

ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
M. E. INFRASTRUCTURE ENGINEERING AND MANAGEMENT
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM
I TO IV SEMESTERS CURRICULA AND SYLLABUS
SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA4159	Statistical Methods for Engineers	FC	4	0	0	4	4
2.	IM4101	Project Management for Infrastructure	PCC	2	1	0	3	3
3.	IM4102	Urban Transportation Systems Planning	PCC	3	0	0	3	3
4.	IM4103	Infrastructure Planning and Management	PCC	3	0	0	3	3
5.	RM4151	Research Methodology and IPR	RMC	2	0	0	2	2
6.		Professional Elective I	PEC	3	0	0	3	3
7.		Audit Course I*	AC	2	0	0	2	0
PRACTICALS								
8.	IM4111	BIM and Project Management Laboratory	PCC	0	0	4	4	2
TOTAL				17	2	6	25	20

* Audit Course is optional

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	IM4201	Infrastructure Contract Management	PCC	3	0	0	3	3
2.	IM4202	Geographical Information Systems and Infrastructure Planning	PCC	2	1	0	3	3
3.	IM4203	Geotechnical Engineering for Infrastructure	PCC	2	0	2	4	3
4.	IM4204	Advanced Structural Design	PCC	3	0	0	3	3
5.		Professional Elective II	PEC	3	0	0	3	3
6.		Professional Elective III	PEC	3	0	0	3	3
7.		Audit Course II*	AC	2	0	0	2	0
PRACTICALS								
8.	IM4211	GIS Laboratory	PCC	0	0	4	4	2
9.	IM4212	Infrastructure Material Testing Laboratory	PCC	0	0	4	4	2
TOTAL				18	2	10	30	22

* Audit Course is optional

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective IV	PEC	3	0	0	3	3
2.		Professional Elective V	PEC	3	0	0	3	3
3.		Open Elective	OEC	3	0	0	3	3
PRACTICALS								
4.	IM4311	Seminar	EEC	0	0	2	2	1
5.	IM4312	Industrial Training (4 weeks)	EEC	-	-	-	-	2
6.	IM4313	Project Work I	EEC	0	0	12	12	6
TOTAL				9	0	14	23	18

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	IM4411	Project Work II	EEC	0	0	24	24	12
TOTAL				0	0	24	24	12

TOTAL NO. OF CREDITS: 72

FOUNDATION COURSES (FC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	MA4159	Statistical Methods for Engineers	4	0	0	4	1

PROFESSIONAL CORE COURSES (PCC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	IM4101	Project Management for Infrastructure	2	1	0	3	1
2.	IM4102	Urban Transportation Systems Planning	3	0	0	3	1
3.	IM4103	Infrastructure Planning and Management	3	0	0	3	1
4.	IM4111	BIM and Project Management Laboratory	0	0	4	2	1
5.	IM4201	Infrastructure Contract Management	3	0	0	3	2
6.	IM4202	Geographical Information Systems for Infrastructure Planning	2	1	0	3	2
7.	IM4203	Geo Technical Engineering for Infrastructure	2	0	2	3	2
8.	IM4204	Advanced Structural Design	3	0	0	3	2
9.	IM4211	GIS Laboratory	0	0	4	2	2
10.	IM4212	Infrastructure Material Testing Laboratory	0	0	4	2	2
TOTAL CREDITS						27	

RESEARCH METHODOLOGY AND IPR COURSES (RMC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	RM4151	Research Methodology and IPR	2	0	0	2	1
TOTAL CREDITS						2	

LIST OF PROFESSIONAL ELECTIVES (PEC)

SEMESTER I, ELECTIVE I

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
			L	T	P		
1.	ST4073	Maintenance, Repair and Rehabilitation of Structures	3	0	0	3	3
2.	IM4001	Material Procurement and Management	3	0	0	3	3
3.	CN4072	Economics and Finance Management in Construction	3	0	0	3	3
4.	CN4074	Organizational Behaviour	3	0	0	3	3

SEMESTER II, ELECTIVE II

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
			L	T	P		
1.	IM4002	Management of Human Resource and Quality	3	0	0	3	3
2.	CN4075	Supply Chain Management and Logistics in Construction	3	0	0	3	3
3.	CN4073	Lean Construction Concepts, Tools and Practices	3	0	0	3	3
4.	IM4003	Value Engineering	3	0	0	3	3

SEMESTER II, ELECTIVE III

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
			L	T	P		
1.	IM4004	Safety in Construction Engineering	3	0	0	3	3
2.	ST4072	Design of Bridge Structures	3	0	0	3	3
3.	IM4005	Modern Construction Material and Technology	3	0	0	3	3
4.	ST4071	Advanced Prestressed Concrete	3	0	0	3	3

SEMESTER III, ELECTIVE IV

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
			L	T	P		
1.	IM4006	Environmental Impact Assessment for Infrastructure Projects	3	0	0	3	3
2.	IM4007	Urban Environmental Management	3	0	0	3	3
3.	IM4008	Life Cycle Analysis and Design for the Environment	3	0	0	3	3
4.	IM4009	Sustainable Development and Urban Planning	3	0	0	3	3

SEMESTER III, ELECTIVE V

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
			L	T	P		
1.	IM4010	Infrastructure for SMART City Planning	3	0	0	3	3
2.	IM4011	Pavement Management System	3	0	0	3	3
3.	IM4012	Airport System Planning and Design	3	0	0	3	3
4.	IM4013	Urban Infrastructure and Asset Management	3	0	0	3	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	IM4311	Seminar	0	0	2	1	3
2.	IM4312	Industrial training (4 weeks)	-	-	-	2	3
3.	IM4313	Project Work I	0	0	12	6	3
4.	IM4411	Project Work II	0	0	24	12	4
TOTAL CREDITS						21	

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	AX4091	English for Research Paper Writing	2	0	0	0	1/2
2.	AX4092	Disaster Management	2	0	0	0	
3.	AX4093	Constitution of India	2	0	0	0	
4.	AX4094	நற்றமிழ் இலக்கியம்	2	0	0	0	

SUMMARY

Name of the Programme: M.E. Infrastructure Engineering and Management						
	SUBJECT AREA	CREDITS PER SEMESTER				CREDITS TOTAL
		I	II	III	IV	
1.	FC	04	00	00	00	04
2.	PCC	11	16	00	00	27
3.	PEC	03	06	06	00	15
4.	RMC	02	00	00	00	02
5.	OEC	00	00	03	00	03
6.	EEC	00	00	09	12	21
7.	Non Credit/Audit Course	✓	✓			
8.	TOTAL CREDIT	20	22	18	12	72

Tentative

OBJECTIVES :

- This course is designed to provide the solid foundation on topics in various statistical methods which form the basis for many other areas in the mathematical sciences including statistics, modern optimization methods and risk modeling. It is framed to address the issues and the principles of estimation theory, testing of hypothesis, correlation and regression, design of experiments and multivariate analysis.

