

**DEPARTMENT OF CIVIL
ENGINEERING**

**Scheme of Instruction and Syllabus of
M.E. (Civil Engineering)**

**Specialization
Construction Engineering and Management**

**Full time
(2017-2018)**



**UNIVERSITY COLLEGE OF ENGINEERING
(Autonomous) Osmania University
Hyderabad – 500 007, TS, INDIA**

(With effect from the Academic Year 2017-2018)

INSTITUTE

Vision

The Vision of the institute is to generate and disseminate knowledge through harmonious blending of science, engineering and technology. To serve the society by developing a modern technology in students' heightened intellectual, cultural, ethical and humane sensitivities, fostering a scientific temper and promoting professional and technological expertise.

Mission

- To achieve excellence in Teaching and Research
- To generate , disseminate and preserve knowledge
- To enable empowerment through knowledge and information
- Advancement of knowledge in Engineering, Science and Technology
- Promote learning in free thinking and innovative environment
- Cultivate skills, attitudes to promote knowledge creation
- Rendering socially relevant technical services to the community
- To impart new skills of technology development
- To inculcate entrepreneurial talents and technology appreciation programmes
- Technology transfer and incubation

DEPARTMENT

Vision

To be as a leading academic department on pace with global standards and contribute to the development of economic, technically viable and useful to societal problems and challenges of civil engineering profession and also contribute to the regional and country's developmental activities.

Mission

- To train the human resources with knowledge base in the field of Civil Engineering so that they can face the challenges of civil and infrastructural engineering problems to provide viable solutions.
- To integrate their understanding and attainable knowledge on the specializations for effective functioning in their profession and useful to the welfare and safety of mankind.
- To enhance the technical knowledge and research aptitude in the domains of various Civil Engineering specializations to serve the society in highly professional manner.
- Produce highly competent and capable professionals and motivated young academicians to provide solutions to real life problems of Engineering and Technology and has apt for continuous learning and dedication towards societal issues.

PROGRAM EDUCATIONAL OBJECTIVES (PEO):

1. Impart and enrich knowledge of effective and quality construction management practices leading to savings in time and cost of construction projects.
2. Apply latest methods, procedures, modern tools and techniques to optimise resources for achieving project objectives in construction projects.
3. Communicate effectively, demonstrates leadership qualities, work in team environment and exhibit professional ethics.
4. Engage in lifelong learning for career enhancement as per the needs of practicing engineers and academician and adapt to changing societal.

PROGRAM OUTCOMES (PO):

1. Apply knowledge of construction engineering to solve problems related to contemporary issues in construction Industry.
2. Analyze, design, conduct numerical experiments, and interpret data of complex construction technology management problems.
3. Use modern engineering tools, instrumentation and software in implementing construction projects.
4. Communicate effectively, demonstrate leadership skills, work in inter-disciplinary engineering teams with social responsibility and ethical values.
5. Engage in lifelong learning and demonstrate awareness of contemporary issues to meet the challenges and demand of the society.
6. Employ sustainable technologies to protect environment and ecosystems.

MAPPING OF PEO'S WITH PO'S

PROGRAMME EDUCATIONAL OBJECTIVES	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
PEO-1	YES	YES	--	--	YES	YES
PEO-2	YES	YES	YES	--	YES	YES
PEO-3	YES	--	--	YES	--	--
PEO-4	YES	YES	YES	YES	YES	YES

M.E- CIVIL ENGINEERING

Subjects for

Specialization: Construction Engineering and Management

Sl. No	Course Code	Course Title (SUBJECTS)	Contact Hrs per Week	Scheme of Examination		Credits
				CIE	SEE	
CORE SUBJECTS						
1	CE 1601	Construction Management	3	30	70	3
2	CE 1602	Construction Project Administration	3	30	70	3
3	CE 1603	Construction Finance	3	30	70	3
4	CE 1604	Economic Decision Analysis in Construction	3	30	70	3
5	CE 1605	Construction Planning and Scheduling	3	30	70	3
6	CE 1606	Quantitative Methods in Const. Management	3	30	70	3
ELECTIVE SUBJECTS						
7	CE 1611	Legal Issues in Construction Management	3	30	70	3
8	CE 1612	Timber and Formwork Design	3	30	70	3
9	CE 1613	Functional Planning and Building Services	3	30	70	3
10	CE 1614	Value Engineering in Construction	3	30	70	3
11	CE 1615	Const. Methods and Equipment	3	30	70	3
12	CE 1616	Management Information systems	3	30	70	3
13	CE 1617	TQM techniques in Construction	3	30	70	3
14	CE 1618	Construction Safety Management	3	30	70	3
15	CE 1619	Human Resources Development for Construction	3	30	70	3
16	CE 1116	Advanced Concrete Technology	3	30	70	3
17	CE 1121	Retrofitting and Rehabilitation of Structures	3	30	70	3
18	CE 1119	Structural Health Monitoring	3	30	70	3
19	CE 1123	Green Building Technology	3	30	70	3
20	CE 1320	Geospatial Technology	3	30	70	3
21	CE 1404	Statistical Techniques	3	30	70	3
22	CE 0111	Engineering Research Methodology	3	30	70	3
23	CE 1125	Disaster Management	3	30	70	3
24	CE 1124	Neural Fuzzy and Expert Systems	3	30	70	3
25	CE 1212	Environmental Impact Assessment	3	30	70	3
DEPARTMENTAL REQUIREMENTS						
26	CEL 1631	Construction Engineering Laboratory-I	2	50	-	2
27	CEL 1632	Construction Engineering Laboratory-II	2	50	-	2
28	CES 1633	Seminar-I	2	50	-	2
29	CES 1634	Seminar-II	2	50	-	2
30	CEP 1635	Project Seminar	4	100	-	8
31	CEP 1636	Dissertation	6	150	-	12

CIE: Continuous Internal Evaluation

SEE: Semester end examination

CONSTRUCTION MANAGEMENT

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
Semester end Examination	: 70marks
Continuous Internal Evaluation	: 30marks

Course Objectives:

- Understand the broad principles and concepts of construction management
- To create awareness of MIS techniques in construction industry
- Represent various works measurement standards

Course Outcomes:

- Ability to take responsibilities as construction manager
- Application of MIS technique in the real time construction operation
- Knowledge of work measurement application in construction industry

UNIT - I

Introduction to management, science or art ? history of construction management, modern management, system approach and emergence of management thought, need, nature and purpose of construction management, major problems in construction industry, firm organization, chain of command, division of work, organization charts, functions and responsibilities of construction manager, case studies, future of construction management.

UNIT – II

Principles of construction management; planning, organizing, staffing, leading, controlling. Decision making in construction industry, nature of managerial decision making, the rational model of decision making, challenges to the rational model, improving the effectiveness of decision making tools and techniques, benefit-cost analysis, replacement analysis, break even analysis, risk management in construction industry.

UNIT – III

Site mobilization and demobilization aspects, various resource management based on funds availability, organization and monitoring of the construction work with respect to cost-time schedules, coordinating, communicating and reporting techniques, Application of MIS to construction, Training of Construction Managers.

UNIT – IV

Work Study: Definition, Objectives, basic procedure, method study and work measurement, work study applications in Civil Engineering.

Method study – Definition, Objective, Procedure for selecting the work, recording facts, symbols, flow process charts, multiple activity charts, string diagrams.

UNIT - V

Work measurement – Time and motion studies, Concept of standard time and various allowances, time study, equipment performance rating. Activity sampling, time - lapse photography technique, Analytical production studies.

Suggested reading:

1. Tenah, K.A. (1985). "The Construction Management Process" Reston Publishing Company, Inc. Virginia, USA.
2. Roy Pilcher (1985) "Project Cost Control in Construction," Collins Professional and technical books, London.
3. Raina, C.M. "Construction Management and Practice." Tata McGraw-Hill, New Delhi, 1980.
4. Construction Planning & management By P S Gahlot & B M Dhir , New Age International Limited Publishers
5. Construction Project planning & Scheduling By Charles Patrick, Pearson, 2012
6. Construction Project Management Theory & practice --- Kumar Neeraj Jha, Pearson,2012
7. Construction management Fundamentals by Knutson, Schexnayder, Fiori, Mayo, Tata McGraw Hill, 2nd Edition, 201
8. Modern construction management--Harris, Wiley India.

