DEPARTMENT OF CIVIL ENGINEERING

Scheme of Instruction and Syllabi

(As per AICTE Model Curriculum)

M.E. (CIVIL)

(Full Time)

Specialization in

CONSTRUCTION MANAGEMENT

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad – 500 007

2019-20

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):

PEO-1: Impart and enrich knowledge of effective and quality construction management practices leading to savings in time and cost of construction projects.

PEO-2: Apply latest methods, procedures, modern tools and techniques to optimise resources for achieving project objectives in construction projects.

PEO-3: Communicate effectively, demonstrates leadership qualities, work in team environment and exhibit professional ethics.

PEO-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):

PO-1: Apply knowledge of construction engineering to solve problems related to contemporary issues in construction Industry.

PO-2: Analyze, design, conduct numerical experiments, and interpret data of complex construction technology management problems.

PO-3: Use modern engineering tools, instrumentation and software in implementing construction projects.

PO-4: Communicate effectively, demonstrate leadership skills, work in inter-disciplinary engineering teams with social responsibility and ethical values.

PO-5: Engage in lifelong learning and demonstrate awareness of contemporary issues to meet the challenges and demand of the society.

PEO-6: Employ sustainable technologies to protect environment and ecosystems.

MAPPING OF PEO'S WITH PO'S

PROGRAMME EDUCATIONAL OBJECTIVES	MAPPING WITH POs					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
PEO-1	Y	Y	-	-	Y	Y
PEO-2	Y	Y	Y	-	Y	Y
PEO-3	Y	-	-	Y	-	-
PEO-4	Y	Y	Y	Y	Y	Y

DEPARTMENT OF CIVIL ENGINEERING, U.C.E., O.U
M. E. CIVIL (CONSTRUCTION ENGINEERING MANAGEMENT)
w. e. f. 2019-2020

Type of course	Course Code	Course Name	Contact hours per week			Scheme of Examination		Credits
			L	T	P	CIE	SEE	
SEMESTER-I								
Core-I	CE601	**Construction Management**	3			30	70	3
Core-II	CE602	**Construction Planning and Administration**	3			30	70	3
Professional Elective-I	CE611	Economic Decision Analysis in Construction	3			30	70	3
	CE612	Legal Issues in Construction Management						
	CE411	Statistical Techniques						
Professional Elective-II	CE613	Construction Finance	3			30	70	3
	CE115	Structural Health Monitoring						
	CE117	Green Building Technology						
Audit-I	AC101	Disaster Mitigation & Management	2	1		30	70	0
	AC102	English for Research Paper Writing	2	1		30	70	0
Lab-I	CE651	Construction Engineering Lab - I			3	50	-	1.5
Lab-II	CE652	Computing Application Lab in Construction Management -I			3	50	-	1.5
MC	CE100	Research Methodology in Civil Engineering	3	-		30	70	3
TOTAL			16	2	8	280	420	18
SEMESTER-II								
Core-III	CE603	**Construction Planning and Scheduling**	3			30	70	3
Core-IV	CE604	**Quantitative methods in Construction Management**	3			30	70	3
Professional Elective-III	CE614	Neural Fuzzy and Expert Systems	3			30	70	3
	CE615	Value Engineering In Construction						
	CE616	TQM techniques in Construction						
Professional Elective-IV	CE617	Construction Safety Management	3			30	70	3
	CE618	Human Resources Development for Construction						
	CE121	Advanced Concrete Technology						
Audit-II	AC103	Personality Development	2	1		30	70	0
	AC104	Stress Management by Yoga						
	AC105	Constitution of India						
Core-V / MC	CE671	Mini Project			6	50		3

Lab-III	CE653	Construction Engineering Lab-II			3	50	-	1.5
Seminar	CE661	Seminar			3	50	-	1.5
TOTAL			14	1	12	300	350	18
SEMESTER-III								
Professional Elective-V	CE619	Construction Planning Equipments and Methods	3			30	70	3
	CE620	Management Information system						
	CE621	Functional Planning and Building Services						
	CE622	Timber and Formwork Design						
	CE623	Environmental Impact Assessment						
Open Elective	CE901	Cost Management of Engineering Projects	3			30	70	3
	CE902	Operation Research						
	CE903	Industrial Safety						
	CE904	Business Analytics						
	CE905	Waste to Energy						
	CE906	Intellectual Property Rights						
	CE907	Composite Materials						
	CE908	Geospatial Technology						
	CE681	Major Project Phase-I	6		20	100		10
TOTAL			12		20	160	**140**	16
SEMESTER-IV								
	CE682	Major Project Phase-II			32		200	16
GRAND TOTAL								68

CIE : Continuous Internal Evaluation **SEE : Semester End Examination**

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SEMESTER-I

CE601 *With effect from the academic year 2019-20*

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
- Awareness of principles of construction Management and decision making in construction Industry
- Applications of mobilization, cost time schedules and MIS technique in the real time construction operation
- Application of work study measurements
- Knowledge of work measurement application in construction industry

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.2	0.2	0.2	-	0.2	0.2
CO2	0.2	0.3	0.3	-	0.2	-
CO3	0.2	0.3	0.3	-	0.2	-
CO4	0.2	0.3	0.3	-	0.2	-
CO5	0.2	0.3	0.3	-	0.2	-

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 Fundamantals 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 Wiely, 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.

CE602 ***With effect from the academic year 2019-20***

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.

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.4	0.2	0.2	-	0.2	-
CO2	0.4	-	-	0.4	0.2	-
CO3	0.4	0.2	0.4	-	-	-
CO4	0.4	0.4	0.2	-	-	-
CO5	0.4	0.2	0.2	-	0.2	-

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.

CE611 *With effect from the academic year 2019-20*

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 of engineering economy by following the basic methods for carrying out Economic studies.
- To demonstrate various interest formulas for comparing the alternative methods.
- To understand various methods of Depreciation for Replacement and Maintenance Analysis.
- To manage and control the Inventory and Cost of Production.
- To estimate the Economic life of an Asset with Inflation Effect.

Course Outcomes

- Highlight the basic principles of Economics and its concepts.
- Able to calculate various interest formulas for comparison of Alternatives.
- Ability to calculate various methods of Depreciation.
- Ability to control the Inventory and Cost of Production.
- Able to estimate the Economic life of an Asset with Inflation effect.

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.3	0.2	0.3	0.1	0.1	-
CO2	0.4	0.2	0.3	-	0.1	-
CO3	0.4	0.2	0.3	-	0.1	-
CO4	0.4	0.2	0.3	-	0.1	-
CO5	0.4	0.2	0.3	-	0.1	-

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.

