications – Energy recovery dehumidifier – Waster heat recovery – Steam plants and distribution systems – Improvement of boiler efficiency – Frequency of blow down – Steam leakage – steam Flash and condense return.

TOTAL: 45 PERIODS

REFERENCES:

1. Moore F., Environmental Control system Mc Graw Hill, Inc. 1994.
2. Brown, GZ, Sun, Wind and light: Architectural design strategies, John Wiley & Sons, 1985.
3. Cook, J, Award – Winning passive Solar Design, Mc Graw Hill, 1984.
4. J.R. Waters, Energy conservation in Buildings: A Guide to part L of the Building Regulations, Blackwell Publishing, 2003.

**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 9

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

UNIT II PROPERTIES OF BITUMINOUS MIXTURES 10

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	11
	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
	Methods to improve bitumen quality – Rheological and chemical additives – Polymer modified bitumen – Super pave concepts – Recycling of bituminous courses – Smart materials for cement concrete pavement – Use of admixtures and fibres.	

TOTAL: 45 PERIODS

REFERENCES:

1. Mix Design Methods for Asphalt Concrete and other Hot mix types MS 2, Sixth Edition, The Asphalt Institute, 1997.
2. Edwin J.Barth, Asphalt Science and Technology, Gordon and Breach Science Publishers, New York, 1984.
3. Bituminous materials in road construction, The English Language Book Society and Her Majesty's Stationery Office, 1966.

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
	Introduction - Project Life Cycle - Types of Construction - Selection of Professional Services - Construction Contractors - Financing of Constructed Facilities - Legal and Regulatory Requirements - Changing Environment of the Construction Industry - Role of Project Managers	
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
	Historical Perspective - Labour Productivity - Factors Affecting Job-Site Productivity - Labour Relations in Construction - Problems in Collective Bargaining - Materials Management - Material Procurement and Delivery - Inventory Control - Tradeoffs of	

Costs in Materials Management. - Construction Equipment - Choice of Equipment and Standard Production Rates - Construction Processes Queues and Resource Bottlenecks

UNIT V COST ESTIMATION 9

Costs Associated with Constructed Facilities - Approaches to Cost Estimation - Type of Construction Cost Estimates - Effects of Scale on Construction Cost - Unit Cost Method of Estimation - Methods for Allocation of Joint Costs - Historical Cost Data - Cost Indices - Applications of Cost Indices to Estimating - Estimate Based on Engineer's List of Quantities - Estimation of Operating Costs.

TOTAL: 45 PERIODS

REFERENCES:

1. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
2. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
3. Frederick E. Gould, Construction Project Management, Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000.
4. Choudhury, S, Project Management, Tata McGraw-Hill Publishing Company, New Delhi, 1988.
5. George J.Ritz , Total Construction Project Management - McGraw-Hill Inc, 1994.

**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

Working Capital Management – Compound Interest and Present Value methods – Discounted Cash Flow Techniques – Capital Budgeting

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

TOTAL : 45 PERIODS

REFERENCES:

1. Vohra, N.D., Quantitative Techniques in Management, Tata McGraw-Hill Company Ltd, New Delhi, 1990.
2. Schroeder, R.G, Operations Management, McGraw Hill, USA, 1982.
3. Levin, R.I, Rubin,D.S., and Stinson J., Quantitative Approaches to Management, McGraw Hill Book Co., 1988.
4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Mifflin Co., Boston, 1975.
5. Hamdy A.Taha, Operations Research: An Introduction, Prentice Hall, 2002.

CN 9258	CONSTRUCTION PERSONNEL MANAGEMENT	L T P C
		3 0 0 3

OBJECTIVE:

- To study the various aspects of manpower management in construction

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

UNIT II	ORGANISATION	10
Organisation – Span of Control – Organisation Charts – Staffing Plan - Development and Operation of human resources - Managerial Staffing – Recruitment – Selection - Placement, Training and Development.		

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
Compensation – Safety and health – GPF – EPF – Group Insurance – Housing - Pension – Laws related to welfare measures.		

UNIT V	MANAGEMENT AND DEVELOPMENT METHODS	10
Compensation - Wages and Salary, Employee Benefits, employee appraisal and assessment - Employee services - Safety and Health – Discipline and discharge - Special Human resource problems, Performance appraisal. - Employee hand book and personnel manual - Job descriptions and organization structure and human relations – Productivity of Human resources.		

TOTAL: 45 PERIODS

REFERENCES:

1. Carleton Counter II and Jill Justice Coutler , The Complete Standard Handbook of Construction Personnel Management, Prentice-Hall, Inc., New Jersey, 1989.
2. Memoria,C.B., Personnel Management, Himalaya Publishing Co., 1997.
3. Josy.J. Familiaro, Handbook of Human Resources Administration, McGraw-Hill International Edition, 1987.
4. Charles D Pringle, Justin Gooderi Longenecter, Management, CE Merrill Publishing Co. 1981.
5. Dwivedi R.S, Human Relations and Organisational Behaviour, Macmillian India Ltd.,2005.

OBJECTIVE:

- To study the role and methods of economics and finance concepts applied to construction business.