UNIT I ESTIMATION THEORY**12**

Estimators : Unbiasedness, Consistency, Efficiency and sufficiency – Maximum likelihood estimation – Method of moments.

UNIT II TESTING OF HYPOTHESIS**12**

Sampling distributions - Small and large samples -Tests based on Normal, t, Chi square, and F distributions for testing of means, variance and proportions – Analysis of r x c tables – Goodness of fit.

UNIT III CORRELATION AND REGRESSION**12**

Multiple and partial correlation – Method of least squares – Plane of regression – Properties of residuals – Coefficient of multiple correlation – Coefficient of partial correlation – Multiple correlation with total and partial correlations – Regression and partial correlations in terms of lower order co-efficient.

UNIT IV DESIGN OF EXPERIMENTS**12**

Analysis of variance – One way and two way classifications – Completely randomized design – Randomized block design – Latin square design - 2^2 Factorial design.

UNIT V MULTIVARIATE ANALYSIS**12**

Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components : Population principal components – Principal components from standardized variables.

TOTAL: 60 PERIODS**OUTCOMES :**

After completing this course, students should demonstrate competency in the following topics:

- Consistency, efficiency and unbiasedness of estimators, method of maximum likelihood estimation and Central Limit Theorem.
- Use statistical tests in testing hypotheses on data.
- Concept of linear regression, correlation, and its applications.
- List the guidelines for designing experiments and recognize the key historical figures in Design of Experiments.
- Perform exploratory analysis of multivariate data, such as multivariate normal density, calculating descriptive statistics, testing for multivariate normality.

The students should have the ability to use the appropriate and relevant, fundamental and applied mathematical and statistical knowledge, methodologies and modern computational tools.

REFERENCES :

- Gupta.S.C., and Kapoor, V.K., "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand and Sons, 2020.
- Jay L. Devore, "Probability and statistics for Engineering and the Sciences", 8th Edition, Cengage Learning, 2014.
- Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education, Asia, 2016.
- Johnson, R.A. and Wichern, D. W. "Applied Multivariate Statistical Analysis", 6th Edition, Pearson Education, Asia, 2012.
- Rice, J.A. "Mathematical Statistics and Data Analysis", 3rd Edition, Cengage Learning, 2015.

OBJECTIVES :

- To Understand and Explain Project Management Process, Project Planning and Time Management, Organizing for Project Management, Resource Planning and Cost Estimation.

UNIT I PROJECT MANAGEMENT - AN OVERVIEW: 6+3

Introduction, Project Management process, Project Management techniques, Relationship to other management disciplines, Related endeavors, Concentric project management, Project formulation and development

UNIT II PROJECT PLANNING AND TIME MANAGEMENT: 6+3

Purpose, Project scheduling, activity definition, activity sequencing, activity duration estimating, schedule development, schedule control, project management using CPM\PERT- Network basics, Network development, PERT analysis, advantages. Computerized network analysis- features of PM software, capabilities of PM software, multi project analysis,

UNIT III ORGANIZING FOR PROJECT MANAGEMENT: 6+3

Project Management – modern trends - Strategic Planning - Effects of Project Risks on Organization - Organization of Project Participants -Traditional Designer-Constructor Sequence - Professional Construction Management - Owner-Builder Operation - Turnkey Operation - Leadership and Motivation for the Project Team.

UNIT IV RESOURCE PLANNING: 6+3

Introduction, Inputs, Tools, Outputs, Resource scheduling, Resource leveling, Resource restrained scheduling, strategies for shortening the schedule Assigning resources: Work, duration, resources, Effort driven scheduling, create a resource list, Exercise on resource planning using software, Level now command, leveling Gantt chart, assigning rate to resources, techniques of duration cost trade-off.

UNIT V COST ESTIMATION: 6+3

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

TOTAL: 45 PERIODS**OUTCOMES:**

- CO1 Explain project, project management, life cycle and project formulation
 CO2 Analyze and Manage time in projects through Gantt charts, and network techniques.
 CO3 Analyze and manage time in projects through CPM and PERT, update and monitor projects
 CO4 Optimize resources of projects using scheduling, fast tracking and re-estimation techniques
 CO5 Explain different approaches for estimating cost

REFERENCES:

- Harold Kerzner – Project Management – systems approach to planning, scheduling & controlling – 7th edition, John wiley & sons, Canada.
- Microsoft Project for Windows 2000 –Microsoft Press, USA 2000.
- Tim Pyron – Microsoft Project 2000 in 24 hours – Sama Teach ypurself series- Techmedia Published New Delhi.
- Chitkara, K.K. "Construction Project Management: Planning, Scheduling and Control", Tata McGraw-Hill Publishing Company, New Delhi, 1998.
- Choudhury S , "Project Management", McGraw-Hill Publishing Company, New Delhi, 1988.

6. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pittsburgh, 2000.
7. Frederick E. Gould, "Construction Project Management", Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000.
8. George J. Ritz, "Total Construction Project Management" - McGraw-Hill Inc, 1994.

IM4102

URBAN TRANSPORTATION SYSTEMS PLANNING

**L T P C
3 0 0 3**

OBJECTIVES:

- To make the learners to understand and explain the principles of the transportation system planning, covering both passenger and freight transports and the methodology of effective management of transport systems.