CE612 *With effect from the academic year 2019-2020*

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

- Student shall able to know basics on construction related contracts.
- Students shall be able to carry out the tendering process.
- Overview of construction management, administration and present status of construction industry.
- Students shall be aware of labor law related legislations.
- Students shall be able to know dispute resolution mechanism

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.5	0.15	0.15	0.1	0.1	-
CO2	0.5	0.1	0.2	0.1	0.1	-
CO3	0.5	0.1	0.1	0.1	0.1	-
CO4	0.5	0.1	0.1	0.1	0.2	-
CO5	0.5	0.1	0.1	0.1	0.2	-

UNIT-1

Introduction to Construction Law - Need for legal issues in Construction–The Indian Contract Act, 1872 - Definition of a Contract and its essentials, Formation of a valid Contract - Offer and Acceptance, Consideration, Capacity to Contract, Free consent, Legality of object, Discharge of a Contract by performance, Impossibility and Frustration, Breach, Damages for breach of a contract, Quasi contracts. Special Contracts Contract of Indemnity and Guarantee, Contract of Bailment and Pledge, Contract of Agency— I T Lawand its Influence on Construction Contracts

UNIT-2

Construction Tendering Process: Introduction to Construction Process,Need for tendering, process of Tendering in Construction, Importance ofSpecifications and Estimates in Construction, Concept of completion of the Contract, Sub-Contracts and requirements, Tendering Models andStrategies, Re Tendering , Prequalification of Bidders, Documents forming a BID and Contract, Agreements and Bonds in Tendering Process – E- Procurement

UNIT-3

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

UNIT-4

Employment legislations - Industrial Dispute Act, Factories Act, Payment of Wages Act, Workmen's Compensation Act. Important Provisions of Employees' State Insurance Act, Payment of Gratuity Act, Employees Provident Fund Act, Worker Compensation and Insurance laws.

UNIT-5

Disputes and Liabilities in Construction: Major sources of disputes in construction, Reasons for Delays – Types, Claims and solutions Construction Liabilities and Litigations, Disputes in Land Development. Dispute Resolution

in Construction and Judicial Process and ADRs, Arbitration and Conciliation Act 1996, Arbitration Agreement, Importance of ADR Methods in Construction, Arbitration Process, Arbitration Clause in Contracts

Suggested Readings:

1) Civil Engineering Contracts and Estimates - B. S. Patil – Universities Press- 2006 Edition, reprinted in 2009.
2) The Indian Contract Act (9 of 1872), 1872- Bare Act- 2018 edition, Asia Law Book Publishers Hyderabad..
3) The Arbitration and Conciliation Act,(1996), 1996 (26 of 1996)- 2006 Edition, Professional Book Publisher.
4) Law of contract Part I and Part II, Dr. R.K. Bangia- 2017 Edition, Allahabad Law Agency.
5) Arbitration, Conciliation and Alternative Dispute Resolution Systems- Dr. S.R. Myneni2004 Edition, reprinted in 2005- Asia Law House Publishers.
6) The Workmen‘s Compensation Act, 1923 (8 of 1923) Bare Act- 2005- Professional Book Publishers.
7) Standard General Conditions for Domestic Contracts- 2001 Edition- Published by Ministry Of Statistics and Program Implementation, Government of India.
8) FIDIC Document (1999). 9) Dispute Resolution Board foundation manual-www.drbf.org

CE411 ***With effect from the academic year 2019-2020***

STATISTICAL TECHNIQUES

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

Course Objectives:

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

Course Outcomes:

Students who successfully complete this course will be able to:

- Use sampling techniques for conducting various surveys related to construction industry.
- Apply the statistical distributions to various construction industry problems
- Decide best fit and develop the regression equations for the given variables
- Apply multi-variant data distributions.
- Applications of sampling distributions to construction Engineering problems.

CO-PO Articulation Matrix

Course Outcome	Program Outcome					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.4	0.25	0.15	-	0.10	0.1
CO2	0.4	0.25	0.15	-	0.10	0.1
CO3	0.4	0.25	0.15	-	0.10	0.1
CO4	0.4	0.25	0.15	-	0.10	0.1
CO5	0.4	0.25	0.15	-	0.10	0.1

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
3. Multivariate Data Analysis – Cootey W.W & Cochens P.R; John Wiley & Sons

CE613 ***With effect from the academic year 2019-20***

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 arrive at the best Investment Options by employing the Capital Budgeting Methods.
- To apply various types of Budgets required for Civil Works.
- Effective Cost Control by employing Standards and Analysis of Variances.
- To manage the Working Capital requirements on Construction Projects.

Course Outcomes

- Understanding of the Pre-requisites before Investing Capital and Long Term Decisions.
- Enable to perform Capital Budgeting Techniques for Investment Analysis.
- Ability to prepare various types of Budgets required for Civil Works.
- Ability to measure the Variances between Standard and Actual performance.
- Ability to estimate the Working Capital requirements on a Construction Projects.

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.4	0.2	0.3	-	0.1	-
CO2	0.4	0.2	0.3	-	0.1	-
CO3	0.4	0.2	0.3	-	0.1	-
CO4	0.4	0.2	0.3	-	0.1	-
CO5	0.4	0.2	0.3	-	0.1	-

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.

CE115 ***With effect from the academic year 2019-20***

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.

CO-PO Articulation matrix

Course outcome	Program outcome					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	0.6	-	-	-	0.2	0.2
CO2	0.6	-	0.1	-	0.2	0.1
CO3	0.6	-	0.1	-	0.2	0.1
CO4	0.5	-	0.2	-	0.2	0.1
CO5	0.5	-	0.2	-	0.2	0.1

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 Magnteostrictive 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 Midplane 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 Giurglutiu, 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

CE117 ***With effect from the academic year 2019-20***

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 judicial 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.

CO-PO Articulation matrix

Course outcome	Program outcome					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.4	0.1	0.1	-	0.1	0.3
CO2	0.4	0.1	0.1	0.2	0.1	0.2
CO3	0.4	0.1	-	-	0.2	0.3
CO4	0.4	0.1	-	-	0.1	0.4
CO5	0.6	0.1	-	0.2	0.2	0.2

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.

AC101 ***With effect from the academic year 2019-20***

DISASTER MITIGATION AND MANAGEMENT

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

Course Objectives:

- To know the various types of disasters and its effect on structures.
- Study the quality assurance and damage assessment of structures
- Educate different types of repair, strengthening, rehabilitation and retrofitting techniques.
- Awareness about flood characteristics and flood forecasting systems
- Description of Flood mitigation, adjustment, and regulation
- Knowledge of Hydrological time series analysis

Course Outcomes:

- Understand the fundamentals of disaster and seismic performance of buildings.
- Able to assess the various damages in structure and give assurance of quality of concrete.
- Decide the appropriate repair, strengthening, rehabilitation and technique required for a case study building.
- Ability to critically review and interpret scientific information on mathematics of flood forecasting and flood routing
- Advanced understanding of flood plain adjustment issues and the other technologies employed for flood management.

CO-PO Articulation matrix

Course outcome	Program outcome					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.6	-	-	-	0.2	0.2
CO2	0.5	-	0.1	-	0.2	0.2
CO3	0.5	-	0.1	-	0.2	0.2
CO4	0.5	0.1	0.1	-	0.1	0.2
CO5	0.5	0.1	0.1	-	0.1	0.2

UNIT – I

Disaster: Classifications - Causes - Impacts including social, economical, political, environmental, health, psychosocial, etc.
Seismic performance of buildings: case studies of major earthquakes in the country, damage to buildings, damage patterns, performance of non-engineered buildings.
Introduction to Repair and rehabilitation of structures.

UNIT – II

Quality assurance for concrete – Strength, Durability and Thermal properties of concrete.
Damage Assessment: - Condition assessment and distress, Purpose of assessment, Rapid assessment - diagnostic techniques, Investigation of damage, , Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems, Procedure for evaluating damaged of structure.

UNIT III

Repair, Rehabilitation And Retrofitting Techniques : Repair materials, Common types of repairs – Repair in concrete structures – Repairs in under water structures – Guniting – Shot create –Underpinning, Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake, Retrofitting techniques.