UNIT I ECONOMICS 10

Role of Civil Engineering in Industrial Development – Advances in Civil Engineering - Engineering Economics – Support Matters of Economy related to Engineering – Market demand and supply – Choice of Technology – Quality Audit in economic law of returns governing production.

UNIT II CONSTRUCTION ECONOMICS 10

Construction development in Housing, transport energy and other infrastructures – Economics of ecology, environment, energy resources – Local material selection – Form and functional designs – Construction workers – Urban Problems – Poverty – Migration – Unemployment – Pollution.

UNIT III FINANCING 13

The need for financial management - Types of financing – Financing instruments– short term borrowing – Long term borrowing – Leasing – Equity financing – Internal generation of funds – External commercial borrowings – Assistance from government budgeting support and international finance corporations – Analysis of financial statements – Balance Sheet - Profit and Loss account – Cash flow and Fund flow analysis – Ratio analysis – Investment and financing decision – Financial Control - centralized management.

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

Loans to Contractors – Interim construction financing – Security and risk aspects.

TOTAL: 45 PERIODS

REFERENCES:

1. Prasanna Chandra, Project Selection, Planning, Analysis, Implementation and Review, Tata McGraw Hill Publishing Company, 1995.
2. Halpin, D.W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.
3. Warneer Z Hirsch, Urban Economics, Macmillan, New York, 1993.
4. Kwaku A, Tenah and Jose M.Guevara, Fundamental of Construction Management and Organisation, Prentice – Hall of India, 1995.
5. Madura, J and Veit, E.T., Introduction to Financial Management, West Publishing Co., St. Paul, 1988.

OBJECTIVE:

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

UNIT I QUALITY MANAGEMENT 9

Introduction – Definitions and objectives – Factor influencing construction quality - Responsibilities and authority - Quality plan - Quality Management Guidelines – Quality circles.

UNIT II QUALITY SYSTEMS 9

Introduction - Quality system standard – ISO 9000 family of standards – Requirements – Preparing Quality System Documents – Quality related training – Implementing a Quality system – Third party Certification.

UNIT III QUALITY PLANNING 9

Quality Policy, Objectives and methods in Construction industry - Consumers satisfaction, Ergonomics - Time of Completion - Statistical tolerance – Taguchi's concept of quality – Codes and Standards – Documents – Contract and construction programming – Inspection procedures - Processes and products – Total QA / QC programme and cost implication.

UNIT IV QUALITY ASSURANCE AND CONTROL 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:

1. James, J.O' Brian, Construction Inspection Handbook – Quality Assurance and Quality Control, Van Nostrand, New York, 1989.
2. Kwaku, A., Tena, Jose, M. Guevara, Fundamentals of Construction Management and Organisation, Reston Publishing Co., Inc., Virginia, 1985.
3. Juran Frank, J.M. and Gryna, F.M. Quality Planning and Analysis, Tata McGraw Hill, 1993
4. Hutchins.G, ISO 9000, Viva Books, New Delhi, 2000
5. Clarkson H. Oglesby, Productivity Improvement in Construction, McGraw-Hill, 1989.
6. John L. Ashford, The Management of Quality in Construction, E & F.N.Spon, New York, 1989.
7. Steven McCabe, Quality Improvement Techniques in Construction, Addison Wesley Longman Ltd, England. 1998.

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.

TOTAL: 45 PERIODS**REFERENCES:**

1. Andrew,D., Szilagg, Hand Book of Engineering Management, 1982.
2. James.A., Adrain, Quantitative Methods in Construction Management, American Elsevier Publishing Co., Inc., 1973.
3. Harvey, A., Levine, Project Management using Micro Computers, Osborne- McGraw Hill C.A.Publishing Co., Inc. 1988.
4. Oxley Rand Poslcit, Management Techniques applied to the Construction Industry, Granda Publishing Ltd., 1980.

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
Problem Areas in Construction Safety – Elements of an Effective Safety Programme – Job-Site Safety Assessment – Safety Meetings – Safety Incentives		
UNIT III	CONTRACTUAL OBLIGATIONS	5
Safety in Construction Contracts – Substance Abuse – Safety Record Keeping		
UNIT IV	DESIGNING FOR SAFETY	15
Safety Culture – Safe Workers – Safety and First Line Supervisors – Safety and Middle Managers – Top Management Practices, Company Activities and Safety – Safety Personnel – Sub contractual Obligation – Project Coordination and Safety Procedures – Workers Compensation		
UNIT 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:

1. Jimmy W. Hinze, Construction Safety, Prentice Hall Inc., 1997.
2. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001.
3. Tamilnadu Factory Act, Department of Inspectorate of factories, Tamil nadu.