UNIT I INTRODUCTION

9

Introduction and concepts; demand for transport – nature of demand, temporal and special variations; factors influencing demand for transport; effect of land use and socioeconomic activities on the demand; conceptual difference between urban, interurban and regional transport planning processes; Interaction of land-use and transport planning processes; urban transport planning process (morphology).

UNIT II TRIP GENERATION AND DISTRIBUTION

9

Trip production process; household characteristics; classification based on trip purpose – trips for work, education, shopping, social and recreational purposes; influencing variables of trips made for different purposes; modelling trip production. Trip attraction process; attraction of trips for different purposes, factors influencing trip attraction for different trip purposes; modelling trip attraction. Presentation of trip distribution data – OD matrix, PA matrix to depict trip distribution among zones; factors influencing trip distribution; variable formulation, modelling trip distribution; Gravity model of trip distribution; calibration of Gravity models.

UNIT III MODE CHOICE ANALYSIS

9

Mode choice for different trip purposes; Influencing factors – socioeconomic characteristics of travelers and characteristics of the different modes of transport; influence of trip purpose on mode choice; modelling mode choice of travelers - trip-end and trip-interchange modelling; Disaggregate mode-choice models; utility concept; Logit model of mode choice; model calibration; model validation.

UNIT IV ROUTE ASSIGNMENT AND TRANSPORTATION SURVEYS

9

Route assignment – description of transport network for route assignment; influencing variables and assignment algorithms; all-or-nothing assignment; multipath traffic assignment; capacity restrained traffic assignment. Transportation surveys – inventory of existing travel pattern, transport facilities and land-use and economic characteristics; definition of the study area; cordon lines; zoning; types of movements in the study area; types of planning related surveys.

UNIT V THE OTHER RELATED TOPICS

9

Transport related land-use models – Land-use estimation procedure; the Lowry model of land use; the equation system; allocation functions; zonal constraints. Urban Structure – urban activity systems; urban movement hierarchies; types of urban structure - centripetal, grid and linear types. Urban goods movement – factors influencing urban goods movement; classification of urban goods movement; principles of modeling urban goods movement.

TOTAL: 45 PERIODS

OUTCOMES:

- C01 Explain transportation planning concepts, the planning morphology and distinction between urban and interurban transportation planning processes.
- C02 Explain trip generation and trip distribution processes; formulate causal variables and develop trip generation and trip distribution models.
- C03 Identify and analyze the factors influencing mode-choice of urban travellers, calibrate logit model of mode choice to apply for the given urban area.
- C04 Develop route assignment variables and calibrate route choice models for assignment of trips distributed to the traffic zones in an urban area.
- C05 Explain the conceptual analytical aspects of aspects transport related land-use models; describe the principals involved in urban structure and urban goods movement.

REFERENCES:

1. Juan de Dios Orituzar and Luis G. Willumson, "Modelling Transport", A John Wiley and Sons, Inc., 4th edition 2017.
2. Norbert Oppenheim, "Urban Travel Demand Modelling" A John Wiley and Sons, Inc., 3rd Edition, 2010.
3. Thomas A. Domencich and Daniel Mc Fadden, "Urban Travel Demand A Behavioral Analysis", American Elsevier Publishing Company Inc., 5th Edition, 2019
4. Geetam Tiwari, "Urban Transport for Growing Cities", Macmillan India Ltd., 1st Edition, 2002.
5. B.G. Hutchinson, "Principles of Urban Transport Systems Planning", McGraw-Hill Book Company, 10th Reprint, 2010
6. Jason C.yu, "Transportation Engineering: Introduction to Planning, Design and Operations", Elsevier, 1992.

IM4103

INFRASTRUCTURE PLANNING AND MANAGEMENT

L T P C
3 0 0 3

OBJECTIVES:

- To understand and explain concepts of infrastructure, private involvement in infrastructure, challenges to successful infrastructure planning and implementation, strategies for successful infrastructure project implementation, sustainable development of infrastructure

UNIT I AN OVERVIEW OF BASIC CONCEPTS RELATED TO INFRASTRUCTURE: 9

Introduction to Infrastructure, an overview of the Power Sector in India., an Overview of the Water Supply and Sanitation Sector in India., an overview of the Road, Rail, Air and Port Transportation Sectors in India. , an overview of the Telecommunications Sector in India. ,an overview of the Urban Infrastructure in India, an overview of the Rural Infrastructure in India, an Introduction to Special Economic Zones, Organizations and layers in the field of Infrastructure, The Stages of an Infrastructure Project Lifecycle., an overview of Infrastructure Project Finance.

UNIT II PRIVATE INVOLVEMENT IN INFRASTRUCTURE: 9

A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Challenges in Privatization of Water Supply: A Case Study, Challenges in Privatization of Power: Case Study, Privatization of Infrastructure in India: Case Study, Privatization of Road Transportation Infrastructure in India.

UNIT III CHALLENGES TO SUCCESSFUL INFRASTRUCTURE PLANNING AND IMPLEMENTATION: 9

Mapping and Facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks: The Case study for Political Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Challenges in Construction and Maintenance of Infrastructure.

UNIT IV STRATEGIES FOR SUCCESSFUL INFRASTRUCTURE PROJECT IMPLEMENTATION: 9
 Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Introduction to Fair Process and Negotiation, Negotiating with multiple Stakeholders on Infrastructure Projects.

UNIT V SUSTAINABLE DEVELOPMENT OF INFRASTRUCTURE: 9
 Information Technology and Systems for Successful Infrastructure Management, - Innovative Design and Maintenance of Infrastructure Facilities, Infrastructure Modeling and Life Cycle Analysis Techniques, Capacity Building and Improving the Governments Role in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.