UNIT – IV

Introduction to Disasters: Hazard, Vulnerability, Resilience, Risks.-Disaster-Different types of cold wave-heat wave- droughts- floods-Effect of climate change on Processes.

Flood characteristics and forecasting: Measureable features of a flood (Elevation, discharge, volume, and duration), flood forecasting (unit hydrograph method, meteorological and snow data, and snow field air temperatures), operation of flood forecasting systems.

Space-time characteristics of rainfall: Policy criteria for design flood of a major and minor reservoir, spillways, diversion dams and barrages, design flood criteria for dams and other hydraulic structures (CWC recommendations).

UNIT - V

Flood Routing: Mathematics of flood routing, various methods of flood routing, Hydrologic and Hydraulic routing.

Flood mitigation: flood ways, channel improvement, evacuation and flood proofing, land management, flood plain management, estimating benefits of flood mitigation.

Flood plain adjustments and regulations: Results of controlling floods, alternatives to controlling floods, range of possible adjustments, practical range of choice, critical characteristics of flood hazards..

Suggested Reading:

1. Barry A. Richardson, "Defects and Deterioration in Buildings", E &FN Spon Press, London, 1991.
2. J. H. Bungey, "Testing of Concrete in Structures", Chapman and Hall,New York, 1989.
3. A.R. Santakumar, "Concrete Technology", Oxford University Press,New Delhi, 2006.
4. Pankaj Agarwal and Manish Shrihkande (2006). "Earthquake Resistance Design of Structures." Prentice Hall of India
5.Ravishankar.K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
6. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.

7. Ven Te Chow (1964), 'Hand Book of Applied Hydrology', McGraw-Hill Publishers, New York.
8. Linsley, R. K. and Franzini A. W. (1992), 'Water Resource Engineering', McGraw-Hill Publishers, New York.
9. Varshney, R. S. (1979), 'Engineering Hydrology', Nem Chand Publishers, Roorkee.
10. Jaya Rami Reddy, P. (1987), 'A. Text Book of Hydrology', Lakshmi Publishers, New Delhi.
11. Daniel H. Hoggan (1989), 'Computer Assisted Flood Plain Hydrology and Hydraulics', McGraw-Hill Publishers, New York.

AC102 ***With effect from the academic year 2019-20***

ENGLISH FOR RESEARCH PAPER WRITING

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

Course Objectives:

- To understand the nuances of language and vocabulary in writing a Research Paper.
- To develop the content, structure and format of writing a research paper.
- To enable the students to produce original research papers without plagiarism.

Course Outcomes: Upon completing this course, students will be able to:

- Interpret the nuances of research paper writing.
- Differentiate the research paper format and citation of sources.
- To review the research papers and articles in a scientific manner.
- Avoid plagiarism and be able to develop their writing skills in presenting the research work.
- Create a research paper and acquire the knowledge of how and where to publish their original research papers.

UNIT-I

Academic Writing: Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT-II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT–III

Research Methodology: Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism

UNIT-IV

Process of Writing a research paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs –Writing first draft –Revising/Editing - The final draft and proof reading.

UNIT-V

Research Paper Publication: Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications – /Advantages/Benefits

Text Book:

1. C. R Kothari, Gaurav, Garg, **Research Methodology Methods and Techniques,** New Age International Publishers. 4th Edition.

Suggested Reading:

1.Day R (2006) "How to Write and Publish a Scientific Paper**",** Cambridge University Press

2.MLA **"**Hand book for writers of Research Papers**"**, East West Press Pvt. Ltd, New Delhi, 7th Edition.

3.Lauri Rozakis, Schaum's, "Quick Guide to Writing Great Research Papers**"**, Tata McGraw Hills Pvt. Ltd, New Delhi.

Online Resource:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

CE651 ***With effect from the academic year 2019-20***

Construction Engineering Laboratory-I

Instruction **: 3 Periods per week**
Sessional : **50 Marks**

Course Objectives:

1. To evaluate the properties of constituents of concrete.
2. To evaluate the properties of various building materials.
3. To evaluate the properties of concrete with variable workability and variable parameters.

Course Outcomes:

1. Ability to evaluate the properties of various constituents of concrete.
2. Able to assess the properties of various building materials.
3. Understand the variation of workability with time for different grades of concrete.
4. Capable to correlate the properties of concrete with variable parameters.
5. Influence of various parameters on strength characteristics of concrete.

CO-PO Articulation matrix

Course outcome	Program outcome					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	0.5	0.3	-	-	0.1	0.1
CO2	0.5	0.3	-	-	0.1	0.1
CO3	0.6	-	-	-	0.2	0.2
CO4	0.5	0.3	-	-	0.1	0.1
CO5	0.5	0.3	-	-	0.1	0.1

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

CE652 ***With effect from the academic year 2019-20***

Computing Application Lab in Construction Management

Instruction **3 Periods per week**
Sessional **50 Marks**

Course objectives

- Understanding the concept of project planning and scheduling
- Application of PRIMAVERA to project planning and scheduling
- Preparation of project schedules

Course outcome

- Students are expected to have gained knowledge on PRIMAVERA software and its application to Construction Engineering and Management
- Students are expected to prepare construction project schedules using PRIMAVERA software

- Ability to extract required data from PRIMAVERA software

CO-PO Articulation matrix

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	-	0.2	0.3	0.2	0.2	-
CO2	-	0.3	0.3	0.2	0.2	-
CO3	-	0.2	0.3	0.3	0.1	-

Experiments:

1. Introduction to components of PRIMAVERA, and Setting up of project in PRIMAVERA (including creating and modifying calendar)
2. Creating Organizational Breakdown Structure (OBS)
3. Creating Enterprise Project Structure (EPS).
4. Creating New Project, Work Breakdown Structure (WBS),
5. Creating Activities and Assigning Duration
6. Assigning resources and their cost to the Activities
7. Scheduling project and identifying Float in PRIMAVERA
8. Identification of critical path in a project in primavera
9. Generating Project Baselines.
10. Importing and exporting files in PRIMAVERA

CE100 ***With effect from the academic year 2019-20***

ENGINEERING RESEARCH METHODOLOGY IN CIVIL ENGINEEERING

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:

- To introduce the conceptual and philosophical foundation of research methodology for Scientific and Engineering Research
- To provide an understanding of the importance of literature review and formulating of a good research problem.
- To offer procedural instruction on how to plan, design & conduct research projects and interpret the data
- To educate the importance of presentation skills and on publication ethics in research

Course Outcomes:

Upon completing this course, each student will be able to:

- Demonstrate the knowledge of research processes (reading, evaluating, and developing) and formulate a research problem
- Perform literature reviews, present research ideas, plan research projects, and to explain the rationale for research ethics
- Understand the importance of innovation & patenting and will be aware of rules and regulations about Intellectual Property Rights
- Choose relevant sampling methods for qualitative and quantitative data collection and processing
- Apply various statistical methods for proper characterization, stigmatization, presentation and interpretation of the

result of research, to test the Hypothesis by using SPSS software and similar software

CO-PO Articulation matrix

Course outcome	Program outcome					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	-	0.2	0.2	0.3	0.3	-
CO2	0.2	0.3	0.3	0.1	0.1	-
CO3	-	0.2	0.2	0.2	0.2	0.2
CO4	0.2	0.3	0.3	-	0.2	-
CO5	-	0.5	0.5	-	-	-

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.

