

AFFILIATED INSTITUTIONS
ANNA UNIVERSITY :: CHENNAI 600 025
REGULATIONS - 2013

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

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MA7152	Statistical Methods for Engineers	3	1	0	4
2.	CN7101	Modern Construction Materials	3	0	0	3
3.	CN7102	Construction Equipment	3	0	0	3
4.	CN7103	Project Formulation and Appraisal	3	0	0	3
5.	CN7104	Quantitative Techniques in Management	3	0	0	3
6.		Elective I	3	0	0	3
TOTAL			18	1	0	19

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	CN7201	Advanced Construction Techniques	3	0	0	3
2.	CN7202	Contract Laws and Regulations	3	0	0	3
3.	CN7203	Construction Planning, Scheduling and Control	3	0	0	3
4.	CN7204	Computer Applications in Construction Engineering and Planning	2	0	2	3
5.		Elective II	3	0	0	3
6.		Elective III	3	0	0	3
PRACTICAL						
7.	CN7211	Advanced Construction Engineering and Computing Techniques Laboratory	0	0	4	2
TOTAL			17	0	6	20

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.		Elective IV	3	0	0	3
2.		Elective V	3	0	0	3
3.		Elective VI	3	0	0	3
PRACTICAL						
4.	CN7311	Practical Training (4 Weeks)	-	-	-	1
5.	CN7312	Project Work (Phase I)	0	0	12	6
6.	CN7313	Seminar	0	0	2	1
TOTAL			9	0	14	17

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1.	CN7411	Project Work (Phase II)	0	0	24	12
TOTAL			0	0	24	12

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

LIST OF ELECTIVES

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
(Elective I)						
1.	CN7001	Advanced Concrete Technology	3	0	0	3
2.	CN7002	Shoring, Scaffolding and Formwork	3	0	0	3
(Elective II & III)						
3.	CN7003	System Integration in Construction	3	0	0	3
4.	CN7004	Energy Efficient Buildings	3	0	0	3
5.	CN7005	Construction Project Management	3	0	0	3
6.	CN7006	Construction Personnel Management	3	0	0	3
(Elective IV,V,VI)						
7.	CN7007	Quality Control and Assurance in Construction	3	0	0	3
8.	CN7008	Economics and Finance Management in Construction	3	0	0	3
9.	CN7009	Resource Management and Control in Construction	3	0	0	3
10.	CN7010	Project Safety Management	3	0	0	3
11.	CN7011	Management Information Systems	3	0	0	3

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**9+3**

Estimators: Unbiasedness, Consistency, Efficiency and Sufficiency – Maximum Likelihood Estimation – Method of moments.

UNIT II TESTING OF HYPOTHESIS**9+3**

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**9+3**

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**

Random vectors and Matrices – Mean vectors and Covariance matrices – Multivariate Normal density and its properties – Principal components: Population principal components – Principal components from standardized variables.

L: 45 + T : 15 TOTAL : 60 PERIODS**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:

1. Gupta.S.C., and Kapoor, V.K., “Fundamentals of Mathematical Statistics”, Sultan Chand and Sons, Eleventh Edition, 2002
2. J.E. Freund, Mathematical Statistical”, 5th Edition, Prentice Hall of India, 2001.
3. Jay L.Devore, “Probability and statistics for Engineering and the Sciences”, 5th Edition, Thomson and Duxbury, Singapore, 2002
4. Murray.R. Spiegel and Larry J.Stephens, “Schaum’sou Tlines- Statistics”, Third Edition, Tata McGraw-Hill, 2000
5. R.A.Johnson and C.B.Gupta, “Miller & Freund’s Probability and Statistics for Engineers”, Pearson Education, Asia, 7th Edition, 2007
6. Richard A.Johnson and Dean W.Wichern, “Applied Multivariate Statistical Analysis”, Pearson Education, Asia, 6th Edition, 2007

OBJECTIVES:

- To study and understand the properties of modern construction materials used in construction such as special concretes, metals, composites, water proofing compounds, non weathering materials, and smart materials.