9. Construction Management and Planning by Sengupta and Guha-Tata McGraw Hill publication.
10. Project Management – K Nagrajan – New age International Ltd.
11. Work study – Currie.
12. Professional Construction Management Barrie-Paulson-McGraw Hill Institute Edition.
13. Project Management – Ahuja H.N. – John Wiley, New York.
14. Construction Project Management Planning, Scheduling and Controlling-Chitakara- Tata McGraw Hill, New Delhi
15. Construction Management – Roy, Pilcher 13.Construction Management – O'Brien.
16. Project Management-Planning and Control---Rory Burkey 4th ed.—Wiley,India.

CONSTRUCTION PROJECT ADMINISTRATION

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
Semester end Examination	: 70marks
Continuous Internal Evaluation	: 30marks

Course Objectives:

- To know the students about the construction administration and Quality aspects.
- To understand the lines of authority in construction projects
- To have the idea of different risks associated with construction industry and remedial measures
- To properly understand the IS specifications and drawings in construction projects.
- To visualize and understand pre-construction operations and its limitations.

Course outcomes:

- To be able to gain the knowledge of construction administration issues and quality related problems in construction projects.
- To be able to have an idea of hierarchy, work responsibility and work progress.
- To be able to understand risks and uncertainty related issues in constructions.
- To be able to understand the IS specifications and drawings for the Civil Engineering Construction projects.
- To be able to understand the pre-construction operations and techniques.

UNIT – I

Introduction to Construction Administration, Control of Quality in Construction, Organizational Structure, Design Build Contracts, Responsibility for Coordination of the trades Role of owner, Contractor, Engineer, and Construction Manager.

UNIT - II

Introduction to authority, Lines of Authority in Construction administration on Construction Projects, Responsibility, Familiarization with construction documents, Staffing responsibilities, Limitations of their duties/functions.

UNIT - III

Reasons for the risks, Certainty, Risk, and Uncertainty, Risk Management, Identification and Nature of Construction Risks, Contractual allocation of Risk, Types of Risks, Minimizing risks and mitigating losses, use of expected values, utility in investment decisions, decision trees, sensitivity analysis and their applications.

UNIT - IV

Specifications and drawings - Role of Engineers and Architects, Specifications, Conflicts due to drawings and specifications, unenforceable phrases; content of the specifications, CSI specifications format, allowances and tolerances in specifications, problems. Municipal regulations and construction drawings

UNIT - V

Preconstruction Operations-Need for the preconstruction operations, Equipments, material and manpower, Constructability Analysis, Issuance of Bidding Documents, Prequalification of Bidders, Bonds, Opening Acceptance and Documentation of Bids, Limitations and advantages of preconstruction operations.

Suggested reading:

1. Fisk, E.R. (2000) "Construction Project Administration," Prentice Hall International, London.
2. Kwakye, A.A. (1997), "Construction Project Administration", Adisson Wesley Longman, London.

CONSTRUCTION FINANCE

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
Semester end Examination	: 70marks
Continuous Internal Evaluation	: 30marks

Course Objectives:

- To train the students with the latest and the best in the rapidly changing field of construction engineering, technology and management.
- To prepare the students to be industry leaders how implement the best engineering and management practices and technologies in the construction industry.
- To manage the working capital required on construction projects.
- To employ capital budgeting methods to arrive at the best investment options.
- To apply various types of budgets required for civil works.

Course Outcomes: The students will be able to

- Estimate the working capital required on a construction project.
- Perform capital budgeting techniques for investment analysis.
- Prepare various types of budgets required in civil works.
- Apply knowledge and skills of modern construction practices and techniques.

UNIT-I

Introduction to investments-types of investments problems, stages in an economic appraisal, risk and uncertainty in investments decisions, cost of capital, time values of money, cash flows, equivalence for comparison and selection, effect of rate of return, and capital ratio.

UNIT-II

Investment analysis- capital budgeting- methods of evaluation of capital budgeting- payback period methods, rate of return method, Net present value method, interval rate of return method, profitability index method.

UNIT-III

Cost concepts, break even analysis, Budgeting and budgeting control system, classification and types of budgets ,fixed and flexible budgets, sales budget, production budget, cost of production budget, materials budget, direct labor budget, overhead cost budget, selling and distribution overhead budget.

UNIT-IV

Standard costing and variance analysis in relation to construct , direct material variance , direct labor variance , overhead variances , job , batch and contract costing- procedures, determination of economic batch, Network analysis as a basis for cost control.

UNIT-V

Working capital, working capital at project level management of cash, Receivable management, Inventory management, price level accounting (Inflation Accounting), project management network techniques- program evaluation review techniques and critical path method.

Suggested reading:

1. Roy Pilcher (1985) "Project Cost Control in Construction," Collins Professional and technical books, London.
2. Humphreys, K.K., and Wellman, P. (1996) "Basic Cost Engineering," Marcel Dekker, Inc. New York.

ECONOMIC DECISION ANALYSIS IN CONSTRUCTION

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
Semester end Examination	: 70marks
Continuous Internal Evaluation	: 30marks

Course Objectives

- To cover the principles engineering economy followed by basic methods for carrying out economic studies considering the time value of money
- To demonstrate various interest formula methods namely present, future, annual worth method, rate of return method and break even analysis for the comparison of alternatives.
- To understand various methods of depreciation, tax and cost analysis of construction equipments followed by cost estimating.
- To manage and control the inventory and cost of production.
- To estimate the economic life of an asset with inflation effect.
- To study the growth of MNC's in relation to construction industry.

Course Outcomes

- Highlight the basic principles of economics and its concepts.
- To prepare various interest formula for the comparison of alternatives.
- Use updated techniques, skills and tools of industrial engineering throughout their professional careers.
- To acquire fundamental knowledge and understanding of production and industrial engineering.

UNIT-I

Introduction to engineering economics, basic economic concepts related to construction industry- marginal cost, marginal revenue, opportunity cost contribution, time perspective, elementary economic analysis-material selection for a product, design selection, building material and process planning.

UNIT-II

Interest formulae's and their applications- time value of money, present worth method, future worth method, annual equivalent method, rate of return method.

UNIT-III

Replacement and maintenance analysis, determination of economic life of an asset, depreciation-straight line method of depreciation, declining balance method of depreciation, sum of the years digits methods depreciation, sinking funds method of depreciation etc.

UNIT-IV

Production and function, cost of production, inventory cost management , optimum rise of construction, input-output analysis in the construction industry.

UNIT-V

Inflation, procedure to adjust inflation, economic life determination without inflation effect, economic life determination with inflation effect, measurement of inflation, impact of inflation on economic evaluations, growth of multinational construction companies.

Suggested reading:

1. Shutt R.C. (1995), "Economics for the construction industry," Longman Scientific and Technical, England.
2. Panneerselvam, R. (2001), "Engineering Economics," Prentice Hall of India, India.

CONSTRUCTION PLANNING AND SCHEDULING

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
Semester end Examination	: 70marks
Continuous Internal Evaluation	: 30marks

Course Objectives:

- To study the various types of planning tools like bar chart, CPM networks.
- Understand various costs involved in construction projects.
- To gain exposure to computer knowledge in construction industry.

Course Outcomes: The student will be able to

- Perform net work analysis of construction activities.
- Understand various critical activities of project and optimize resources
- Understand the computer based models adopted in construction industry.

UNIT-I

Historical background and introduction to project planning, bar charts, limitations of bar charts, milestone charts, and work breakdown structure, events and activities numbering of networks, PERT and CPM.

UNIT-II

Time estimates, float, slack, probability of completion time, application of PERT/CPM to construction industry problems.

UNIT-III

Cost analysis - direct cost, indirect costs, and slope of the project activities, optimization of cost and schedule through network contraction – applications in construction industry.

UNIT-IV

Cost control in construction projects, importance of cost control and its objectives, resource analysis - smoothing and leveling of various construction projects.

UNIT-V

Precedence network, advantages of precedence network, logic of precedence network diagram, and computer applications on network problems related to construction industry.

Suggested reading:

1. Moder, J.J., Phillips, C.R., and Davis, E.W., “Project Management with CPM and PERT and precedence diagramming.” C.B.S. Publishers & Distributors, New Delhi, 1986.
2. Pilcher, R. “Project Cost Control in Construction.” Collins, London, 1992
3. Brien. J.J. “CPM in Construction Management.” McGraw Hill Book Company Inc., NY,1971.