SEMESTER-II

CE603 ***With effect from the academic year 2019-20***

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:

- Understand the concept of planning and scheduling techniques in the Construction Industry
- Discuss the various methods of time estimates and network techniques in the construction projects
- Evaluate the construction cost, duration and computer applications on network problems related to construction industry

Course outcomes:

- Able to gain the knowledge of project planning, scheduling and design related problems in construction projects.
- Ability to develop the planning and scheduling and control of the projects in the construction industry.
- Able to evaluate the construction cost, duration and quality of the construction projects.
- Apply the computer applications on network related problems to construction industry
- Ability to develop the working knowledge on various network techniques and softwares useful in the construction industry.

CO-PO Articulation matrix

Course outcome	Program outcome					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.3	0.3	0.2	-	0.1	0.1
CO2	0.3	0.2	0.2	-	0.2	0.1
CO3	0.2	0.3	0.3	-	0.1	01
CO4	0.3	0.2	0.3	0.1	0.1	-
CO5	0.2	0.2	0.3	0.1	0.1	0.1

UNIT I

Construction Planning: 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, choice of technology and construction methods, PERT and CPM, Estimating Activity duration, Estimating resource requirements for work activities.

UNIT II

Scheduling Procedures and Techniques: Construction schedules, Critical Path Method- Scheduling calculations (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, crashing and time/ cost tradeoffs, improving the scheduling process.

UNIT IV

Cost Control and Monitoring and Accounting: Cost control in construction projects, importance of cost control and its objectives, the project budget, forecasting for activity cost control, control of project cash flows, schedule control, schedule and budget updates, relating cost and schedule information. Resource analysis - smoothing and leveling of various construction projects.

UNIT V

Precedence Network: 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.
4. B.C. Punmia and K.K. Khandelwal., Project Planning and Control with PERT and CPM." Laxmi Publications (P), Ltd, 2008.

CE604 ***With effect from the academic year 2019-20***

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:

1. To study the various quantitative methods applied to the elements of management.
2. To gain knowledge of formulation of optimization models using various methods.
3. To understand transportation model utility in construction industry
4. To modify and improve network flow problems to optimize the resourses.
5. To understand the concepts of simulation, decision theory, sequencing and queuing theory.

Course Outcomes:

1. Ability to learn various quantitative method and apply for various construction engineering problems.

2.Ability to form and solve application based Linear Programming problem to optimize the objectives .

3. Able to understand transportation model utility and its application in construction industry

4. Understand modification of network flow problems to optimize the usage of resources.

5. Understand the concept of simulation, decision theory, sequencing and queuing theory.

CO-PO Articulation matrix

Program outcomes	Course outcomes					
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
CO1	0.4	0.2	0.3	-	0.1	-
CO2	0.4	0.2	0.3	-	0.1	-
CO3	0.4	0.2	0.3	-	0.1	-
CO4	0.4	0.2	0.3	-	0.1	-
CO5	0.4	0.2	0.3	-	0.1	-

UNIT – I

Introduction: Phases of operation research, models and scope of operation research in construction management

Linear Programming: Introduction, terminology, formulation of LPP, graphical and algebraic methods of solving LPP, standard form and canonical form of linear programming, illustrative examples.

UNIT – II

Linear Programming: Simplex methods, Artificial variable techniques, Dual formulations - illustrative examples, application to construction management.

UNIT – III

Transportation problem, introduction, terminology, formulation of mathematical models, minimization and maximization problems, methods of solution, illustrative examples.

Assignment problem: Introduction, terminology, formulation of mathematical models, solution of assignment problem, illustrative examples.

UNIT – IV

Decision theory - Introduction, types, decision trees, applications.
Simulation - Introduction, advantages, limitations, types, applications.
Network analysis - Modifications and improvements on CPM/PERT

UNIT – V

Sequencing problem - Introduction, concepts, definition, assumptions, types, applications.
Queuing Models- Introduction, structure of queuing system, characteristics, application.

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.

CE614 *With effect from the academic year 2019-20*

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.
- Understand the applications of the Neural Networks, Fuzzy Logic and Genetic Algorithms in construction management

Course Outcomes:

- Learn the applied mathematical concepts and problem-solving approaches to construction management problems
- Understanding the basic concepts and terminology and architecture of Neural networks models
- Ability to understand fuzzy logic concepts to apply for construction management problems
- Carry out intelligent and expert system approaches in solving engineering problems that are appropriate for construction management studies.
- Exposure to Matlab and tools pertaining to artificial neural networks, fuzzy logic using standard methods.

Program outcomes	Course outcomes					
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
CO-1	0.2	0.2	0.2	0.2	-	0.2
CO-2	0.2	0.4	0.2	-	0.1	0.1
CO-3	0.2	0.4	0.2	-	0.1	0.1
CO-4	0.2	0.2	0.2	0.2	-	0.2
CO-5	0.2	0.3	0.2	-	0.2	0.1

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 tools. Demonstration of the importance of artificial neural networks, fuzzy logic and expert systems with the help of at least two practical exam$_{p}$l$_{es}$ civil engineering for each study. Importance of nuero-fuzzy systems

UNIT-II

Neural Networks: Components of artificial neural networks - neuron$_{s}$, inputs, outputs, error, error propagation, hidden layers, threshold logi$_{c,}$ 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 - Percptrons - 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 developmen[1] and hybrid expert systems.

UNIT-V

Exposure to Software Packages: Neural networks (Matlab 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, Juda 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. Addition-Wesley, Reading MA, 1991.

CE615 ***With effect from the academic year 2019-20***

VALUE ENGINEERING IN CONSTRUCTION

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

Course Objectives:

- Introduction to basic concepts of value engineering and construction project budgeting
- Analysis of various structures using LCC methodology
- Evaluation of projects based on various management tools

Course Outcomes:

- Acquaintance with the basic concepts of value engineering
- Ability to understand and apply the cost control methodology for various projects
- Knowledge of Life Cycle Cost methodology and its applications
- Comprehensive understanding about the various phases of Job and work plans
- Knack for the application of FAST and Delphi techniques for various projects

CO-PO Articulation Matrix

Course	**Program Outcomes**					
outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	0.2	0.1	0.2	0.3	0.2	--
CO2	0.1	0.4	0.2	0.1	0.1	--
CO3	0.2	0.3	0.3	0.1	0.1	--
CO4	0.1	0.2	0.2	0.3	0.2	--
CO5	0.1	0.3	0.3	0.2	0.05	--

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.

CE616 *With effect from the academic year 2019-20*

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

1) To familiarize with quality management in construction industry.
2) To familiarize with clauses for quality management in construction industry.
3) To understand the leadership and teamwork for total quality management in construction organisation.
4) To understand the production and management and its application to construction industry.
5) To study the senior management and total quality management in construction industry.

Course Outcome

1) Able to adopt new approaches to maintain quality in construction industry.
2) Able to understand the clauses of ISO 9000.
3) Ability to apply tools in leadership and teamwork for total quality management.
4) Able to implement the techniques in construction industry.
5) Ability to handle the changes in construction industry by total quality management.