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.
2. Aitkens , High Performance Concrete, McGraw Hill, 1999
3. Ashby, M.F. and Jones.D.R.H.H. "Engineering Materials 1: An introduction to Properties, applications and designs", Elsevier Publications, 2005.
4. Deucher, K.N, Korfiatis, G.P and Ezeldin, A.S, Materials for civil and Highway Engineers, Prentice Hall Inc., 1998.
5. Mamlouk, M.S. and Zaniewski, J.P., Materials for Civil and Construction Engineers, Prentice Hall Inc., 1999.
6. Santhakumar.A.R., Concrete Technology, Oxford University press, New Delhi
7. Shan Somayaji, Civil Engineering Materials, Prentice Hall Inc., 2001
8. Shetty M.S, Concrete Technology: Theory and Practice, S.Chand & Company Ltd., 2005.

CN7102	CONSTRUCTION EQUIPMENT	L T P C
		3 0 0 3

OBJECTIVES:

- 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
Identification – Planning of equipment – Selection of Equipment - Equipment Management in Projects - Maintenance Management – Equipment cost – Operating cost – Cost Control of Equipment - Depreciation Analysis – Replacement of Equipment- Replacement Analysis - Safety Management		

UNIT II	EQUIPMENT FOR EARTHWORK	9
Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders – Dozer, Excavators, Rippers, Loaders, trucks and hauling equipment, Compacting Equipment, Finishing equipment.		
UNIT III	OTHER CONSTRUCTION EQUIPMENT	9
Equipment for Dredging, Trenching, Drag line and clamshells, Tunneling – Equipment for Drilling and Blasting - Pile driving Equipment - Erection Equipment - Crane, Mobile crane - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Equipment for Demolition.		
UNIT IV	ASPHALT AND CONCRETE PLANTS	9
Aggregate production- Different Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Pumping Equipment – Ready mix concrete equipment, Concrete pouring equipment. Asphalt Plant, Asphalt Pavers, Asphalt compacting Equipment		
UNIT V	MATERIALS HANDLING EQUIPMENT	9
Forklifts and related equipment - Portable Material Bins – Material Handling Conveyors – Material Handling Cranes- Industrial Trucks.		
		TOTAL : 45 PERIODS

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:

1. Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 1988.
2. Dr.Mahesh Varma, Construction Equipment and its planning and Application, Metropolitan Book Company, New Delhi. 1983.
3. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 2006.
4. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 1988.

CN7103	PROJECT FORMULATION AND APPRAISAL	L T P C
		3 0 0 3

OBJECTIVES:

- 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	9
Project Cash Flows – Time Value of Money – Cost of Capital.		
UNIT III	PROJECT APPRAISAL	9
NPV – BCR – IRR – ARR – Urgency – Pay Back Period – Assessment of Various Methods – Indian Practice of Investment Appraisal – International Practice of Appraisal – Analysis of Risk – Different Methods – Selection of a Project and Risk Analysis in Practice.		

UNIT IV PROJECT FINANCING 9
Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators – Ratios.

UNIT V PRIVATE SECTOR PARTICIPATION 9
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:

1. Barcus, S.W. and Wilkinson.J.W., Hand Book of Management Consulting Services, McGraw Hill, New York, 1986.
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan India Ltd., 1992
3. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation Review, McGraw Hill Publishing Company Ltd., New Delhi. 2006.
4. United Nations Industrial Development Organisation (UNIDO) Manual for the Preparation of Industrial Feasibility Studies, (IDBI Reproduction) Bombay, 1987.

CN7104 QUANTITATIVE TECHNIQUES IN MANAGEMENT L T P C
3 0 0 3

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 9
Introduction to Operations Research - Linear Programming – Graphical and Simplex Methods, Duality and Post – Optimality Analysis – Transportation and Assignment Problems.