QUANTITATIVE METHODS IN CONST. MANAGEMENT

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
Semester end Examination	: 70marks
Continuous Internal Evaluation	: 30marks

Course Objectives:

- To study the classical methods like monte-carlo simulation methods in construction.
- To gain knowledge of formulation of optimization models using L.P., D.P tools
- To understand transportation model utility in construction industry

Course Outcomes:

The students will be able to

- Solve simple problems using L.P. and D.P algorithms.
- Formulate problems using L.P., D.P and assignment models
- Understand CPM / PERT methods and solve problems of construction field.

UNIT-I

Introduction, phases of operations research (or), models and scope of or in construction management, concept of probability and statistics - classical methods such as monte-carlo and lagrangian multiplier methods.

UNIT-II

Standard formulation of linear programming, graphical solutions of linear programming, simplex method, linear programming and their computer solutions, characteristics of linear optimization problems.

UNIT-III

Transportation problems: introduction, terminology, minimization and maximization problems – formulation of mathematical models – methods of solution of transportation models using north west corner and least cost method and vogel's approximation method. Assignment problems, formulation and solution of assignment problems.

UNIT-IV

Dynamic programming: introduction, terminology, need for dynamic programming, characteristics of dynamic programming, application of dynamic programming in construction industry - waiting line models.

UNIT-V

Decision theory, game theory, simulation and its applications to construction, Modifications and improvements on CPM/PERT techniques.

Suggested reading:

1. Adrian, J. "Quantitative Methods in Construction Management." American Elsevier Publishing Co., Inc., Amsterdam, Netherlands, 1973.
2. Moder, J.J., Phillips, C.R., and Davis, E.W., "Project Management with CPM and PERT and precedence diagramming." C.B.S. Publishers & Distributors, New Delhi, 1986.
3. Stark, R.M., and Mayer, J.H. "Quantitative Construction Management." John Wiley and Sons, NY, 1983.

LEGAL ISSUES IN CONSTRUCTION MANAGEMENT

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
Semester end Examination	: 70marks
Continuous Internal Evaluation	: 30marks

Course Objectives

- To study the various types of construction contracts and their legal aspects and provisions
- To study the tenders, arbitration, legal requirements, labor and human rights regulations

Course Outcomes

- Know different types of contracts in construction, arbitration and legal aspects and its provision

UNIT-1

Introduction to Construction Law: Need for legal issues in Construction in the Indian Judicial System – Context of Construction Industry, Principles of a Contract, Indian Contract Act 1872 – Provisions for Construction Industry, Essentials of a Valid Contract, Types of Contracts, Alternate Contract Methods, Concept of Completion of a Contract, IT Law 2000 and its Influence on construction Contracts

UNIT-2

Construction Tendering Process: Introduction to Construction Process, Need for tendering, process of Tendering in Construction, Importance of Specifications and Estimates in Construction, Concept of completion of the contract, Sub-Contracts and requirements, Tendering Models and Strategies, Prequalification of Bidders, Documents forming a BID and a Contract, Agreements and Bonds in Tendering Process

UNIT-3

Construction Administration: Duties and Responsibilities – Project Manager, Owner, Engineers and Contractors, Important Site Documents, Process of Building Permissions, Provision for Scheduling delays and accelerations, Environmental Provisions for Construction Contracts.

UNIT-4

Disputes and Liabilities in Construction: Major sources of disputes in construction, Delays – Types, Claims and solutions, Labor Laws in India, Worker Compensation and Insurance laws, Construction Liabilities and Litigations, Disputes in Land Development,

UNIT-5

Dispute Resolution in Construction: Dispute Resolution in Construction, Judicial Process in Dispute Resolution, Alternate Dispute resolution methods, Arbitration and Conciliation Act 1996, Importance of Arbitration in Construction, Arbitration Process, Arbitration Clause in Contracts

Suggested Readings:

1. Indian Contract Act 1892
2. Indian Arbitration and Conciliation Act, 1996

TIMBER AND FORMWORK DESIGN

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
Semester end Examination	: 70marks
Continuous Internal Evaluation	: 30marks

Course objectives

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

Course outcomes

- Design decking, form work and false work.
- Understand the sequence of construction of civil engineering structures.
- Understand the safety steps involved in the design of form work and false work.
- Know the detailed planning of framework, design of forms and erection of form work.

UNIT-I

Introduction: Formwork and false work - Temporary work systems, construction planning and site constraints, Materials and construction of the common formwork and false work systems, Special and proprietary forms.

UNIT-II

Formwork – Design: Concrete pressure on forms, Design of timber and steel forms, Loading and moment of formwork.

UNIT-III

Design of Decks and False works: Types of beam, decking and column formwork, Design of decking, Design of formwork for walls, False work design, Effects of wind load

UNIT-IV

Foundation and soil on false work design; Design of formwork for shear wall

UNIT-V

Special forms: The use and applications of special forms; Sequence of construction; Safety use of formwork and false work. Timber Fasteners – nails, screws, bolts

Suggested Readings:

1. Austin, C.K., Formwork for Concrete, Cleaver, Hume Press Ltd., London, 1996.
2. Michael P. Hurst, Construction Press, London and New York, 2003.

FUNCTIONAL PLANNING AND BUILDING SERVICES

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
Semester end Examination	: 70marks
Continuous Internal Evaluation	: 30marks

Course Objectives:

- Understand functional planning aspects in buildings.
- Understanding of water requirement and distribution aspects in buildings
- Conceptualization of solid waste disposal, fire fighting and codal practices of electrical fixtures in building.

Course Outcomes:

The students will be able to

- Space requirements of typical buildings like Residential, Office and Hospitals.
- Preparation of layout plan for water distributions and drainages.
- Prepare schedule for maintenance of various service equipments like Lifts and Electrical devices in buildings.

UNIT-I

Components of urban forms and their planning, Concepts of neighborhood unit, Functional planning of buildings, Importance of building services, type of services required, planning of services, organization structures of services management, role and administrative functions of supervisors. Space requirements and relationship for typical buildings like residential, offices hospitals etc.

UNIT-II

Plumbing & Water supply system: Basics of plumbing systems, requirement of plumbing works, activity flowchart for plumbing work, Quality, checking of materials, water requirements for different types of buildings, simple method of removal of impurities, water saving practices and their potential, rainwater harvesting , type of spouts, sizes of rainwater pipes, typical detail of a water harvesting pit.

Water supply and distribution system is high-rise building, pumps and pumping mechanisms, Operation & maintenance of fittings & fixtures of water supply & sanitary. Do's & Don'ts for water pipe.

UNIT-III

Solid Waste disposal : Approaches for solid waste management, Solid wastes collection and removal from buildings, On-site processing and disposal methods, guidelines for municipal solid waste management, e-waste management

Disposal of Wastes : Sanitary land filling, composting, Vermi-compost, Incineration, Pyrolysis Treatment system, Root zone treatment system, Decentralized Wastewater Treatment Systems (DEWATS), Soil Bio technology, packaged Bio-Reactor

UNIT-IV

Fire fighting : Basic requirement and various components of the fire fighting system. maintenance, fire fighting in high-rise buildings, commercial/industrial complexes, public buildings, checklist for fire safety. Lifts/Elevators, Escalators: Legal formalities for elevators, various types of lifts, working mechanisms of lift and escalators. Indian standard codes for planning & installations of elevator, inspection & maintenance of lifts.

UNIT V

Telecommunication network, computer network LAN, electrical network, basics of single phase & three phase electrification, precautions and safety measures, IS codes for electrical appliances & wiring operations & maintenance of network & appliances.

Air-Conditioning and Heating: Flowcharts, Centralized systems, monitoring and working of the equipments, checklist of inspection, performance tests.

Building maintenance: Scheduled and contingency maintenance planning, M.T.S. for building maintenance, maintenance standards, Economic maintenance decisions, applications of computer in service management

Suggested Readings:

1. Building Technology IVOR H. Seeley, Mac Millian.
2. Building Finishes, fittings and domestic service Chudley, longman, Scientific and Technical.
3. Fred Hall, Building Services & Equipment ,Longman Scientific and Technical.
4. Lee Smith, Harry Slecter, Plumbing Technology, Design and installation, Delmar Publisher INC.
5. Fred Hall, Plumbing Cold water supplies, Drainage and Sanitation, Longman Scientific & Technical.
6. Roger Greeno, Building Services, Technology and Design, Longman.
7. Norbert Lechner, Heating Cooling, Lighting John Wiley & Sons.
8. Maintenance of Buildings A.C. Panchadari, New age international (P) limited Publishers.