TOTAL: 45 PERIODS

OUTCOMES:

- CO1 Explain the basic concepts related to Infrastructure Projects
- CO2 Discuss the role of private sector in infrastructure growth.
- CO3 Describe the strategies for successful Infrastructure Project implementation.
- CO4 Develop Infrastructure modeling and Life Cycle Analysis Techniques.
- CO5 Explain Sustainable development of Infrastructure

REFERENCES:

1. Grigg, Neil, Infrastructure engineering and management, Wiley, (1988).
2. Haas, Hudson, Zaniewski, Modern Pavement Management, Krieger, Malabar, (1994).
3. Hudson, Haas, Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, (1997).

RM4151 RESEARCH METHODOLOGY AND IPR L T P C
2 0 0 2

UNIT I RESEARCH DESIGN 6
 Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES 6
 Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING 6
 Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS 6
 Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT V PATENTS 6
 Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.

TOTAL :30 PERIODS

REFERENCES

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

IM4111

BIM AND PROJECT MANAGEMENT LABORATORY

L T P C
0 0 4 2

OBJECTIVES

- To Conduct Laboratory tests on BIM and hands on practice in Project Management Package.

EXPERIMENTS:

BIM Lab

1. Introduction to BIM
2. 2D and 3D Exercises
3. Infrastructure Modelling
4. Introduction to GEOBIM exercises

Project Management Lab

5. Breaking down project components.
6. Defining custom data items.
7. Planning resources and costs.
8. Resource leveling.
9. Quantity and Cost Estimation
10. Hands on practice in MS Project and Primavera software packages.
11. Mini project

TOTAL: 60 PERIODS

SYSTEM SPECIFICATIONS

HP Desktops Computers - 18 Nos
(Intel i7 core, 4 GB RAM, 1 TB HDD and 1 GB Graphics card)

SOFTWARES

1. MS Project – 10 users (latest Version)
2. Primavera – 10 users (latest Version)
3. MS Office – Excel
4. Revit
5. AutoCAD

OUTCOMES:

CO1- Explain the importance of BIM in Infrastructure Projects
CO2- Develop 2D and 3D Exercises using BIM
CO3- Apply the concept of Modelling in Infrastructure Projects
CO4- Implement MS project in planning infrastructure projects
CO5- Practice MS Project and Primavera Software packages

REFERENCES:

1. Harris P.E., Project Management using Primavera, Eastern Harris Publications, 2nd Edition,2008.
2. M.S. Project – Microsoft Press, 1st Edition,2003
3. Harris P.E., Project Management using Primavera, Eastern Harris Publications, 2nd Edition,2008.
4. M.S. Project – Microsoft Press, 1st Edition,2003

IM4201**INFRASTRUCTURE CONTRACT MANAGEMENT****L T P C
3 0 0 3****OBJECTIVES:**

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

UNITI CONSTRUCTION CONTRACTS 9

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

UNITII TENDERS 9

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

UNITIII ARBITRATION 9

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

UNITIV LEGAL REQUIREMENTS 9

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

UNITV LABOUR REGULATION 9

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

TOTAL : 45 PERIODS**OUTCOME:**

CO1- Explain different types of contracts in construction, arbitration and legal aspect and its provisions.

CO2-Analyse the Tenders based on Technical, Contractual and Commercial points of View

CO3- Describe the powers and duties of Arbitrator

CO4- Examine the legal Requirements of Purchase of Urban and Rural land

CO5- Discuss the laws relating to Wages, Bonus and Industrial Disputes

REFERENCES:

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

REFERENCES:

1. Murthy, V.N.S., "Advanced Foundation Engineering", CBS Publishers & Distributors, New Delhi, 2007.
2. Purushothama Raj, P., Ground Improvement Techniques, Laxmi Publications (P) Ltd., New Delhi, 2007
3. Tomlinson M.J., Pile Design and Construction Practice, Fourth Edition, E & FN SPON an imprint of Chapman & Hall.
4. Das, B.M., Principles of Foundation Engineering, Sixth Edition, India Edition, Homson, 2007.
5. Hans-George Kempfert & Berhane Gebreselassie. Excavation and Foundations in soft soils, Springer.

IM4204

ADVANCED STRUCTURAL DESIGN

L T P C
3 0 0 3

OBJECTIVES :

- To understand and explain the design of special RC Elements, Steel Structures, Industrial Buildings, Tall Building and special structures.

UNIT I DESIGN OF SPECIAL RC ELEMENTS 9

Design of slender columns - Design of RC walls. Strut and tie method of analysis for corbels and deep beams, Design of corbels, Deep-beams and grid floors.

UNIT II DESIGN OF COLD FORMED STEEL STRUCTURES 9

Introduction to Direct Strength Method - Behavior of Compression Elements - Effective width for load and deflection determination - Behavior of Unstiffened and Stiffened Elements - Design of webs of beams - Flexural members - Lateral buckling of beams - Shear Lag - Flange Curling - Design of Compression Members - Wall Studs.

UNIT III TALL BUILDING 9

The Tall Building in the Urban Context - The Tall Building and its Support Structure - Development of High Rise Building Structures - General Planning Considerations. Dead Loads - Live Loads - Construction Loads - Snow, Rain, and Ice Loads - Wind Loads - Seismic Loading - Water and Earth Pressure Loads - Loads - Loads Due to Restrained Volume Changes of Material - Impact and Dynamic Loads - Blast Loads - Combination of Loads.

UNIT IV ANALYSIS AND DESIGN OF SPECIAL STRUCTURES 9

The Rigid Frame Structure Approximate Analysis for Vertical Loading - Approximate Analysis for Lateral Loading - Approximate Design of Rigid Frame Buildings - Shear Wall Structure - The Vierendeel Structure - The Hollow Tube Structure.

UNIT V PRESTRESSED CONCRETE 9

Principles of Pre-stressing - Types and Systems of Pre-stressing, need for High Strength materials, Analysis, methods losses, deflection (short- long term), camber, cable layouts - Behavior of flexural members, determination of ultimate flexural strength - Codal provisions - Design of flexural members, Design for shear, bond and torsion. Design of end blocks.

TOTAL: 45 PERIODS

COURSE OUTCOME

- CO1 Design various concrete structures and structural elements by limit state design and detailing for ductility as per codal requirements.
- CO2 Describe the design procedure for special structures such as Deep beams, Corbels, Deep beams, and Grid floors
- CO3 Design steel structures for different load conditions.