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.3	-	0.3	0.2	0.2	-
CO2	0.4	-	0.3	-	0.3	-
CO3	0.3	0.2	0.4	-	0.1	-
CO4	0.4	-	0.4	-	0.2	-
CO5	0.3	-	0.1	0.3	0.3	-

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.

CE617 *With effect from the academic year 2019-20*

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

- Able to know the importance of safety and create safety organization in the conduction projects.
- Able to create and manage an effective safety program and identify hazards using various techniques in a construction company.
- Able to handle equipments and materials with safety precautions
- Will be aware of various laws related to construction safety and able to evaluate workers insurance.
- Understand experience modification rates (EMR) and perform safety analysis in the construction industry.

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.5	0.1	0.1	0.1	0.1	0.1
CO2	0.6	0.1	0.1	0.1	0.1	0.1
CO3	0.5	0.1	0.1	0.1	0.1	0.1
CO4	0.5	0.1	0.1	0.1	0.1	0.1
CO5	0.5	0.1	0.1	0.1	0.1	0.1

UNIT-1

Safety management function, Importance of safety in construction industry, Line versus staff authority, Safety responsibility and accountability in construction industry, Safety organizations, 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
Causes and safety of accidents on various construction sites, 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

CE618 *With effect from the academic year 2017-18*

HUMAN RESOURSES DEVELOPMENT FOR CONSTRUCTION

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

Course Objections

- To study the human resource management in relation to job analysis, selection, recruitment in construction industry.
- To understand the various concepts of organisation and management theories.
- To study the strategic human resource management approaches and operational human resources management approaches.
- To study the employee relations and the evolution of empowerment within human resource management.
- Educate the students to know about trade unions and management relationships to solve the employee problems in the industry.

Course Outcome

- Able to understand the job analysis, selection, recruitment in construction industry
- Ability to understand and apply the management theories and human behaviour theories.
- Able to understand the human resource approaches and apply in the construction management.
- Able to understand the changing role of trade unions and collective bargaining.
- Ability to solve employee problems and promote industrial counselling.

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.3	-	0.3	0.2	0.2	-
CO2	0.4	-	-	0.4	0.2	-
CO3	0.3	-	0.3	0.2	0.2	-
CO4	0.4	-	-	0.4	0.2	-
CO5	0.4	-	-	0.4	0.2	-

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.

CE121 *With effect from the academic year 2019-20*

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.

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.6	-	-	-	0.2	0.2
CO2	0.6	-	-	-	0.2	0.2
CO3	0.6	-	-	-	0.2	0.2
CO4	0.6	-	-	-	0.2	0.2
CO5	0.6	-	-	-	0.2	0.2

UNIT - I

Concrete as a composite material; advantages-limitations; Materials science aspects of the properties and behavior of Cement Concrete: physical and

chemical aspects of cement hydration, type and morphology of hydrates; Structure of concrete-Transition zone-Micro structural engineering. Modern trends in concrete manufacture and placement techniques-methods of transportation-placing and curing-extreme whether concreting-special concreting methods-vaccum dewatering of concrete-under water concreting.

UNIT – II

Strength of Hardened concrete-NDT; Stress-strain relations; Dimensional stability-shrinkage and creep; Durability of concrete -Durability concept- pore structure and transport processes- reinforcement corrosion-chloride attack-carbonation- fire resistance- frost damage- sulphate attack- alkali aggregate reaction- delayed ettringite formation- methods of providing durable concrete-short-term tests to assess long-term behavior.

UNIT - III

Mix design of concrete –Quality control – Principles of concrete mix design-Various methods of mix design - IS code method - British and ACI methods-Mix design of special concrete- Design of high strength and high performance concrete-Design of pumpable concrete

UNIT – IV

Mineral Admixtures – Hydration of Admixtures - Slags – Pozzolanas and Fillers – Dispersing admixtures-Retarding admixtures-Accelerating admixtures-Air entraining admixtures-Water resisting admixtures-Corrosion inhibiting admixtures-Shrinkage reducing admixtures-Under water admixtures-Sprayed concrete admixtures- Compatibility issues with Chemical Admixtures.

UNIT - V

Special concrete- Fly ash concrete -Silica fume concrete -Fiber reinforced concrete- Sprayed concrete - Geopolymer concrete-Self compacting concrete-Roller compacted concrete- Ferro cement-Recycled aggregate concrete-Slurry Infiltrated Concrete-Mix design-properties and their applications; Engineered cementitious composites

Suggested Reading:

1. A.M. Neville, “Properties of Concrete”, English Language Book Society-Longman Publications, 1988.

2. A.M. Neville & J.J.Brooks, “Concrete Technology”, Pearson Education Limited, 2010.

3. P.K. Mehta and J.M.M. Paulo, “Concrete – Microstructure – Properties and Material”, McGraw-Hill, New York, 1997.

4. Zongji Li “Advanced Concrete Technology”, John Wiley & sons, inc, 2011.

5. John Newman, Ban Seng Choo, “Advanced Concrete Technology”, Elsevier publisher, 2003.

6. Thomas Dyer, “ Concrete Durability”, CRC Press, Taylor & Francis group,2014

7. N. Krishna Raju, “Design of Concrete Mix”, CBS Publications, New Delhi, 1985.

AC103 *With effect from the academic year 2019-20*

PERSONALITY DEVELOPMENT

Instruction : 2 periods per week
Duration of Semester End Examination : 3 hours
University Examinations : 70marks
Continuous Internal Evaluation : 30 marks

Course Objectives:

- To learn to achieve the highest goal happily.
- To become a person with stable mind, pleasing personality and determination.
- To awaken wisdom among themselves.

Course Outcomes: Upon completing this course, students will be able to:

- Develop their personality and achieve their highest goal of life.
- Lead the nation and mankind to peace and prosperity.
- To practice emotional self regulation.
- Develop a positive approach to work and duties.
- Develop a versatile personality.

UNIT-I

Neetisatakam – Holistic development of personality - Verses 19, 20, 21, 22 (Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT-II

Neetisatakam – Holistic development of personality (cont'd) - Verses 52, 53, 59 (dont's) - Verses 71,73,75 & 78 (do's) - Approach to day to day works and duties.

UNIT-III

Introduction to Bhagavadgeetha for Personality Development - Shrimad Bhagawad Geeta: Chapter 2 – Verses 41, 47, 48 - Chapter 3 – Verses 13,21,27,35 - Chapter 6 – Verses 5,13,17,23,35 - Chapter 18 – Verses 45, 46, 48 Chapter – 6: Verses 5, 13, 17, 23, 35; Chapter – 18: Verses 45, 46, 48

UNIT-IV

Statements of basic knowledge - Shrimad BhagawadGeeta: Chapter 2- Verses 56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad Bhagawat Geeta.

UNIT-V

Role of Bahgavadgeeta in the present scenario - Chapter 2 – Verses 17 – Chapter 3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

Suggested Reading:

1."Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata

2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi

Web Resource

1. NTPEL:http://nptel.ac.in/downloads/109104115

AC104 *With effect from the academic year 2019-20*

STRESS MANAGEMENT BY YOGA

Instruction : 2 periods per week

Course Objectives:

- Creating awareness about different types of stress and the role of yoga in the management of stress.
- Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
- Prevention of stress related health problems by yoga practice.

Course Outcomes: Upon completing this course, students will be able to:

- To understand yoga and its benefits.
- Enhance Physical strength and flexibility.
- Learn to relax and focus.
- Relieve physical and mental tension through asanas
- Improve work performance and efficiency.