VALUE ENGINEERING IN CONSTRUCTION

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
Semester end Examination	: 70 marks
Continuous Internal Evaluation	: 30 marks

Course Objectives:

- Define Value engineering and its objectives
- Estimation of project budget using capitalized income approach
- Analyse a building using LCC methodology

Course Outcomes:

- Establish value engineering techniques and methodology
- Draw value engineering job plan and work plan phases
- Concept of Delphi techniques and rules for brainstorming

UNIT - I

Introduction to value engineering (VE), definition, objectives of value engineering, reasons for unnecessary costs, VE techniques and methodology, interface with the other programs.

UNIT - II

Elements of the project budget, need for cost control, meaning of capitalization, capitalization process, and capitalized income approach to construction project budgeting.

UNIT - III

Life cycle cost (LCC) and building costs, LCC technology and examples, LCC methodology, LCC formats and analysis and weighted evaluation – application of LCC to buildings.

UNIT - IV

Value engineering and total project management, level of effort, team selection, value engineering job plan, and work plan phases.

UNIT - V

Classifying function, defining function, project level function system technique (fast) diagram, creativity and fixation, interpersonal skills, generation of ideas, brainstorming, rules for brainstorming, Delphi technique, application of Delphi technique to civil engineering projects.

Suggested Reading:

1. Tenah, K.A. (1985). "The Construction Management Process", Reston Publishing Company, Inc. Virginia
2. Dell'Isola, Alphonse (1997). "Value Engineering: Practical Applications." R.S. Means Company, Inc: Kingston, MA.
3. Oberiender, G. D. (1993). "Project Management for Engineering and Construction". *McGraw-Hill, Inc.*: New York.

CONSTRUCTION METHODS AND EQUIPMENT

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
University Examinations	: 70marks
Continuous Internal Evaluation	: 30marks

Course Objectives:

- Importance of prefabrication in construction
- Advantages of modular coordination in prefabrication
- Application of different equipments in construction industry

Course Outcomes:

- Evaluate advantages and disadvantages of prefabrication in construction industry
- comprehend different I.S. recommendations for modular planning
- Analyse the role of different equipments in construction industry

UNIT-I

Precast and Prefabricated construction - need for prefabrication, classification and scope. Advantages and disadvantages of prefabrication and design principles of prefabrication system.

UNIT-II

Modular coordination and its importance, I.S. Recommendations for modular planning, standardization, mass production and methods of Transportation.

UNIT-III

Construction equipment- hoisting equipment such as hoist winch, hoisting chains and hooks, slings. Various types of cranes - tower crane, mobile crane, and derrick crane, safety in crane operations, their characteristics performance and applications to building process.

UNIT-IV

Concrete mixers, truck mixers, pneumatic concrete placer and vibrators for concrete, and Scaffolding. Their characteristics performance and applications to building process

UNIT-V

Conveying equipment - package conveyor, screw conveyor, bucket conveyor and different types of belts, their Characteristics, performance and applications.

Suggested Reading:

1. Peurify, R.L.(1996). "Construction, Planning, Equipment and Methods." McGraw-Hill Book Company, Inc, NY
2. Mahesh Varma (1997) "Construction Equipment and its planning & applications." Metropolitan Book Co (P) Ltd, New Delhi, India.
3. U.K. Srivastava (1999). "Construction Planning and Management." Galgotia Publications Pvt., ltd, New Delhi, India

MANAGEMENT INFORMATION SYSTEMS

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
University Examinations	: 70marks
Continuous Internal Evaluation	: 30 marks

Course objectives:

- To study the concepts of information systems and their applications, system development and information systems, implementation and control, and system audit.
- Analyze the business issues, processes, and techniques associated with management information systems

Course outcomes:

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

UNIT-1

Importance of management information systems (MIS), logical foundation of MIS, manager's view of information systems, functions of management, managerial role, activities of a construction organization.

UNIT-II

Management and decision making in construction industry, classification of information systems, and impact of construction work on management information systems.

UNIT-III

Strategic uses of information technology, inter organizational systems, strategic information systems related to construction industry.

UNIT-IV

Information technology, role of information technology in construction industry, impact of information technology on the individuals, impact on the construction organization, and process of reengineering work.

UNIT-V

File structures and processing methods in construction organizations, data base concepts and data base management systems.

Suggested reading:

1. Robert Schultheis, Mary Sumner. (1999). "Management Information Systems-The Manager's View." Tata McGraw Hill Edition, New Delhi.
2. Kwakye, A.A. (1997), "Construction Project Administration", Adisson Wesley Longman, London.

TQM TECHNIQUES IN CONSTRUCTION

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
University Examinations	: 70marks
Continuous Internal Evaluation	: 30 marks

Course Objectives:

- To familiarize with quality management in construction Industry
- To familiarize with clauses for quality management in construction Industry
- To understand the leadership in construction Industry

Course Outcomes:

The students will be able to

- Prepare approaches to maintain quality in construction Industry
- Prepare approaches for team work in construction Industry
- Define objectives on quality management issues.

UNIT-1

Quality management in construction industry, new approach to quality management, and road to quality management.

UNIT-II

Formal QA, quality assurance, ISO 9000, clauses of ISO 9000, third party assessment for construction works.

UNIT-III

Leadership and total quality management, tools for total quality management, teamwork for total quality management, stages in team development, and role within a team.

UNIT-IV

Learning organization, lean production and management applied to construction industry.

UNIT-V

Quality management in the construction industry, research objectives, senior management and total quality management, cultural change in construction.

Suggested reading:

1. Steven McCabe. (1998). "Quality Improvement Techniques in Construction." LONGMAN.
2. Kwakye, A.A. (1997), "Construction Project Administration", Adisson Wesley Longman, London.

CONSTRUCTION SAFETY MANAGEMENT

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
University Examinations	: 70marks
Continuous Internal Evaluation	: 30 marks

Course Objectives:

- To study and understand the various safety concepts and requirements applied to construction industry.
- To study the various construction safety problems and safety programs.
- To study the various laws related to safety in construction industry
- To study the importance of workers compensation insurance.

Course outcomes

- Ability to identify safety risks on jobsites.
- Able to create and manage an effective safety program in a construction company.
- Will be aware of various laws related to construction safety
- Understand experience modification rates (EMR) and worker's compensation insurance premiums.

UNIT-1

Safety management function, Importance of safety in construction industry, Line versus staff authority, Safety responsibility and accountability in construction industry, Safety organizations, Role of various parties, duties, responsibilities of top management, site managers, supervisors etc., Role of safety officers, Responsibilities of general employees, Safety administration.

UNIT-II

Construction safety problems, Hazards in construction projects, Accident: definition, causes, cost, measurement, investigation and prevention of accidents, Legal and financial aspects of accident, Safety Program: Need,

Elements of an Effective and safety program, general safety program in construction industry.

Hazard Identifications and Control Techniques – HAZOP, FMEA, FMECA.

UNIT-III

Safety in use of construction equipment - vehicles, cranes, hoists and lifts etc., Safety of scaffolding, ladders, working platforms etc, safety while using electrical appliances, explosives, blasting etc, fire safety, Fire safety Causes and safety of accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, high rise constructions etc., safety measures for storage and handling of building materials.

Safety equipment and gear used on construction site, First aid on site.

UNIT-IV

Laws related to construction industry, Laws related to the Industrial Safety, Safety Provisions in the Factory Act, Labour laws.

Measurement of Safety Performance, Safety Audit.

Experience modification rating, workers insurance.

UNIT-V

Case based reasoning, case indexing, retrieval, accident prevention and forecasting using CBR method.

Systems safety analysis, faulty tree analysis, failure modes and effects analysis in construction industry.

Suggested reading:

1. John V. Grimaldi. (1996). "Safety Management." AITBS Publishers & Distributors, New Delhi, India.
2. Kwakye, A.A. (1997), "Construction Project Administration", Adisson Wesley Longman, London.
3. Jimmy W.Hinze, "Construction Safety ", Prentice Hall Inc., 1997.

4. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, "Construction Safety and Health Management ", Prentice Hall Inc., 2001. Internal continuous assessment: 100 marks Internal continuous assessment is in the form of periodical tests, assignm
5. James, J.O Brien, "Construction Inspection Handbook - Quality Assurance and Quality Control ", Van Nostrand, New York, 1989. 14
6. Kwaku A., Tenah and Jose M.Guevera, "Fundamental of Construction Management and Organization ", Prentice Hall of India, 1995.
7. Juran Frank, J.M. and Gryna, F.M. " Quality planning and Analysis ", Tata McGraw Hill, 1982.
8. Hutchins. G., "ISO 9000 ", Viva Books, New Delhi, 1993.
9. Hand book on Construction Safety Practices, SP:70, BIS,2001.
10. Safety Management in Construction Industry- A manual for project managers, NICMAR, Mumbai

HUMAN RESOURCES DEVELOPMENT FOR CONSTRUCTION

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
University Examinations	: 70marks
Continuous Internal Evaluation	: 30 marks

Course objectives:

- To study the management and control of human resources in construction industry.
- To understand the concepts of organization and management theory.

Course outcomes:

- On completion of this course the students will be able to know resource planning and management in construction.
- Plan and manage key human resource functions within organizations.
- Contribute to employee performance management and organizational effectiveness.

UNIT-I

The Human resource Management an Introduction:- Human resource, Nature and scope of HRM, The human resource in the environment, Human resource activities, Diversity of work and Strategies- Human resource hiring:-Job analysis, selection, recruitment, orientation, placement, socialization-

Maintenance and development of the Human Resource: Work motivation and performance, Employee welfare, Compensation, Welfare schemes, Career enlargement and enrichment, Leadership and Effective communication.

UNIT-II

Organization and management theory: Challenges of managing people in construction, Contemporary management Theory, Production efficiency: the Classical Approach, Human Behavior theory, Manager's attitude towards people in construction, Expectations of the employment relationship.

UNIT-III

Strategic HRM approaches and operational HRM approaches: Models of HRM, Employee resourcing, Recruitment & Selection, Case Study Discussion, Training & Development, Appraisal Systems, Reward management, Case Study Discussion, Mentoring, Career in Construction Management.

UNIT-IV

Employee relations and empowerment: Employees relations, The changing role of trade unions, The effect of unions, Collective bargaining, Case Study Discussion, The evolution of empowerment within HRM.

UNIT-V

Work for Analysis:-Trade Unions and Management relationships, Ethical Issues, Employee problems, Industrial Counseling.

Employee empowerment- salient features- diversity and worklife balance.

Employee welfare - strategic Human resource development - employment legislation -legal aspects.

Suggested reading:

1. Langfor D.A. Human Resource management in construction, Longman, 1995.
2. Martin Loosemore, Andrew Dainty, Helen Lingard, Human Resource Management in construction projects: strategic and operational approaches, Taylor and Francis, 2010.

ADVANCED CONCRETE TECHNOLOGY

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
University Examinations	: 70marks
Continuous Internal Evaluation	: 30 marks

Course Objectives:

- Learn the characterization of constituents of concrete.
- Design concrete mix by various methods as per different codes.
- Study the different types of admixtures, mix design, properties and applications of special concretes.

Course Outcomes:

- Learn hydration of cement and tests on properties of cement and aggregates.
- Comprehend the properties and testing of concrete in fresh and hardened state.
- Understand the shrinkage and creep mechanisms, curing and durability of concrete.
- Design concrete mixes by various methods.
- Familiarize with the types of admixtures, and applications of special concretes.

UNIT - I

Constituents of Concrete:

- a) **Cement:** Types of cement and their composition, manufacture of Portland cement, hydration of cement and hydration product, structure of hydrated cement, heat of hydration, gel theories, review of tests on properties of cement.
- b) **Aggregate:** Classification of aggregates, particle shape and texture, bond and strength of aggregate and its influence on strength of concrete, porosity, absorption and moisture content and their influence, soundness of aggregate, alkali aggregate reaction, sieve

analysis and grading of aggregate, review of tests on properties of aggregate.

UNIT - II

Properties of Concrete: Mixing and batching, workability, factors affecting workability, measurements of workability, various tests and procedures, segregation and bleeding, vibration of concrete, types of vibrators and their influence on composition, analysis of fresh concrete, strength of concrete, water-cement ratio, gel space ratio, effective water in the mix, mechanical properties of concrete, tests and procedure, influence of various parameters on strength of concrete, relationship between various mechanical strengths of concrete.

UNIT - III

Shrinkage and Creep of Concrete: Types of shrinkage, mechanism of shrinkage, factors affecting shrinkage, creep mechanism, factors influencing creep, rheological model, effects of creep.

Curing of Concrete: Methods of curing, maturity concept, influence of temperature on strength of concrete.

Durability of Concrete: Permeability of concrete, chemical attack of concrete, tests on sulphate resistance, effect of frost, concreting in cold weather, hot weather concreting, and air entrained concrete.

UNIT - IV

Mix Design of Concrete: Basic considerations, process of mix design, factors in the choice of mix proportions and their influence, quality control, various methods of mix design, I.S. Code method, British and ACI methods.

UNIT - V

Admixtures: Classification of admixtures, chemical and mineral admixtures, influence of various admixtures on properties of concrete, their applications.

Fly Ash Concrete: Mix design, properties and its applications.

High Strength Concrete: Mix design, properties and its applications.

Fiber Reinforced Concrete: Mix design, properties and its applications.

Ferro cement, lightweight concrete, high-density concrete, recycled aggregate concrete and their applications.

Suggested Reading:

1. Neville. A.M, (1988), Properties of Concrete, English Language Book Society/Longman Publications.
2. Mehta. P.K and Paulo. J.M.M, (1997), Concrete – Microstructure – Properties and Material, McGraw-Hill.
3. Krishna Raju. N., (1985), Design of Concrete Mix, CBS Publications.

RETROFITTING AND REHABILITATION OF STRUCTURES

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
University Examinations	: 70marks
Continuous Internal Evaluation	: 30 marks

Course Objectives:

- Learn the fundamentals of maintenance and repair strategies.
- Study the quality assurance, serviceability and durability of concrete.
- Know the various materials and techniques used for repair of structures.
- Educate the different repair, strengthening, rehabilitation and retrofitting techniques.
- Instruct the various health monitoring and demolition techniques.

Course Outcomes:

- Understand the fundamentals of maintenance and repair strategies.
- Diagnose for serviceability and durability aspects of concrete.
- Know the materials and techniques used for repair of structures.
- Decide the appropriate repair, strengthening, rehabilitation and retrofitting technique required for a case study building.
- Use an appropriate health monitoring and demolition techniques.

UNIT - I

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

Repair Strategies: Causes of distress in concrete structures, Construction and design failures, Condition assessment and distress-diagnostic techniques, Assessment procedure for Inspection and evaluating a damaged structure,

UNIT - II

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

UNIT - III

Materials and Techniques for repair: Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fiber reinforced concrete. Bacterial concrete, Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coating and cathodic protection

UNIT - IV

Repairs, Rehabilitation and Retrofitting of structures: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure, long term health monitoring techniques. Repair of Structure – Common Types of Repairs – Repair in Concrete Structures – Repairs in Under Water Structures – Guniting – Shot Create – Underpinning. Strengthening of Structures – Strengthening Methods – Retrofitting – Jacketing.

UNIT – V

Demolition Techniques & Health Monitoring of structures: Engineered demolition techniques for Dilapidated structures Use of Sensors – Building Instrumentation

Suggested Reading:

1. Concrete Technology by A.R. Santakumar, Oxford University press
2. Defects and Deterioration in Buildings, E F & N Spon, London
3. Non-Destructive Evaluation of Concrete Structures by Bungey - Surrey University
4. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.

5. Concrete Repair and Maintenance Illustrated, RS Means Company Inc
W. H. Ranso, (1981)
6. Building Failures : Diagnosis and Avoidance,
EF & N Spon, London, B.7 .Mehta, P.K and Montevic. P.J., Concrete-
Microstructure, Properties and Materials, ICI, 1997.,8Jackson, N., Civil
Engineering Materials, ELBS, 1983.

STRUCTURAL HEALTH MONITORING

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
University Examinations	: 70marks
Continuous Internal Evaluation	: 30 marks

Course Objectives:

- Learn the fundamentals of structural health monitoring.
- Study the various vibration-based techniques for structural health monitoring.
- Learn the structural health monitoring using fiber-optic and Piezoelectric sensors.
- Study the structural health monitoring using electrical resistance and electromagnetic techniques.

Course Outcomes:

- Understand the fundamentals of maintenance and repair strategies.
- Diagnose for serviceability and durability aspects of concrete.
- Know the materials and techniques used for repair of structures.
- Decide the appropriate repair, strengthening, rehabilitation and retrofitting technique required for a case study building.
- Use an appropriate health monitoring technique and demolition technique.