CN 9263	MANAGEMENT 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
Information Systems - Establishing the Framework - Business Models - Information System Architecture - Evolution of Information Systems.		
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
Integrated Construction Management Information System - Project Management Information System - Functional Areas, Finance, Marketing, Production, Personnel - Levels, DSS, EIS, and ES - Comparison, Concepts and Knowledge Representation - Managing International Information System.		
UNIT IV	IMPLEMENTATION AND CONTROL	10
Control - Testing Security - Coding Techniques - Defection of Error - Validating - Cost Benefit Analysis - Assessing the value and risk of Information System.		
UNIT V	SYSTEM AUDIT	10
Software Engineering qualities - Design, Production, Service, Software specification, Software Metrics, Software quality assurance - Systems Methodology - Objectives - Time and Logic, Knowledge and Human Dimension - Software life cycle models - Verification and Validation.		

TOTAL: 45 PERIODS

REFERENCES:

1. Kenneth C Laudon and Jane Price Laudon, Management Information Systems - Organisation and Technology, Prentice Hall, 1996.
2. Gordon B. Davis, Management Information System: Conceptual Foundations, Structure and Development, McGraw Hill, 1974.
3. Joyce J Elam, Case series for Management Information Systems , Simon and Schuster, Custom Publishing, 1996.
4. Ralph H Sprague and Hugu J Watson, Decision Support for Managers, Prentice Hall, 1996.
5. Michael W. Evans and John J Marciniak, Software Quality assurance and Management, John Wiley and Sons, 1987.
6. Card and Glass, Measuring Software Design quality , Prentice Hall, 1990.

CN 9264

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

Energy required for building construction - Heat Transfer – Measuring Conduction – Thermal Storage – Measurement of Radiation – The Green house Effect – Psychrometry Chart – Measuring latent and sensible heat. Thermal Comfort – Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Protection – Types of Shading Devices – Conservation – Heating and Cooling loads.

UNIT II PASSIVE SOLAR HEATING AND COOLING

9

General Principles of passive Solar Heating – Key Design Elements - Direct gain Trombe Walls, Water Walls, Convective Air loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Predicting ventilation in buildings – window ventilation calculations - Radiation – Evaporation and dehumidification – Mass Effect – Load Control – Air Filtration and odor removal – Heat Recovery in large buildings

UNIT III DAYLIGHTING AND ELECTRICAL LIGHTING

9

Materials, components and details - Insulation – Optical materials – Radiant Barriers Glazing materials - Daylighting – Sources and concepts – Building Design Strategies – Case Studies – Electric Lighting –Light Distribution – Electric Lighting control for daylighted buildings – Illumination requirement – Components of Daylight factor – Recommended Daylight factors – Daylighting analysis – Supplementary Artificial Lighting Design

UNIT IV HEAT CONTROL AND VENTILATION

9

Requirements – Heat transmission through building sections – Thermal performance of Building sections – Orientation of buildings – Building characteristics for various climates – Thermal Design of buildings Influence of Design Parameters – Mechanical controls – Examples. Ventilation – Requirements – Minimum standards for ventilation – Ventilation Design – Energy Conservation in Ventilating systems – Design for Natural Ventilation.

UNIT V DESIGN FOR CLIMATIC ZONES

9

Energy efficiency – an overview of design concepts and architectural interventions – Energy efficient buildings for various zones – cold and cloudy – cold and sunny – composite – hot and dry – moderate – warm and humid – case studies of residences, office buildings and other buildings in each zones – Energy Audit - Certification

TOTAL : 45 PERIODS

REFERENCES:

1. Moore, F., Environmental Control System, McGraw Hill Inc. 2002
2. Brown, G.Z. and DeKay, M., Sun, Wind and Light – Architectural Design Strategies, John Wiley and Sons Inc, 2001
3. Chilogioji, M.H., and Oura, E.N., Energy Conservation in Commercial and Residential Buildings - Marcel Dekker Inc., New York and Basel, 1995.
4. Cook, J., Award-winning Passive Solar Designs, McGraw Hill Book Company, 1984
5. Dubin, F.S. and Long, C.G., Energy Conservation Standards – For Building Design, Construction and Operation - McGraw Hill Book Company 1990.
6. Majumdar, M. (Ed), Energy – efficient Buildings in India, Tata Energy Research Institute, Ministry of Non Conventional Energy Sources, 2002.
7. Tyagi, A. K.(Ed), Handbook on energy audits and management Tata Energy Research Institute, 2000.
8. Handbook on Functional Requirements of Buildings Part 1 to 4 SP: 41 (S and T) -1995
9. Energy Conservation Building Code, Bureau of Energy Efficiency, New Delhi, 2007.

**ST 9257 MAINTENANCE AND REHABILITATION OF STRUCTURES L T P C
3 0 0 3**

OBJECTIVE:

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

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, Gunitite 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 PERIODS

REFERENCES:

1. Denison Campbell, Allen and Harold Roper, “Concrete Structures, Materials, Maintenance and Repair”, Longman Scientific and Technical UK, 1991.

2. Allen R.T and Edwards S.C, "Repair of Concrete Structures", Blakie and Sons, UK, 1987.
3. Raikar, R.N., "Learning from failures - Deficiencies in Design, Construction and Service" - R&D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
4. Santhakumar A.R., "Concrete Technology" Oxford University Press, Printed in India by Radha Press, New Delhi, 2007.
5. Peter H.Emmons, "Concrete Repair and Maintenance Illustrated", Galgotia Publications pvt. Ltd., 2001.