UNIT-I

Meaning and definition of Yoga - Historical perspective of Yoga - Principles of Astanga Yoga by Patanjali.

UNIT–II

Meaning and definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

UNIT-III

Concept of Stress according to Yoga - Stress assessment methods - Role of Asana, Pranayama and Meditation in the management of stress.

UNIT-IV

Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas – Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar

UNIT-V

Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama – Kapalabhati Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.

Meditation techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

Suggested Reading:

1. "Yogic Asanas for Group Training - Part-I": Janardhan Swami Yogabhyasi Mandal, Nagpur.
2. "Rajayoga or Conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.
3. Nagendra H.R nad Nagaratna R, "Yoga Perspective in Stress Management", Bangalore, Swami Vivekananda Yoga Prakashan

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2. https://freevideolectures.com/course/3539/indian-philosophy/11

AC105 *With effect from the academic year 2019-20*

CONSTITUTION OF INDIA

Course Objectives:

- The history of Indian Constitution and its role in the Indian democracy.
- Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes: Upon completing this course, students will be able to:

- Understand the making of the Indian Constitution and its features.
- Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.
- Have an insight into various Organs of Governance - composition and functions.
- Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
- Understand Electoral Process, special provisions.

UNIT-I

History of making of the Indian constitutions: History, Drafting Committee (Composition & Working). **Philosophy of the Indian Constitution**: Preamble, Salient Features.

UNIT-II

Contours of Constitutional Rights and Duties Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III

Organs of Governance": Parliament: Composition, Qualifications, Powers and Functions, Union executives : President, Governor, Council of Ministers, Judiciary, appointment and transfer of judges, qualifications, powers and functions

UNIT-IV

Local Administration - District's Administration head: Role and importance. Municipalities: Introduction, ayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati Raj: Introduction, PRI: Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: positions and role. Block level: Organizational Hierarchy (Different departments) Village level: role of elected and appointed officials. Importance of grass root democracy.

UNIT-V

Election commission: Election Commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission :Role and functioning. Institute and Bodies for the welfare of SC/ST/OBC and women**.**

Suggested Reading:

1. "The Constitution of India", 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1st Edition, 2015.
3. M. P. Jain, "Indian Constitution Law", 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

Web Resource:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

CE671 *With effect from the academic year 2019-20*

MINI PROJECT

Instruction : 2 periods per week
Duration of Semester End Examination 6 hours
Continuous Internal Evaluation 50 marks

Course Objectives

- To review available literature and formulate construction industry related problems
- To learn the technique of writing reports and prepare presentation

Course Outcomes

At the end of this course, students will be able to

- Solve complex problems in the field of construction industry by applying appropriate techniques and tools.
- Prepare technical reports and presentations
- Exhibit good communication skill to engineering community and society.
- To publish paper on research work

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.6	0.2	0.2	-	0.1	-
CO2	0.6	-	-	0.4	-	-
CO3	-	-	-	0.6	0.2	0.2
CO4	0.45	0.1	0.1	0.15	0.1	0.1

Each student will be attached to a faculty member who will monitor the progress of the student.

Mini Project will have mid semester presentation and end semester presentation. Mid semester Presentation will include identification of the problem based on the literature review on the topic referring to latest literature

available. End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution. The student is required to submit a technical writeup, 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.

CE653 ***With effect from the academic year 2019-20***

Construction Engineering Laboratory-II

Instruction : 3 Periods per week
Sessional : 50 Marks

Course Objectives:

- To study the concrete mix design using various codes and evaluate the properties of concrete.
- To evaluate the properties of concrete and correlate them with the non-destructive testing results.
- To 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:

- Able to design the concrete mixes using various codes and assess the properties of concrete.
- Competent to correlate the properties of concrete with the non-destructive testing results.
- Able to assess the effect of different parameters on non-destructive testing results.
- Able to estimate the crack propagation and crack patterns in a beam.

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.5	0.3	-	-	0.1	0.1
CO2	0.5	0.3	-	-	0.1	0.1
CO3	0.5	0.3	-	-	0.1	0.1
CO4	0.5	0.3	-	-	0.1	0.1

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.

3.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.

CE661 ***With effect from the academic year 2019-20***

Seminar

Instruction : 3 Periods per week
Sessional : 50 Marks

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:

- Detailed literature review and collection of relevant material
- Narrowing the suitable seminar topic
- Framing the objectives
- Prepare technical reports and presentations

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.4	0.15	0.15	0.15	0.1	.05
CO2	0.4	0.15	0.15	0.15	0.1	.05
CO3	0.6	0.15	0.15	-	0.1	-
CO4	0.6	-	-	0.4	-	-

The objective of the seminar is to prepare the student for a systematic and independent study of the state of art topics in his/her specialization. Seminar topics may be chosen by the students with the advice of the faculty members. Each 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.

SEMESTER-III

CE619 ***With effect from the academic year 2019-20***

CONSTRUCTION PLANNING EQUIPMENTS AND METHODS

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
- Able to understand the role of hoisting equipments in construction industry
- Able to apply the knowledge of equipment in the manufacturing of concrete.
- Acquire the knowledge of conveying equipments used in construction industry.

Course outcome	Program outcome					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.6	-	-	-	0.2	0.2
CO2	0.6	-	-	-	0.2	0.2
CO3	0.6	-	-	-	0.2	0.2
CO4	0.6	-	-	-	0.2	0.2
CO5	0.6	-	-	-	0.2	0.2

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.
5. U.K. Srivastava (1999). "Construction Planning and Management." Galgotia Publications Pvt., ltd, New Delhi, India

CE620 *With effect from the academic year 2019-20*

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 importance of management information system in construction industry.
- To study the concepts of information system management and decision making in construction industry.
- Understand the strategic information systems related to construction industry.
- To study the role of information technology in construction industry.
  To study the data base management systems in construction organisations.

COURSE OUTCOME

- The student will be able to know the logical foundation of MIS and managers view of information system.
- Ability to understand the concepts of information system and apply in decision making process in construction industry.
- Ability to apply the strategic uses of information technology in construction industry.
- Able to understand the impact of information technology on individuals and construction organisation.
- Ability to implement file structures and processing methods in construction organisation.

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.3	0.2	0.3	-	0.2	-
CO2	0.3	0.3	0.2	-	0.2	-
CO3	0.3	0.2	0.3	-	0.2	-
CO4	0.3	0.3	-	-	0.4	-
CO5	0.3	-	0.4	-	0.3	-

UNIT-1

Importance of management information systems (MIS), logical foundation of MIS, manger'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, an 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.

CE621 ***With effect from the academic year 2019-20***

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

- Able to understand the space requirements of typical buildings like Residential, Office and Hospitals.
- Preparation of layout plan for water distributions and drainages.
- Apply the guidelines for municipal solid waste management
- Prepare schedule for maintenance of various service equipments like Lifts and Electrical devices in buildings.
- Know the concepts of building maintenance

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.5	0.10	-	-	0.2	0.2
CO2	0.6	0.10	0.1	-	0.1	0.1
CO3	0.6	0.10	0.1	-	0.1	0.1
CO4	0.5	0.10	-	-	0.2	0.2
CO5	0.5	0.1	-	0.2	0.1	0.1

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.

CE622 ***With effect from the academic year 2019-20***

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

- Able to understand the material used in form work and false work system
- Acquire the knowledge to 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.