UNIT-I

Introduction to SHM: An Overview of Structural Health Monitoring and Smart Materials

UNIT-II

Vibration Control for SHM: Vibration Control using SHM – Introduction to FE formulation, Constitutive Relationship, Element Stiffness Matrix for High Precision Finite Element, Element Mass Matrix for High Precision

Finite Element, Developing Actuator and Sensor Influence Matrix, Estimating Sensor Voltage, Active Control of Damping, A Case study of Performance Estimation for Different Patches, SHM of Ribbon Reinforced Composite Laminate

UNIT-III

SHM using Piezo and Magnetostrictive Layers: Delamination Sensing using Piezo Sensory Layer, Voltage Response from Piezopatch, Electrical Impedance Method basic theory, A Case Study: Results and Discussions, SHM using Magnetostrictive Sensory Layer, Basics of Magnetization and Hysteresis, Delamination Sensing using Magnetostrictive Sensory Layer, Constitutive relationship with composite relationship, MS Layer in symmetric Laminate, MS Layer Away from the Mid plane in Asymmetric Laminate, Case Studies related to MS Layer based SHM

UNIT-IV

SHM using LDV: Experimental Modal Analysis using LDV – Introduction, What is LDV?, Velocity and Displacement Measurement using LDV, Case Study for Symmetric Laminate, Case Study for Cross-ply

Suggested Reading:

1. Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes, Structural Health Monitoring, John Wiley and Sons, 2006.
2. Douglas E Adams, Health Monitoring of Structural Materials and Components-Methods with Applications, John Wiley and Sons, 2007.
3. J.P. Ou, H.Li and Z.D. Duan, Structural Health Monitoring and Intelligent Infrastructure, Vol-1, Taylor and Francis Group, London, U.K, 2006.
4. Victor Giurgutiu, Structural Health Monitoring with Wafer Active Sensors, Academic Press Inc, 2007.
5. Smart Materials and Structures, Gandhi and Thompson
6. Structural Health Monitoring: Current Status and Perspectives, Fu Ko Chang

GREEN BUILDING TECHNOLOGY

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
University Examinations	: 70marks
Continuous Internal Evaluation	: 30 marks

Course Objectives:

- Exposure to the green building technologies and their significance.
- Understand the judicious use of energy and its management.
- Educate about the Sun-earth relationship and its effect on climate.
- Enhance awareness of end-use energy requirements in the society.
- Develop suitable technologies for energy management.

Course Outcomes:

- Understand the fundamentals of energy use and energy processes in building.
- Identify the energy requirement and its management.
- Know the Sun-earth relationship vis-a-vis its effect on climate.
- Be acquainted with the end-use energy requirements.
- Be familiar with the audit procedures of energy.

UNIT I

Overview of the significance of energy use and energy processes in building - Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

UNIT II

Indoor environmental requirement and management - Thermal comfort - Ventilation and air quality – Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement.

UNIT III

Climate, solar radiation and their influences - Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT IV

End-use, energy utilization and requirements - Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building. Heat gain and thermal performance of building envelope - Steady and non steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer

UNIT V

Energy management options - Energy audit and energy targeting - Technological options for energy management

Suggested Reading:

1. Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
2. Carter, W. Nick, 1991: Disaster Management, Asian Development Bank, Manila.
3. Sahni, Pardeep et.al. (eds.) 2002, Disaster Mitigation Experiences and Reflections, Prentice Hall of India, New Delhi.
4. Bryant Edwards (2005): Natural Hazards, Cambridge University Press,U.K.

GEOSPATIAL TECHNOLOGY

Instruction:	3 periods per
week Duration of Semester End Examination:	3 hours
CIE:	30 marks
SEE:	70 marks
Credits:	3

Course Objectives:

- Discuss the various spatial and non-spatial data types, and data base management techniques
- Develop the concepts and professional skills in utility of geospatial techniques
- Improve the working knowledge of geospatial techniques in field problems

Course Outcomes:

- Geospatial technology relating to the data acquiring and processing that is associated with geographic locations
- Application of Geospatial techniques in the decision support systems useful for decision makers and community services.
- Utility of Geospatial techniques in the fields of natural resource management, environment, urban planning and development, etc.

UNIT –I

Introduction - Basic concepts, socioeconomic challenges, fundamentals of geographical information systems (GIS), history of geographical information system, components of geographical information systems.

Projections and Coordinate Systems - Map definitions, representations of point, line, polygon, common coordinate system, geographic coordinate system, map projections, transformations, map analysis.

UNIT –II

Data Acquisition and Data Management - data types, spatial, non spatial (attribute) data, data structure and database management, data format, vector and raster data representation, object structural model filters and files data in computer, key board entry, manual digitizing, scanner, aerial photographic data, remotely sensed data, digital data, cartographic database, digital elevation data, data compression, data storage and maintenance, data quality and standards, precision, accuracy, error and data uncertainty.

Data Processing - Geometric errors and corrections, types of systematic and non systematic errors, radiometric errors and corrections, internal and external errors.

UNIT –III

Data Modeling - Spatial data analysis, data retrieval query, simple analysis, recode overlay, vector data model, raster data model, digital elevation model, cost and path analysis, knowledge based system.

GIS Analysis and Functions - Organizing data for analysis, analysis function, maintenance and analysis of spatial data, buffer analysis, overlay analysis, transformations, conflation, edge matching and editing, maintenance and analysis of spatial and non spatial data.

UNIT –IV

Applications of GIS - Environmental and natural resource management, soil and water resources, agriculture, land use planning, geology and municipal applications, urban planning and project management, GIS for decision making under uncertainty, software scenario functions, standard GIS packages, introduction to Global Positioning Systems (GPS) and its applications.

UNIT – V

Introduction to Remote Sensing - General background of remote sensing technology, objectives and limitations of remote sensing, electro-magnetic radiation, characteristics, interaction with earth surface and atmosphere, remote sensing platforms and sensors, satellite characteristics, digital image processing, IRS series and high resolution satellites, software scenario functions, remote sensing applications to watershed modeling, environmental modeling, urban planning and management.

References:

1. Burrough, P. A., and McDonnell R. A. (1998). *Principles of Geographical Information Systems*. Oxford University Press, New York, Pp.333.
2. Choudhury S., Chakrabarti, D., and Choudhury S. (2009). *An Introduction to Geographic Information Technology*. I.K. International Publishing House (P) Ltd, New Delhi, Pp.276.
3. Kang-tsung Chang. (2006). *Introduction to Geographical information Systems*. Tata McGraw-Hill Publishing Company Ltd., Third Edition, New Delhi, Pp.432.
4. Lilysand T.M., and Kiefer R.W. (2002). *Remote Sensing and Image Interpretation*. John Wiley and Sons, Fourth Edition, New York, Pp.724.
5. Sabins F.F. Jr. (1978). *Remote Sensing Principles and Interpretations*. W.H. Freeman and Company, San Francisco, Pp. 426.
6. Tor Bernhardsen. (2002). *Geographical Information System*. Wiley India (P) Ltd., Third Edition, New Delhi, Pp. 428.
7. Hoffman-Wellenhof, B, et al. (1997). *GPS Theory and Practice*. Fourth Edition, Springer Wein, New York.

STATISTICAL TECHNIQUES

Instruction	: 3 periods per week
Duration of University Examination	: 3 Hours
University Examination	: 70 Marks
Sessionals	: 30 Marks

Objectives:

- To introduce fundamental knowledge of sampling technique
- To describe basic statistical techniques such as statistical distributions and correlation methods
- To impart knowledge on exact sampling distributions and the tests of significance

Outcomes:

- Students who successfully complete this course will be able to:
- Use sampling techniques for conducting various surveys related to transportation engineering
- Decide best fit and develop the regression equations for the given variables
- Applications of sampling distributions in Highway and Traffic Engineering problems.

UNIT-I

Introduction: Frequency distribution; Measures of central tendency; Measures of dispersion; Standard error, Moments (about mean, arbitrary numbers and origin); Skewness; Kurtosis; Sampling-Definitions and Applications; Simple random sampling; Stratified sampling; Systematic sampling; Sample size determination; Applications in Highway and Traffic Engineering

UNIT-II

Statistical Distribution; Probability, Bayes' Theorem; Binomial, Poisson, Exponential and Normal distributions; Fitting of distributions; Mean and variance ; Chi-square test of goodness-of-fit; Applications in Highway and traffic Engineering. Mathematical expectation.