UNIT II PRODUCTION MANAGEMENT 9
Inventory Control - EOQ - Quantity Discounts - Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control.

UNIT III FINANCIAL MANAGEMENT 9
Working Capital Management – Compound Interest and Present Value methods – Discounted Cash Flow Techniques – Capital Budgeting.

UNIT IV DECISION THEORY 9
Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory.

UNIT V MANAGERIAL ECONOMICS 9
Cost Concepts – Break-even analysis – Pricing Techniques – Game theory Applications.

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:

1. Frank Harrison, E., The Managerial Decision Making Process, Houghton Mifflin Co., Boston, 1999.
2. Hamdy A.Taha, Operations Research: An Introduction, Prentice Hall, 2010.
3. Levin, R.I, Rubin,D.S., and Stinson J., Quantitative Approaches to Management, McGraw Hill College, 1993.
4. S.L.Tang, Irtishad U.Ahmad, Syed M.Ahmed, Ming Lu, Quantitative Technique for Decision making in Construction, Hongkong University Press, HKU, 2004.
5. Schroeder, R.G, Operations Management, McGraw Hill, 2009.
6. Vohra, Nd., Quantitative Techniques in Management, Third Edition, Tata McGraw-Hill Company Ltd, 2007.

CN7201**ADVANCED CONSTRUCTION TECHNIQUES****L T P C
3 0 0 3****OBJECTIVES:**

- 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

Seismic retrofitting - Strengthening of beams - Strengthening of columns - Strengthening of slab - Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation – Micro piling and underpinning for strengthening floor and shallow profile - Sub grade water proofing, Soil Stabilization techniques.

UNIT V DEMOLITION 9

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:

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

CN7202**CONTRACT LAWS AND REGULATIONS****L T P C
3 0 0 3****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 9

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 9

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 9

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 9

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 9

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**OUTCOME:**

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

REFERENCES:

- Gajaria G.T., Laws Relating to Building and Engineering Contracts in India,
- Jimmie Hinze, Construction Contracts, McGraw Hill, 2001.

- Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
- Kwaku, A., Tenah, P.E. Jose M.Guevara, P.E., Fundamentals of Construction Management and Organisation, Printice Hall, 1985.M.M.Tripathi Private Ltd., Bombay, 1982.
- Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited, 2006.

CN7203 CONSTRUCTION PLANNING, SCHEDULING AND CONTROL L T P C
3 0 0 3

OBJECTIVES:

- 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

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-Node 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

OUTCOME:

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

REFERENCES:

- Calin M. Popescu, Chotchai Charoenggam, Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications, Wiley, New York, 1995.
- Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, McGraw-Hill Publishing Company, New Delhi, 1998.
- Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.

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 – Demonstration

TOTAL : 30 PERIODS

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

OBJECTIVES:

- 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

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.

CN7311

PRACTICAL TRAINING (4 Weeks)

L T P C
- - - 1

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.

CN7312

PROJECT WORK (PHASE I)

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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.

CN7313

SEMINAR

L T P C
0 0 2 1

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

CN7411

PROJECT WORK (PHASE II)

L T P C
0 0 24 12

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.

CN7001**ADVANCED CONCRETE TECHNOLOGY****L T P C
3 0 0 3****OBJECTIVES :**

- 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**

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 TESTS ON CONCRETE**9**

Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and shrinkage – Durability of concrete.

UNIT III MIX DESIGN**9**

Principles of concrete mix design, Methods of concrete mix design, IS Method, ACI Method, DOE Method – 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 – High performance concrete. High performance fiber reinforced concrete, Self-Compacting-Concrete, Geo Polymer Concrete, Waste material based concrete – Ready mixed 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.

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:

1. Gambhir.M.L., Concrete Technology, McGraw Hill Education, 2006.
2. Gupta.B.L., Amit Gupta, "Concrete Technology, Jain Book Agency, 2010.
3. Neville, A.M., Properties of Concrete, Prentice Hall, 1995, London.
4. Santhakumar.A.R. ;"Concrete Technology",Oxford University Press,2007.
5. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2003.