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.6	-	-	-	0.2	0.2
CO2	0.45	0.2	0.15	-	0.1	0.1
CO3	0.6	-	-	-	0.2	0.2
CO4	0.6	-	-	-	0.2	0.2
CO5	0.45	0.2	0.15	-	0.1	0.1

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 NewYork, 2003.

CE623 *With effect from the academic year 2019-20*

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 Inventory and principles.
- Understanding legislative acts to contribute towards clean environment
- Applying the legislation acts of EIA in designs.
- Understanding various characteristics of municipal solid waste.
- Design of an efficient municipal solid waste management system

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.4	-	-	-	0.2	0.4
CO2	0.4	-	-	0.1	0.1	0.4
CO3	0.4	-	-	0.1	0.1	0.4
CO4	0.4	-	-	0.1	0.15	0.35
CO5	0.4	-	-	0.1	0.15	0.35

UNIT I

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

UNIT II

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

UNIT III

Enviornmental Assessment: Introduction, process, Basic steps involved, Description of enviornmental 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 enviornmental 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

CE901 *With effect from the academic year 2019-20*

COST MANAGEMENT OF ENGINEERING PROJECTS

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

Objectives

- Introduce the concepts of cost management, inventory valuation , decision making
- Fundamentals of cost overruns, project execution and technical activities
- Introduce the concepts of Quantitative techniques for cost management, Linear Programming, PERT/CPM

Outcomes

- Understanding of strategic cost management process, control of cost and decision making based on the cost of the project.
- Ability to appreciative detailed engineering activities of the project and execution of projects
- Preparation of project report and network diagram
- Able to plan Cost Behavior , Profit Planning , Enterprise Resource Planning, Total Quality Management.
- Applications of various quantitative techniques for cost management.

UNIT I

Introduction and Overview of the Strategic Cost Management Process-Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System- Inventory valuation- Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT II

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning- Project execution as conglomeration of technical and non- technical activities- Detailed Engineering activities.

UNIT III

Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

UNIT IV

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems- Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector- Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints- Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets- Performance budgets- Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT V

Quantitative techniques for cost management, Linear Programming, PERT/CPM,- Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Suggested Reading::

1.Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi

2.Charles T. Horngren and George Foster, Advanced Management Accounting

3.Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting

4.Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher

5.N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

CE902 *With effect from the academic year 2019-20*

OPERATION RESEARCH

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

Objectives

- Introduce the concepts of optimization techniques
- Formulation of LPP models
- Basic concepts of Non-linear programming, Dynamic programming, Game theory are introduced.

Course Outcomes

- Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
- Students should able to apply the concept of non-linear programming
- Students should able to carry out sensitivity analysis
- Student should able to model the real world problem and simulate it.
- Student should able to apply graph theory, competitive models, and game theory simulations

Unit 1:

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit 2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Unit 3:

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit 4

Scheduling and sequencing - single server and multiple server models deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit 5

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Suggested Reading::

1.H.A. Taha, Operations Research, An Introduction, PHI, 2008

2.H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.

3.J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008

4.Hitler Libermann Operations Research: McGraw Hill Pub. 2009

5.Pannerselvam, Operations Research: Prentice Hall of India 2010

6.Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

CE903 *With effect from the academic year 2019-20*

INDUSTRIAL SAFETY

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

Course Objectives:

- Causes for industrial accidents and preventive steps to be taken.
- Fundamental concepts of Maintenance Engineering.
- About wear and corrosion along with preventive steps to be taken
- The basic concepts and importance of fault tracing.
- The steps involved in carrying out periodic and preventive maintenance of various equipments used in industry

Course Outcomes: Upon completing this course, students will be able to:

- Identify the causes for industrial accidents and suggest preventive measures.
- Identify the basic tools and requirements of different maintenance procedures.
- Apply different techniques to reduce and prevent Wear and corrosion in Industry.
- Identify different types of faults present in various equipments like machine tools, IC Engines, boilers etc.
- Apply periodic and preventive maintenance techniques as required for industrial equipments like motors, pumps and air compressors and machine tools etc

UNIT-I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light,

cleanliness, fire, guarding, pressure vessels, etc, Safety color codes, Fire prevention and firefighting, equipment and methods.

UNIT–II

Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT–III

Wear and Corrosion and their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications of Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication, Ring lubrication, Definition of corrosion, principle and factors affecting the corrosion, Types of corrosion, corrosion prevention methods.

UNIT–IV

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, any one machine tool, Pump, Air compressor, Internal combustion engine, Boiler, Electrical motors, Types of faults in machine tools and their general causes.

UNIT–V

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and

advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of Machine tools, Pumps, Air compressors, Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

1. H. P. Garg, "Maintenance Engineering", S. Chand and Company
2. Audels, "Pump-hydraulic Compressors", Mcgraw Hill Publication

Suggested Reading:

1. Higgins & Morrow, "Maintenance Engineering Handbook", Da Information Services.
2. Winterkorn, Hans, "Foundation Engineering Handbook", Chapman & Hall London

CE904 *With effect from the academic year 2019-20*

BUSINESS ANALYTICS

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

Course Objectives:

- Understanding the basic concepts of business analytics and applications
- Study various business analytics methods including predictive, prescriptive and prescriptive analytics
- Prepare the students to model business data using various data mining, decision making methods

Course Outcomes: Upon completing this course, students will be able to:

- To understand the basic concepts of business analytics
- Identify the application of business analytics and use tools to analyze business data
- Become familiar with various metrics, measures used in business analytics
- Illustrate various descriptive, predictive and prescriptive methods and techniques
- Model the business data using various business analytical methods and techniques

UNIT-I

Introduction to Business Analytics: Introduction to Business Analytics, need and science of data driven (DD) decision making, Descriptive, predictive, prescriptive analytics and techniques, Big data analytics, Web and Social media analytics, Machine Learning algorithms, framework for decision making, challenges in DD decision making and future.

UNIT-II

Descriptive Analytics: Introduction, data types and scales, types of measurement scales, population and samples, measures of central tendency, percentile, decile and quadrille, measures of variation, measures of shape-skewness, data visualization

UNIT-III

Forecasting Techniques: Introduction, time-series data and components, forecasting accuracy, moving average method, single exponential smoothing, Holt's method, Holt-Winter model, Croston's forecasting method, regression model for forecasting, Auto regression models, auto-regressive moving process, ARIMA, Theil's coefficient

UNIT-IV

Decision Trees: CHAID, Classification and Regression tree, splitting criteria, Ensemble and method and random forest. **Clustering**: Distance and similarity measures used in clustering, Clustering algorithms, K-Means and Hierarchical algorithms, **Prescriptive Analytics**- Linear Programming(LP) and LP model building,

UNIT-V

Six Sigma: Introduction, introduction, origin, 3-Sigma Vs Six-Sigma process, cost of poor quality, sigma score, industry applications, six sigma measures, DPMO, yield, sigma score, DMAIC methodology, Six Sigma toolbox

Text Books:

1. U Dinesh Kumar, "Data Analytics", Wiley Publications, 1st Edition, 2017
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications with SAS", Associate Publishers, 2015

Suggested Reading:

1. S. Christian Albright, Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", 5th Edition, Cengage, 2015

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18-mg11/preview
2. https://nptel.ac.in/courses/110105089/

CE905 *With effect from the academic year 2019-20*

WASTE TO ENERGY

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 various forms of waste
- To understand the processes of Biomass Pyrolysis.
- To learn the technique of Biomass Combustion.