UNIT-III

Regression and Correlation : Linear regression and correlation; Multiple correlation; Multiple correlation coefficient; Standard error of estimate; Analysis of variance; Curvilinear regression; Applications in Transportation Engineering.

UNIT-IV

Multi Variate Data Distributions; Types of data; Basic vectors and matrices; Simple estimate of centroid, Standard deviation Variance and covariance ; Correlation matrices ; Principal component analysis;. Time series analysis. Estimation-Point Estimation, Interval Estimation, Box Plot, Maximum likelihood estimation, Biased & Non Biased Estimation.

UNIT - V

Exact Sampling Distributions and Tests of Significance; Chi-square distribution; students' t-distribution; Snedectors F-distribution. Large sample and small sample tests; Tests for single mean. Means of two samples, Proportions, two variances, two observed correlation coefficients, paired T-tests, Applications. Intervals for mean, variance and regression coefficients; Applications in Highway and Traffic Engineering Problems.

Suggested Reading

1. Basic Statistics - Simpson and Kafks; Oxford and IBH Calcutta, 1969.
2. Fundamentals of Mathematical Statistics - Gupta, S.C. and Kapoor, K. V. Sultanchand Multivariate Data Analysis – Cootey W.W & Cochens P.R; John Wiley & Sons

ENGINEERING RESEARCH METHODOLOGY

No. of Credits	: 3 Credits
Instruction	: 3 Periods per week
Duration of University Examination	: 3 Hours
Semester End Evaluation	: 70 Marks
Continuous Internal Evaluation	: 30 Marks

Course Objectives:

- Learn the research types, methodology and formulation.
- Know the sources of literature, survey, review and quality journals.
- Understand the research design for collection of research data.
- Understand the research data analysis, writing of research report and grant proposal.

Course Outcomes:

- Differentiate the research types and methodology.
- Able to do literature survey using quality journals.
- Able to collect research data.
- Process research data to write research report for grant proposal.

UNIT - I

Research methodology: Objectives and motivation of research - Types of research - Research approaches - Significance of research - Research methods verses methodology - Research and scientific method - Importance of research methodology - Research process - Criteria of good research - Problems encountered by researchers in India - Benefits to the society in general. Defining the research problem: Definition of research problem - Problem formulation - Necessity of defining the problem - Technique involved in defining a problem.

UNIT – II

Literature survey: Importance of literature survey - Sources of information - Assessment of quality of journals and articles - Information through internet.

Literature review: Need of review - Guidelines for review - Record of research review.

UNIT – III

Research design: Meaning of research design - Need of research design - Feature of a good design - Important concepts related to research design - Different research designs - Basic principles of experimental design - Developing a research plan - Design of experimental set-up - Use of standards and codes.

UNIT – IV

Data collection: Collection of primary data - Secondary data - Data organization - Methods of data grouping - Diagrammatic representation of data - Graphic representation of data - Sample design - Need for sampling - Some important sampling definitions - Estimation of population - Role of statistics for data analysis - Parametric vs. non parametric methods - Descriptive statistics - Measures of central tendency and dispersion - Hypothesis testing - Use of statistical softwares.

Data Analysis: Deterministic and random data - Uncertainty analysis - Tests for significance - Chi-square - Student's t-test - Regression modeling - Direct and interaction effects – ANOVA - F-test - Time series analysis - Autocorrelation and autoregressive modeling.

UNIT - V

Research report writing: Format of the research report – Synopsis – Dissertation - Thesis - Its differentiation – References – Bibliography – Webliography - Technical paper writing - Journal report writing - Making presentation - Use of visual aids.

Research proposal preparation: Writing a research proposal and research report - Writing research grant proposal.

Suggested Reading:

1. C.R Kothari, “Research Methodology, Methods & Technique”, New Age International Publishers, New Delhi, 2004.
2. R. Ganesan, “Research Methodology for Engineers”, MJP Publishers, Chennai, 2011.
3. Ratan Khananabis and Suvasis Saha, “Research Methodology”, Universities Press, Hyderabad, 2015.
4. Y.P. Agarwal, “Statistical Methods: Concepts, Application and Computation”, Sterling Publishing Pvt. Ltd., New Delhi, 2004.
5. Vijay Upagade and Aravind Shende, “Research Methodology”, S. Chand & Company Ltd., New Delhi, 2009.
6. G. Nageswara Rao, “Research Methodology and Quantitative methods”, BS Publications, Hyderabad, 2012.

Disaster Management

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
University Examinations	: 70marks
Continuous Internal Evaluation	: 30 marks

Course Objectives:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country.
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

Course Outcomes:

After completion of this course, the student shall able to

- Understand the fundamentals of disasters and its impacts.
- Understand the cyclones, local storms and floods.
- Know the procedures to prevent, mitigate and prepare community based disaster risk reduction.
- Know the inter-relationship between disasters and development.
- Know the disaster risk management in India and case studies on reducing disaster risks.

UNIT-I

Introduction to Disasters: Concepts and definitions of Disaster, Hazard, Vulnerability, Resilience, Risks. Natural and Manmade disasters, impact of drought, review of past disasters and drought in India, its classification and characteristics. Classification of drought, causes, Impacts (including social, economic. political, environmental, health, psychosocial, etc.).

UNIT-II

Disaster: Classifications, Causes, Impacts including social, economic, political, environmental, health, psychosocial etc.

Differential Impacts - in terms of caste, class, gender, age, location, disability Global trends in disasters, urban disasters, pandemics, complex emergencies, climate change.

Cyclones and Floods: Tropical cyclones & Local storms, Destruction by tropical cyclones and local storms, Cumulative atmospheric hazards/ disasters, Cold waves, Heat waves, Causes of floods, Flood hazards in India.

UNIT-III

Approaches to Disaster Risk Reduction: Disaster cycle - its analysis, Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural sources, roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), states, Centre, and other stake-holders.

UNIT-IV

Inter-relationship between Disasters and Development: Factors affecting Vulnerabilities, differential impacts, impact of development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation, Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT-V

Disaster Risk Management in India: Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, OM Act and Policy, other related policies, plans, programmes and legislation)

Field Work and Case Studies: The field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the college is located.

Suggested Reading:

1. Sharma, V. K. (1999), “Disaster Management”, National Centre for Disaster Management, IPE, Delhi.
2. Anil, K. Gupta and Sreeja, S. Nair (2011), “Environmental Knowledge for Disaster Risk Management”, NIDM, New Delhi.
3. Nick (1991), “Disaster Management: A Disaster Manager's Handbook”, Asian Development Bank, Manila Philippines.
4. Kapur, et al. (2005), “Disasters in India: Studies of Grim Reality”, Rawat Publishers, Jaipur.
5. Pelling Mark (2003), “The Vulnerability of Cities: Natural Disaster and Social Resilience”, Earthscan Publishers, London.

NEURAL FUZZY AND EXPERT SYSTEMS

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3 hours
University Examinations	: 70marks
Continuous Internal Evaluation	: 30 marks

Course Objectives:

- Explain the concepts of neural networks, fuzzy logic, and genetic algorithms.
- Solve problems that are appropriately solved by neural networks, fuzzy logic, and genetic algorithms.
- Understand the structure of expert systems.
- Get exposure to software packages in practice.

Course Outcomes:

- Learn the mathematical theory behind the intelligent problem solving approaches and apply them to write the code to solve a particular design problem.
- Carry out three design projects in the course in neural networks, fuzzy logic, and genetic algorithms.
- Covers intelligent approaches to solving engineering problems that are appropriate for pattern matching, control, optimization, and other areas.
- Solve the problems pertaining to artificial neural networks, fuzzy logic and expert systems using standard software packages.

UNIT-I

Introduction: Brief introduction to the study of artificial intelligence. An insight to the concept of natural intelligence followed by the development of artificial neural networks, fuzzy logic systems and expert systems tool. Demonstration of the importance of artificial neural networks, fuzzy logic and expert systems with the help of at least two practical examples civil engineering for each study. Importance of neuro-fuzzy systems

UNIT-II

Neural Networks: Components of artificial neural networks - neurons, inputs, outputs, error, error propagation, hidden layers, threshold logic, weights, bias, noise, momentum, rate of learning, training and testing - Hebb's rule, Delta rule - Supervised learning - Generalized Delta rule - unsupervised learning.