CN7002**SHORING, SCAFFOLDING AND FORMWORK****L T P C
3 0 0 3****OBJECTIVES:**

- To study and understand the overall and detailed planning of formwork, plant and site equipment.
- To understand the Design and erection of forms for various elements such as slabs, beams, columns, walls, shells and tunnels.
- To know the latest methods of form 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

Lumber - Types - Finish - Sheathing boards working stresses - Repetitive member stress - Plywood - Types and grades - Jointing Boarding - Textured surfaces and strength - Reconstituted wood - Steel - Aluminum - Hardware and fasteners - Nails in Plywood - Allowable withdrawal load and lateral load. Pressures on formwork - Examples - Vertical loads for design of slab forms - Uplift on shores - Laterals loads on slabs and walls.

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:

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

OBJECTIVES:

- To study and understand the construction system integration, environmental factors, services, maintenance and safety systems.

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**OUTCOME:**

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

REFERENCES:

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

OBJECTIVES:

- 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

Climate adapted and climate rejecting buildings – Heat Transfer – Measuring Conduction – Thermal Storage – Measurement of Radiation – The Green house Effect – Convection – Measuring latent and sensible heat – Psychrometry Chart – Thermal Comfort – Microclimate, Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Path Diagrams – Sun Protection – Types of Shading Devices – Design responses to energy conservation strategies.

UNIT II PASSIVE SOLAR HEATING AND COOLING 9

General Principles of passive Solar Heating – Key Design Elements – Sunspace – Direct gain – Trombe Walls, Water Walls – Convective Air loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Principles – Case studies – Courtyards – Roof Ponds – Cool Pools – Predicting ventilation in buildings – Window Ventilation Calculations – Room Organization Strategies for Cross and Stack Ventilation – Radiation – Evaporation and dehumidification – Wind Catchers – Mass Effect – Zoning – Load Control – Air Filtration and odor removal.

UNIT III DAYLIGHTING AND ELECTRICAL LIGHTING 9

Materials, components and details – Insulation – Optical materials – Radiant Barriers – Glazing materials – Glazing Spectral Response – Day lighting – Sources and concepts – Building Design Strategies – Case Studies – Daylight apertures – Light Shelves – Codal requirements – Day lighting design – Electric Lighting – Light Distribution – Electric Lighting control for day lighted buildings – Switching controls – Coefficient of utilization – Electric Task Lighting – Electric Light Zones – Power Adjustment Factors.

UNIT IV HEAT CONTROL AND VENTILATION 9

Hourly Solar radiation – Heat insulation – Terminology – 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 – Calculation of probable indoor wind speed.

UNIT V DESIGN FOR CLIMATIC ZONES 9

Energy efficiency – An Overview of Design Concepts and Architectural Interventions – Embodied Energy – Low Embodied Energy Materials – Passive Downdraft Evaporative Cooling – Design of 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 – Commonly used software packages in energy efficient building analysis and design - Energy Audit – Certification.

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:

1. Brown, G.Z. and DeKay, M., Sun, Wind and Light - Architectural Design Strategies, John Wiley and Sons Inc, 2001
2. Energy Conservation Building Code, Bureau of Energy Efficiency, New Delhi, 2007.
3. Handbook on Functional Requirements of Buildings Part 1 to 4 SP : 41 (S and T) 1995
4. Majumdar, M (Ed), Energy - Efficient Buildings in India, Tata Energy Research Institute, Ministry of Non Conventional Energy Sources, 2002.
5. Moore, F., Environmental Control System, McGraw Hill Inc. 2002.
6. Tyagi, A.K. (Ed). Handbook on Energy Audits and Management Tata Energy Research Institute, 2000.

OBJECTIVES:

- To study the various management techniques for successful completion of construction projects.
- To study the effect of management for project organization, design of construction process, labour, material and equipment utilization, and cost estimation.