CO4 Explain the design procedure for different types of industrial structures
CO5 Analyze and Design Bunkers, Silos and Chimneys.

REFERENCES:

1. Gambhir.M. L., "Design of Reinforced Concrete Structures", Prentice Hall of India,2012.
2. Purushothaman, P, "Reinforced Concrete Structural Elements: Behaviour Analysis and Design", Tata McGraw Hill,1986
3. Unnikrishna Pillai and Devdas Menon "Reinforced Concrete Design', Third Edition, Tata McGraw Hill Publishers Company Ltd., New Delhi,2007.
4. Varghese, P.C, "Advanced Reinforced Concrete Design", Prentice Hall of India,2005.
5. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India,2007.
6. Lynn S. Beedle, Plastic Design of Steel Frames, John Wiley and Sons,1990.
7. Narayanan.R.et.al., Teaching Resource on Structural steel Design, INSDAG, Ministry of Steel Publishing,2000.
8. Subramanian.N, Design of Steel Structures, Oxford University Press,2014.
9. Wie Wen Yu, Design of Cold Formed Steel Structures, McGraw Hill Book Company,1996
10. Taranath B S, "Structural Analysis and Design of Tall Buildings" Tata McGraw Hill Education Pvt Ltd, New Delhi,2011

IM4211

GIS LABORATORY

L T P C
0 0 4 2

OBJECTIVES :

- To Demonstrate and Acquire skills in using GIS softwarepackage.

EXERCISES:

- Data Input – Onscreen Digitization – Creation of Point, Line and Polygonlayers
- Projection, Re-projection and Coordinate Transformation of Maps
- Attribute data input and Measurement of Distance, Area
- Linking External Database and Tabular Data Analysis using SQL commands
- Generating Graphs, Charts and Diagrams from Tabular data
- Data Conversion – Vector to Raster and Raster to Vector
- Map Joining, Edge Matching and Layout Design
- Map compilation and Design

TOTAL: 60 PERIODS

SYSTEM SPECIFICATIONS

HP Desktop Computers - 18 Nos

(Intel i7 core, 4 GB RAM, 1 TB HDD and 1 GB Graphics card).

SOFTWARES

- i) ESRI – ArcGIS (latest Version) – 18Users
- ii) Quantum GIS (Open Source) – 18Users

OUTCOMES:

CO1 Describe the Projection Systems and their applications

CO2 Compile and Design a typical map with suitable mapelements

CO3 Generate Spatial Databases through spatial and non-spatial data input

CO4 Analyse attribute data using SQL commands

CO5 Present the outcome in spatial and pictorial form

REFERENCE:

1. H. Robinson et al, Elements of Cartography, 7th Edition, John Wiley and Sons,2004.
2. C.P. Lo Albert K.W. Yeung, "Concepts and Techniques of Geographic Information Systems", Prentice Hall of India Publishers,2006.

3. Munnell, Alicia, Editor, Is There a Shortfall in Public Capital Investment? Proceedings of a Conference Held in June(1990).
4. World Development Report 1994: Infrastructure for Development(1994).
5. Zimmerman, K. and F. Botelho, "Pavement Management Trends in the United States," 1st European Pavement Management Systems Conference, Budapest, September(2000).

IM4212

INFRASTRUCTURE MATERIAL TESTING LABORATORY

**L T P C
0 0 4 2**

OBJECTIVES

- To conduct experiments by providing advanced tools to expertise for the pursuit of industrial and academic research.
- To conduct laboratory tests on concrete, RCC Beams.
- To conduct field and laboratory tests of soils

EXPERIMENTS

Structural Engineering Lab

1. Cube Testing – Mix Design
2. Fabrication, casting and testing of simply supported Reinforced Concrete Beam for Strength and Deflection behavior -Testing of Simply Supported Steel Beam for Strength and Deflection Behavior.
3. Non -Destructive Testing using Concrete Test Hammers, Ultrasonic pulse velocity testers
4. Multibay portal frame Analysis using STADDPRO software

Geotechnical Engineering Lab

1. Tri-axial shear test (Drained and Un-drained test)
2. Consolidation test
3. Unconfined compressive strength test
4. Direct Shear test
5. Geotextile Testing
6. Slope stability, Bearing capacity and settlement analysis using PLAXIS software.

EQUIPMENTS

1. Loading frame of 100-ton capacity with required accessories
2. Compression Testing Machine (CTM) with required accessories
3. Tri-axial equipment
4. Consolidometer Accessories include Consolidation Ring Porous Stones, Consolidation Cell, Dial Gauges, Loading Device, Equipment for measuring Initial Height of Test Specimen to an accuracy of 0.1 mm
5. Unconfined compressive strength test equipment consists of trimmers, saws, extruders, and moulding components.
6. Direct shear test consists of shear box, soil container, loading unit, proving ring, dial gauge to measure shear deformation and volume changes
7. NDT equipment consists of Concrete Test Hammers, Ultrasonic pulse velocity testers
8. STAAD PRO & PLAXIS Software

TOTAL: 60 PERIODS

Course Outcomes

CO1- Explain the procedure for Mix Design and conduct Cube testing

CO2- Analyse the strength and deformation behaviour Reinforced Concrete Beams by conducting experiments

CO3- Perform Non Destructive testing of different structural components

CO4- Practice STAAD Pro & PLAXIS software for various applications

CO5- Develop Laboratory Reports of various testing of Materials

IM4311

SEMINAR

L T P C
0 0 2 1

OBJECTIVE:

- To work on a specific technical topic in Infrastructure Engineering in order to acquire the skills of oral presentation and to acquire technical writing abilities for seminars and conferences.

SYLLABUS: The students will work for two hours per week guided by a group of staff members. They will be asked to talk on any topic of their choice related to Infrastructure Engineering and to engage in dialogue with the audience. A brief copy of their talk also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will also answer the queries on the topic. The students as audience also should interact. Evaluation will be based on the technical presentation and the report and also on the interaction during the seminar.