Types of Neural Networks - Perceptrons - feed forward back propagation networks - Hop field networks

UNIT-III

Fuzzy sets: Crispness, vagueness, uncertainty, and fuzzy sets. Basic. Definitions and operations of Fuzzy sets, approximate reasoning, and membership function. Fuzzy Relations: Fuzzy relation and fuzzy composition, fuzzy aggregation procedures, Dominance Matrix, Weightages, applications of Fuzzy sets to civil engineering problems, and pattern recognition.

UNIT-IV

Expert systems: Structure of expert systems, Knowledge acquisition, Knowledge organization, methods of representing Knowledge, types of inference engines, reasoning under uncertainty, various types of expert system tools, heuristics, search mechanism, expert system development and hybrid expert systems.

UNIT-V

Exposure to Software Packages: Neural networks (Mat lab tool kit) — fuzzy logic — expert systems (L5 object). Applications of Artificial Neural Networks, Fuzzy logic and expert systems in civil engineering — Case studies with at least one problem on each aspect of ANN, FL and Expert systems.

Suggested Readings:

1. Fuzzy Sets, Decision Making, and Expert Systems, Zimmerman, H. J., Kluwer Academic Publications, Boston, 1987.
2. "Artificial Intelligence and Expert System", Elaine Rich, Judea Pearl, Heuristics.
3. "Expert Systems in Construction and Structural Engineering" Adeli H., Chapman, 1988.
4. "Neural Networks Algorithms, Applications and Programming" Freeman, J.A., and Skapura, D.M. Addison-Wesley, Reading MA, 1991.

ENVIRONMENTAL IMPACT ASSESSMENT

Instruction	: 3 periods per week
Duration of Semester End Examination	: 3hours
CIE	: 30 marks
SEE	: 70 marks
Credits	: 3

Course Objectives:

- Introduction of EIA concepts and methodologies.
- Importance of data collection of EIA assessment.
- Preparation of EIA reports and discussion about various environmental impact Laws pertaining to India.

Course Outcomes:

- Knowledge to assess environmental related projects.
- Understanding legislative acts to contribute towards clean environment
- Design of an efficient municipal solid waste management system

UNIT I

Environmental Impact Assessment: Definition, basic concepts and principles of EIA. Regulatory frame work in India. Environmental inventory, base line studies, over view of EIA studies.

UNIT II

Assessment and Methodologies: Physical, biological assessment, Socio economic and cultural environmental assessment, EIA methodologies– Adhoc, matrix, checklist approaches. Economic evaluation of impacts-cot benefits of EIA, Public participation in environmental decision making. Procedures for reviewing EIA analysis and statement.

UNIT III

Environmental Assessment: Introduction, process, Basic steps involved, Description of environmental setting – Base line data collection, possible impacts due to water resources projects. Impact prediction and assessment – methods of impact assessment, Matrix and check list method, Selection of proposed action. Preparation of environmental impact statement.

UNIT IV

Environmental Legislation and Regulations: Rationale, concerns, legislative data systems, safe drinking water act, clean water act, clean air act, noise control act, resource conservation and recovery act, comprehensive environmental response, compensation and liability act.

UNIT V

Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/recycle, energy recovery, treatment and disposal).

References:

1. Canter, L.W. (1996), 'Environmental Impact Assessment', McGraw-Hill Book Company, New York.
2. Corbitt Robert A. (1999), 'Standard Hand Book of Environmental Engineering' McGraw-Hill Book Company, New York.
3. Marriott (), 'Environmental Impact Assessment: A Practical Guide', McGraw-Hill Book Company, New York.
4. Sabins F.F. Jr.(1978), 'Remote Sensing Principles and Interpretations' W.H. Freeman and Company, San Francisco
5. Jensen John R. (1986), 'Introductory Digital Image Processing', Prentice-Hall of India New York

Construction Engineering Laboratory-I

Instruction	: 3 Periods per week
Sessional	: 50 Marks
Credits	: 2

Course Objectives:

- Evaluate the properties of constituents of concrete.
- Evaluate the properties of various building materials.
- Evaluate the properties of concrete with variable workability.
- Evaluate the properties of concrete with variable parameters.

Course Outcomes:

- Learn the properties of constituents of concrete.
 - Assess the properties of various building materials.
 - Correlate the properties of concrete with variable workability.
 - Correlate the properties of concrete with variable parameters.
1. Evaluation of properties of cement, fine aggregates and coarse aggregates.
 2. Evaluation of properties of reinforcing steel, timber, building block and tile.
 3. Variation of workability with time for different grades of concrete – experimental observations.
 4. Experimental observation on influence of following parameters on strength characteristics of concrete (Some of these parameters may be considered depending up on time)
 - i. Size, Shape and grade of coarse aggregate
 - ii. Grading of fine aggregate
 - iii. Hand Mixing / Machine Mixing
 - iv. Aggregate – Cement Ratio
 - v. Coarse Aggregate – Fine Aggregate Ratio
 - vi. Size and Shape of Test Specimen
 - vii. Admixtures

Construction Engineering Laboratory-II

Instruction	: 3 Periods per week
Sessional	: 50 Marks
Credits	: 2

Course Objectives:

- Study the concrete mix design using various codes and evaluate the properties of concrete.
- Evaluate the properties of concrete and correlate them with the non-destructive testing results.
- Evaluate the effect of different parameters on non-destructive testing results.
- Evaluate the crack propagation in a beam under single-point - two-point loading.

Course Outcomes:

- Design the concrete mixes using various codes and assess the properties of concrete.
 - Correlate the properties of concrete with the non-destructive testing results.
 - Appraise the effect of different parameters on non-destructive testing results.
 - Estimate the crack propagation and crack patterns in a beam.
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1. Concrete mix design by BIS, ACI and BS method – proportioning, batching, mixing, moulding of specimens for compression, modulus of elasticity and modulus of rupture – testing of specimens as per relevant codes of practice (comparative study).

2. Development of correlation between Non-Destructive and Destructive tests using Rebound Hammer & UPV instruments.

1. Influence of following parameters on NDT readings – experimental observations.

- Aggregate Cement Ratio
- Cement Ratio
- Excess / Deficient Cement
- Excess / Deficient Water
- Aggregate type.

(Some of the above parameters may be considered depending upon time)

4. Strain and deflection measurement for a structural member under single point / two point loading – crack propagation observation.

Measurement and plotting.

Seminar-I

Instruction	: 3 Periods per week
Sessional	: 50 Marks
Credits	: 2

Course 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.

Course Outcomes:

- Identify appropriate topic of relevance.
- Update literature on technical articles of selected topic and develop comprehension.
- Prepare a technical report.
- Deliver presentation on specified technical topic

Assigned reading and students reports on problems selected from the field of construction engineering and management.

Seminar-II

Instruction	: 3 Periods per week
Sessional	: 50 Marks
Credits	: 2

Course 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.

Course Outcomes:

- Identify appropriate topic of relevance.
- Update literature on technical articles of selected topic and develop comprehension.
- Prepare a technical report.
- Deliver presentation on specified technical topic

Assigned reading and students reports on problems selected from the field of construction engineering and management.

Project Seminar

Instruction	: 4 Periods per week
Sessionals	: 100 Marks
Credits	: 8

Course Objectives:

- Define the statement of research problem.
- Update the literature in chosen area of research and establish scope of work.
- Develop the study methodology.
- Carryout basic theoretical study/experiment.

Course Outcomes:

- Detailed literature review and collection of relevant material
- Narrowing the suitable dissertation topic
- Framing the objectives

Each student will be attached to a faculty member who will monitor the progress of the dissertation. The student is required to submit a technical write-up, presentation of their study (about 20 minutes) followed by a discussion.

At least two faculty members will be associated with the seminar presentation to evaluate and award marks.

Dissertation

Instruction	: 6 Periods per week
University Examination	: Viva Voice
Marks	: 200
Credits	: 16

Course Objectives:

- Expand on the defined research problem in dissertation.
- Conduct laboratory/analytical studies.
- Analyse data, develop models, offer solutions and give conclusions.

Course Outcomes:

- Expand on the defined Research Problem in dissertation
- Conduct Laboratory/analytical studies
- Analyse Data, develop models, offer solutions and give conclusions

Each student will be attached to a faculty member who will monitor the progress of the student. The student is required to submit a technical write-up, presentation of their study (about 20 minutes) followed by a discussion.

The dissertation shall be internally scrutinized by a Viva-Voce committee consisting of the Head of the Department, Chairman Board of Studies, Supervisor and Examiner.

The Dissertation will be scrutinized by an external examiner as per the institute guide lines applicable.

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