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**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:

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

OBJECTIVES:

- 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**9**

Manpower Planning process , Organising, Staffing, directing, and controlling – Estimation, manpower requirement – Factors influencing supply and demand of human resources – Role of HR manager – Personnel Principles.

UNIT II ORGANISATION**9**

Requirement of Organisation – Organisation structure – Organisation Hierarchical charts – Staffing Plan - Development and Operation of human resources - Managerial Staffing – Recruitment – Selection strategies – Placement and Training.

UNIT III HUMAN RELATIONS AND ORGANISATIONAL BEHAVIOUR**9**

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**

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

UNIT V MANAGEMENT AND DEVELOPMENT METHODS**9**

Wages and Salary, Employee benefits, Employee appraisal and assessment – Employee services – Safety and Health Management – Special Human resource problems – Productivity in human resources – Innovative approach to designing and managing organization – Managing New Technologies – Total Quality Management – Concept of quality of work life – Levels of change in the organizational Development – Requirements of organizational Development – System design and methods for automation and management of operations – Developing policies, practices and establishing process pattern – Competency upgradation and their assessment – New methods of training and development – Performance Management.

TOTAL : 45 PERIODS**OUTCOME:**

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

REFERENCES:

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

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 II	COMPARING ALTERNATIVES PROPOSALS	9
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	9
Real Estate - Investment Property, Equipment Replace Analysis, Depreciation – Tax before and after depreciation – Value Added Tax (VAT) – Inflation.		
UNIT IV	FUNDS MANAGEMENT	9
Project Finance – Sources of finance - Long-term and short -term finance, Working Capital Management, Inventory valuation, Mortgage Financing - International financial management-foreign currency management.		
UNIT V	FUNDAMENTALS OF MANAGEMENT ACCOUNTING	9
Management accounting, Financial accounting principles- basic concepts, Financial statements – accounting ratios - funds flow statement – cash flow statement.		

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:

1. Blank, L.T., and Tarquin, a.J (1988) Engineering Economy, 4th Edn. Mc-Graw Hill Book Co.
2. Collier C and GlaGola C (1998) Engineering Economics & Cost Analysis, 3rd Edn. Addison Wesley Education Publishers.
3. Patel, B M (2000) Project management- strategic Financial Planning, Evaluation and Control, Vikas Publishing House Pvt. Ltd. New Delhi.
4. Shrivastava, U.K., (2000) Construction Planning and Management, 2nd Edn. Galgotia Publications Pvt. Ltd. New Delhi.
5. Steiner, H.M. (1996) Engineering Economic principles, 2nd Edn. Mc-Graw Hill Book, New York.

CN7009	RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION	L T P C
		3 0 0 3

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	9
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	9
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	9
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.

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. Health Management, Prentice Hall Inc., 2001.

CN7011**MANAGEMENT INFORMATION SYSTEMS****L T P C
3 0 0 3****OBJECTIVES:**

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

UNIT I INTRODUCTION**9**

Information Systems – Establishing the Framework – Business Models – Information System Architecture – Evolution of Information Systems.

UNIT II SYSTEM DEVELOPMENT**9**

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

UNIT III INFORMATION SYSTEMS**9**

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**9**

Control – Testing Security – Coding Techniques – Defection of Error – Validating – Cost Benefit Analysis – Assessing the value and risk of Information System.

UNIT V SYSTEM AUDIT**9**

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**OUTCOME:**

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

REFERENCES:

1. Card and Glass, Measuring Software Design Quality , Prentice Hall, 1990.
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. Kenneth C Laudon and Jane Price Laudon, Management Information Systems - Organisation and Technology, Prentice Hall, 1996.
5. Michael W. Evans and John J Marciniak, Software Quality assurance and Management, John Wiley and Sons, 1987.
6. Ralph H Sprague and Huge J Watson, Decision Support for Managers, Prentice Hall, 1996.