TOTAL: 30 PERIODS

OUTCOME:

- On completion of the course, the student is expected to be able to acquire the skills of oral presentation and to acquire technical writing abilities for seminars and conferences.

IM4312

INDUSTRIAL TRAINING (4 WEEKS)

L T P C
0 0 0 2

OBJECTIVE:

- To train the students in the field work so as to have a firsthand knowledge of practical problems related to Infrastructure Engineering in carrying out engineering tasks.

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

OUTCOME:

- On completion of the course, the student is expected to be able to develop skills in facing and solving the problems experiencing in the Infrastructure Engineering field.

IM4313

PROJECT WORK I

L T P C
0 0 12 6

OBJECTIVE:

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

SYLLABUS:

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the

semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 180 PERIODS

OUTCOME:

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

IM4411

PROJECT WORK II

L T P C
0 0 24 12

OBJECTIVES:

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

SYLLABUS:

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

TOTAL: 360 PERIODS

OUTCOME:

- On completion of the project work students will be in a position to take up any challenging practical problem and find better solutions.

ST4073

MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES

L T P C
3 0 0 3

OBJECTIVE:

- To study the damages, repair and rehabilitation of structures

UNIT I MAINTENANCE AND REPAIR STRATEGIES 9

Maintenance, Repair and Rehabilitation, retrofit and strengthening, need for rehabilitation of structures Facets of Maintenance, importance of Maintenance, routine and preventive maintenance, causes of deterioration. Non-destructive Testing Techniques

UNIT II STRENGTH AND DURABILITY OF CONCRETE 9

Quality assurance for concrete based on Strength and Durability - Thermal properties, microstructure of concrete – packing density- Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion

UNIT III REPAIR MATERIALS AND SPECIAL CONCRETES 9

Repair materials-Various repair materials, Criteria for material selection, Methodology of selection, Health and safety precautions for handling and applications of repair materials, Special mortars and concretes- Polymer Concrete and Mortar, Quick setting compounds, Grouting materials-Gas forming grouts, Sulfoalumate grouts, Polymer grouts, Acrylate and Urethane grouts, Bonding agents-Latex emulsions, Epoxy bonding agents, Protective coatings-Protective coatings for Concrete and Steel, FRP sheets

UNIT IV PROTECTION METHODS AND STRUCTURAL HEALTH MONITORING 9

Concrete protection methods – reinforcement protection methods- self regulating anode - Corrosion protection techniques – Corrosion inhibitors, concrete coatings-Corrosion resistant steels, Coatings to reinforcement, cathodic protection, Structural health monitoring.

UNIT V REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES 9

Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, Overlays, Repair to active cracks, Repair to dormant cracks. Corrosion of embedded steel in concrete, Mechanism, Stages of corrosion damage, Repair of various corrosion damaged of structural elements (slab, beam and columns) Jacketing, Column jacketing, Beam jacketing, Beam Column joint jacketing, Reinforced concrete jacketing, Steel jacketing, FRP jacketing, Strengthening, Beam shear strengthening, Flexural strengthening

TOTAL: 45 PERIODS**OUTCOMES:**

- On completion of the course, the student is expected to be able to
- CO1 Explain the importance of maintenance assessment of distressed structures
- CO2 Apply the knowledge on Quality assurance for concrete based on Strength and Durability
- CO3 Identify various repair materials and advancements in concrete
- CO4 Explain the knowledge on Concrete protection methods Structural health monitoring
- CO5 Select Various strengthening and repair methods for different cases

REFERENCES:

1. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth-Heinemann, Elsevier, New Delhi 2012
2. DovKominetzky.M.S., - Design and Construction Failures, Galgotia Publications Pvt.Ltd., 2001
3. Ravishankar.K., Krishnamoorthy.T.S, Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures, Allied Publishers, 2004.
4. Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.
5. Hand Book on “Repair and Rehabilitation of RCC Buildings” – Director General works CPWD ,Govt of India , New Delhi – 2002
6. BS EN 1504 - Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity

IM4001**MATERIAL PROCUREMENT AND MANAGEMENT****L T P C****3 0 0 3****OBJECTIVES :**

- To Understand and Explain various types of Material Procurement, Management, Stores management and Quality Control

UNIT I INTRODUCTION:**9**

Importance of material management and its role in construction industry scope, objectives and functions, Integrated approach to materials management, Role of materials manager.

UNIT II CLASSIFICATION AND CODIFICATION OF MATERIALS OF CONSTRUCTION: 9

ABC,FSN, VED, SOS analysis- Procedure and its use, Standardization in materials and their management, Procurement, identification of sources of procurement, vendor analysis. Vendor analysis concept of (MRKP) Material requirement planning, planning, purchase procedure, legal aspects

UNIT III INVENTORY MANAGEMENT 9

Store Purchase Manual, Contractors Obligation. Inventory Control techniques. EOQ, Advantages and limitation of use of EOQ, Periodic ordering, order point control, safety stock, stock outs, application of AC analysis in inventory control, concept of (JIT) - Just in time management, Indices used for assessment of effectiveness of inventory management.

UNIT IV STORES MANAGEMENT: 9

Receipt and inspection, care and safety in handling, loss on storage, wastage, Bulk purchasing, site layout and site organization, scheduling of men, materials and equipment.

UNIT V QUALITY CONTROL 9

Conventional methods of quality control of Construction materials. Statistical method of quality control, Sampling techniques quality control in process. Quality Management and its economics. Project procurement processes. Use of (MMS) – Materials Management Systems in materials planning, procurement, inventory control, cost control etc. Project evaluation: Discounted Cash Flow, Real Options Theory. Project delivery methods, Competitive bidding. Risk allocation and management. Integrated project delivery. Contract negotiation.