Course outcomes: Upon completing this course, students will be able to:

- Understand the concept of conservation of waste
- Identify the different forms of wastage
- Chose the best way for conservation to produce energy from waste
- Explore the ways and means of combustion of biomass
- Develop a healthy environment for the mankind

UNIT-I:

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II:

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III:

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers Fluidized bed gasifiers – Design, construction and operation –

Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV:

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V:

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Suggested Reading::

1.Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.

2.Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

3.Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.

4.Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

OE906 *With effect from the academic year 2019-20*

INTELLECTUAL PROPERTY RIGHTS

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

Objectives

- Acquaint the students with basics of intellectual property rights with special reference to Indian Laws and its practices.
- Compare and contrast the different forms of intellectual property protection in terms of their key differences and similarities.
- Provide an overview of the statutory, procedural, and case law underlining these processes and their interplay with litigation.

Outcomes

- Skill to understand the concept of intellectual property rights.
- Develop proficiency in trademarks and acquisition of trade mark rights
- Skill of acquiring the copy rights , ownership rights and transfer
- Able to protect trade secrets, liability for misappropriations of trade secrets
- Ability to apply the patents and demonstration of case studies

UNIT I:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT – II

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III

Law of copy rights : Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.

UNIT V

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Suggested Reading

- Halbert, "*Resisting Intellectual Property*", Taylor & Francis Ltd, 2007.
- Mayall, "*Industrial Design*", McGraw Hill, 1992.
- Niebel, "*Product Design*", McGraw Hill, 1974.
- Asimov, "*Introduction to Design*", Prentice Hall, 1962.
- Robert P. Merges, Peter S. Menell, Mark A. Lemley, " *Intellectual Property in New Technological Age*", 2016.
- T. Ramappa, *"Intellectual Property Rights Under WTO*", S. Chand, 2008.

CE907 ***With effect from the academic year 2019-20***

COMPOSITE MATERIALS

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

Course Objectives

- Study the concepts of composite construction.
- Learn analysis and designs of composite beams, floors, columns and trusses as per the recommendations of IS codes of practice.
- Apply the concepts for design of multi-storey composite buildings.
- Scope of analysis is restricted to skeletal structures subjected to prescribed dynamic loads.

Course Outcomes

- Understand the fundamentals of composite construction, and analysis and designs of composite beams.
- Analyse and design the composite floors
- Select suitable materials for composite columns,
- Analyse composite trusses and understand connection details.
- Analyse and design the multi-storey composite buildings

UNIT-I

Introduction of composite constructions: Benefits of composite construction - Introduction to IS - BS and Euro codal provisions.

Composite beams: Elastic behaviour of composite beams - No and full interaction cases - Shear connectors - Ultimate load behaviour - Serviceability limits - Effective breadth of flange - Interaction between shear and moment - Basic design consideration and design of composite beams.

UNIT-II

Composite floors: Structural elements - Profiled sheet decking - Bending resistance - Shear resistance - Serviceability criterion - Analysis for internal forces and moments - Design of composite floors.

UNIT-III

Composite columns: Materials - Concrete filled circular tubular sections - Non-dimensional slenderness - Local buckling of steel sections - Effective elastic flexural stiffness - Resistance of members to axial compressions - Composite column design - Fire resistance.

UNIT-IV

Composite trusses: Design of truss - Configuration - Truss members - Analysis and design of composite trusses and connection details.

UNIT-V

Design of multi-storey composite buildings: Design basis - Load calculations - Design of composite slabs with profile decks - Composite beam design - Design for compression members - Vertical cross bracings - Design of foundation.

Suggested Reading:

1. R.P. Johnson, "Composite Structures of Steel and Concrete - Beams, Slabs, Columns and Frames in Buildings", Blackwell Publishing, Malden, USA, 2004.
2. "INSDAG Teaching Resources for Structural Steel Design", Vol-2, Institute for Steel Development and Growth Publishers, Calcutta, India.
3. "INSDAG Handbook on Composite Construction – Multi-Storey Buildings", Institute for Steel Development and Growth Publishers, Calcutta, India.
4. "INSDAG Design of Composite Truss for Building", Institute for Steel Development and Growth Publishers, Calcutta, India.
5. "INSDAG Handbook on Composite Construction – Bridges and Flyovers", Institute for Steel Development and Growth Publishers,

Calcutta, India.
6. IS: 11384-1985, “Code of Practice for Composite Construction in Structural Steel and Concrete”, Bureau of Indian Standards, New Delhi, 1985.

CE908 **With effect from the academic year 2019-20**

GEOSPATIAL TECHNOLOGY

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

Course Objectives:

- Understand 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:

At the end of the course the student will be able to:

- Understand the geospatial technology relating to the data acquiring and processing that is associated with geographic locations
- Apply Geospatial techniques in the decision support systems useful for decision makers and community services.
- Ability to solve the problems related to the natural resource management, environment, urban planning and Infrastructure development, etc.
- Able to generate the thematic maps using Geospatial techniques
- Apply the concept of Geospatial Techniques to the Civil Engineering problems

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	0.2	0.4	0.2	0.1	0.1
CO2	0.2	0.3	0.3	0.1	0.1	-
CO3	0.3	0.2	0.2	0.1	0.1	0.1
CO4	0.2	0.2	0.2	0.2	0.1	0.1
CO5	0.1	0.2	0.3	0.2	0.1	0.1

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.

CE681 *With effect from the academic year 2019-20*

MAJOR PROJECT PHASE-I

Instruction : 6 periods per week
CIE : 20 marks
SEE : 100 marks
Credits : 10

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
- Prepare technical reports and presentations

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.4	0.15	0.15	0.15	0.1	.05
CO2	0.4	0.15	0.15	0.15	0.1	.05
CO3	0.6	0.15	0.15	-	0.1	-
CO4	0.6	-	-	0.4	-	-

Each student will be attached to a faculty member who will monitor the progress of the work. The student will carry out the project which may be development of Software / Hardware / Simulation studies / Design analysis / Experimental related to his/her specialization. The work will be monitored regularly by the guide. At the end of the semester 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. The sessional marks will be awarded jointly by these examiners based on the report, presentation and viva voice

SEMESTER-IV

CE682

With effect from the academic year 2019-20

MAJOR PROJECT PHASE-II

Instruction : 32 Periods per week
University Examination : Viva Voice
Marks : 200

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

At the end of this course, students will be able to

- Solve complex problems by applying appropriate techniques and tools.
- Prepare technical reports and presentations
- Exhibit good communication skill to engineering community and society.
- To publish paper on research work

CO-PO Articulation matrix

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6
CO1	0.6	0.2	0.2	-	0.1	-
CO2	0.6	-	-	0.4	-	-
CO3	-	-	-	0.6	0.2	0.2
CO4	0.45	0.1	0.1	0.15	0.1	0.1

Each student will be attached to a faculty member who will monitor the progress of the student. The student will carry out the project which may be development of Software / Hardware / Simulation studies / Design analysis / Experimental related to his/her specialization. The work will be monitored

regularly by the guide. The student is required to submit a technical writeup, 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 final marks will be allotted based on the report, presentation and viva voce conducted by the external examiner whose name is suggested by Chairman BOS.