TOTAL: 45 PERIODS

OUTCOMES:

- CO1 Identify the need and role of material management Understand
- CO2 Classify materials, identify sources of procurement, conduct vendor analysis
- CO3 Exercise control for effective management of inventory
- CO4 Manage stores and exercise quality control on materials
- CO5 Apply MMS in planning, procurement, inventory and cost control, evaluate projects and manage risks

REFERENCES

1. "A Guide to the Project Management Body of Knowledge (PMBOK Guide) - Fourth Edition, An American National Standard, ANSI/PMI 990001-2008"
2. Chitale A.K. and R.C. Gupta, "Material Management – Text and Cases", Prentice Hall of India Pvt. Ltd., 2007
3. Denise Bower, "Management of Procurement", Construction Management Series, Thomas Telford Publishing, 2003
4. Joseph Philips, PMP, Project Management and Professional (Certification Study Guides), McGraw Hill Publication, 2013
5. Jhamb L.C., "Inventory Management", Everest Publishing house, 2005
6. Menon K.S., "Purchasing and Inventory Control", Wheeler Publication, 1993
7. Ministry of Rural Development, GOI, "Procurement Manual", National Rural Livelihoods Project, 2010
8. Peter Holm Andreasen, "Dynamics of Procurement Management – A Complexity Approach", Copenhagen Business School, 2012
9. Peter Baily, David Farmer, Barry Crocker, David Jessop & David Jones, "Procurement Principles and Management", FT Prentice Hall, 2010
10. Manual for Ministry of Roads, Transport and Highways (MoRTH), GOI, 2007, 4th Revision

**CN4072 ECONOMICS AND FINANCE MANAGEMENT IN CONSTRUCTION L T P C
3 0 0 3**

OBJECTIVE:

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

UNIT I	BASIC PRINCIPLES	9
Time Value of Money – Cash Flow diagram – Nominal and effective interest- continuous interest . Single Payment Compound Amount Factor (P/F,F/P) – Uniform series of Payments (F/A,A/F,F/P,A/P)– Problem time zero (PTZ)- equation time zero (ETZ). Constant increment to periodic payments – Arithmetic Gradient(G), Geometric Gradient (C).		
UNIT II	COMPARING ALTERNATIVES PROPOSALS	9
Comparing alternatives- Present Worth Analysis, Annual Worth Analysis, Future Worth Analysis, Rate of Return Analysis (ROR) and Incremental Rate of Return (IROR)Analysis, Benefit/Cost Analysis, Break Even Analysis.		
UNIT III	EVALUATING ALTERNATIVE INVESTMENTS	9
Real Estate - Investment Property, Equipment Replace Analysis, Depreciation – Tax before and after depreciation – GST– Input Tax Credit (ITC) – Assessment and Administration of GST – Inflation.		
UNIT IV	FUNDS MANAGEMENT	9
Project Finance – Sources of finance - Long-term and short -term finance, Working Capital Management, Inventory valuation, Mortgage Financing - International financial management-foreign currency management.		
UNIT V	FUNDAMENTALS OF MANAGEMENT ACCOUNTING	9
Management accounting, Financial accounting principles- basic concepts, Financial statements – accounting ratios - funds flow statement – cash flow statement.		

TOTAL : 45 PERIODS

OUTCOME:

- On completion of the course, the student is expected to be able to

- CO1 Describe the basic principles of Economic in construction
- CO2 Evaluate alternate proposals
- CO3 Evaluate alternative investments
- CO4 Select best source of finance for a project
- CO5 Manage the finance and accounting

REFERENCES:

1. Blank, L.T., and Tarquin,a.J Engineering Economy,4th Edn. Mc-Graw Hill Book Co., 1988
2. Collier C and GlaGola C Engineering Economics & Cost Analysis, 3rd Edn. Addison Wesley Education Publishers.,1998.
3. Patel, B M Project management- strategic Financial Planning, Evaluation and Control, Vikas Publishing House Pvt. Ltd. New Delhi, 2000
4. Shrivastava,U.K., Construction Planning and Management,2nd Edn. Galgotia Publications Pvt. Ltd. New Delhi., 2001.
5. Steiner, H.M. Engineering Economic principles, 2nd Edn. McGraw Hill Book, 1996

CN4074

ORGANIZATIONAL BEHAVIOUR

**L T P C
3 0 0 3**

OBJECTIVE:

- To learn basic concepts of organizational behavior.
- To gain a solid understanding of human behavior in the workplace from an individual.
- To gain a solid understanding of human behavior in the workplace in group.
- To learn the concepts of Leadership and power.
- To learn the dynamics of organizational behavior.

UNIT I	INTRODUCTION TO ORGANIZATIONAL BEHAVIOUR	9
Definition, need and importance of organizational behaviour –Nature and scope –Frame work – Organizational behaviour models.		
UNIT II	INDIVIDUAL BEHAVIOUR	9
Personality : types –Factors influencing personality, theories–Types of learners –The learning process –Learning theories –Organizational behaviour modification –Misbehaviour: Types and Management Intervention - Emotions: Emotional Labour –Emotional Intelligence –Theories – Attitudes: Characteristics, Components, Formation, Measurement and Values - Perceptions : Importance , Factors influencing perception –Interpersonal perception -Impression Management Motivation –importance –Types –Effects on work behavior.		
UNIT III	GROUP BEHAVIOUR	9
Organization structure –Formation –Groups in organizations –Influence –Group dynamics – Emergence of informal leaders and working norms –Group decision making techniques –Team building -Interpersonal relations –Communication –Control.		
UNIT IV	LEADERSHIP AND POWER	9
Meaning –Importance–Leadership styles –Theories –Leaders Vs Managers –Sources of power – Power centers –Power and Politics.		
UNIT V	DYNAMICS OF ORGANIZATIONAL BEHAVIOUR	9
Organizational culture and climate –Factors affecting organizational climate –Importance of Job satisfaction –Determinants–Measurements – Influence on behavior - Organizational change – Importance –Stability Vs Change – Proactive Vs Reaction change– The change process – Resistance to change – Managing change - Stress - Work Stressors–Prevention and Management of stress – Balancing work and Life - Organizational development –Characteristics and objectives – .Organizational effectiveness.		
		TOTAL : 45 PERIODS

OUTCOME:

- On completion of the course, the student is expected to be able to

- CO1** Identify the need and importance of organizational behavior and the framework of organizational models
- CO2** Explain the various learning theories and develop alternative organizational behavior approaches in the workplace
- CO3** Describe the importance of group dynamics and team building.
- CO4** Explore the various leadership styles and politics.
- CO5** Explain the dynamics of organization behaviour with balance of work life.

REFERENCES:

1. Stephen P. Robins, "Organisational Behavior", PHI Learning / Pearson Education, 15th edition, 2012.
2. Fred Luthans, "Organisational Behavior", McGraw Hill, 12th Edition, 2005.
3. Schermerhorn, Hunt and Osborn, "Organisational Behavior", John Wiley, 12th Edition, 2011.
4. Udai Pareek, "Understanding Organisational Behaviour", 2nd Edition, Oxford Higher Education, 2008.
5. Mc Shane & Von Glinov, "Organisational Behaviour", 6th Edition, Tata McGraw Hill, 2012.

OBJECTIVES :

- To understand and Explain Management of Human Resources, Labour Legislation, Quality Assurance and Control, Quality management in Construction and Total Quality Management.

UNIT I	HUMAN RESOURCES MANAGEMENT	9
Introduction – Concept- Growth – Role and function. Manpower Planning for Construction Companies – Line and Staff function. Recruitment, selection, placement, induction and training; over staffing; Time office and establishment functions; wage and salary administration – Discipline- Separation Process.		
UNIT II	LABOUR LEGISLATION	9
Labour laws- labour law relating to construction industry- Interstate migration-Industrial relations- Collective bargaining- Worker's participation in management. Grievancehandling- discipline-role of law enforcing agencies and judiciary – women in constructionindustry.		
UNIT III	QUALITY ASSURANCE AND CONTROL	9
Objectives – Regularity agent, owner, design, contract and construction oriented objectives, methods – Techniques and needs of QA/QC – Different aspects of quality – Appraisals, Factors influencing construction quality – Critical, major failure aspects and failure mode analysis, – Stability methods and tools, optimum design – Reliability testing, reliability coefficient and reliability Prediction.		
UNIT IV	QUALITY MANAGEMENT IN CONSTRUCTION	9
Importance of quality; Elements of quality- quality characteristics- quality by design - quality conformance, contractor quality control- identification and traceability, Continuous Chain Management – brief concept and application. Importance of specifications- Incentives and penalties in specifications – Workmanship as a mark of quality – Final Inspection. Quality assurance techniques – Inspection, testing, sampling. Documentation – Organization for quality control, Cost of quality.		
UNIT V	TOTAL QUALITY MANAGEMENT	9
Overview of the contributions of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Taguchi techniques – introduction, loss function, parameter and tolerance design, signal to noise ratio. Concepts of Quality circle, Japanese 5S principles and 8D methodology–Introduction to IS/ISO 9004:2000 – quality management systems – guidelines for performance improvements. Quality Audits. TQM culture, Leadership – quality council, employee involvement, motivation, empowerment, recognition and reward - TQM framework, benefits, awareness and obstacles.		

TOTAL : 45 PERIODS**COURSE OUTCOME:**

- CO1 Explain the need and importance of human resource management, labour laws relating to Construction industry
- CO2 Identify the need and measures to improve safety in construction industry and safety audit
- CO3 Explain the need for applying ergonomics to construction industry
- CO4 Enumerate the need, importance, elements of quality and significance of quality assurance in Industry
- CO5 Explain the principles of Total Quality Management.

REFERENCES:

- James, J.O' Brian, "Construction Inspection Handbook" – Total Quality Management, Van Nostrand, 1997
- John L. Ashford, "The Management of Quality in Construction", E & F. N. Spon, 1989.
- Juran Frank, J.M. and Gryna, F.M. "Quality Planning and Analysis", McGraw Hill, 2001

OUTCOME:

On completion of this course, the student is expected to be able to

- CO1** Explains the contemporary management techniques and the issues in present scenario.
- CO2** Apply the basics of lean management principles and their evolution from manufacturing industry to construction industry.
- CO3** Develops a better understanding of core concepts of lean construction tools and techniques and their importance in achieving better productivity.
- CO4** Apply lean techniques to achieve sustainability in construction projects.
- CO5** Apply lean construction techniques in design and modeling

REFERENCES:

1. Corfe, C. and Clip, B., Implementing lean in construction: Lean and the sustainability agenda, CIRIA, 2013.
2. Shang Gao and Sui Pheng Low, Lean Construction Management: The Toyota Way, Springer, 2014.
3. Dave, B., Koskela, L., Kiviniemi, A., Owen, R., and Tzortzopoulos, P., Implementing lean in construction: Lean construction and BIM, CIRIA, 2013.
4. Ballard, G., Tommelein, I., Koskela, L. and Howell, G., Lean construction tools and techniques, 2002.
5. Salem, O., Solomon, J., Genaidy, A. and Luegring, M., Site implementation and Assessment of Lean Construction Techniques, Lean Construction Journal, 2005.

IM4003**VALUE ENGINEERING****L T P C
3 0 0 3****OBJECTIVES :**

- To Understand and Explain Value Engineering, Estimation, Job Plan, Reliability estimation and Various Phases.

UNIT I INTRODUCTION**9**

Value Engineering (VE) and Value Analysis (VA) - Life Cycle of a product-Methodology of value engineering – Difference from the conventional methods of cost reduction- Unnecessary costs reasons- Quantitative definition of value- Use value and Prestige value.

UNIT II ESTIMATION**9**

Estimation of product Quality/performance-Types of functions- Relationship between Use functions and Esteem Functions in product design – Functional cost and Functional Worth – Effect of Value improvement on profitability-Test for poor value –Aims of Systematic Approach.

UNIT III JOB PLAN**9**

Functional approach to value improvement-various phases and techniques of Job Plan – Factors governing project selection – Types of Projects-Life Cycle Costing (LCC) for managing the Total Value- Concepts in LCC – Present value concept-Annuity concept- Net Present value-Pay back period-Internal rate of return on Investment (IRR)-Examples and Illustrations.

UNIT IV RELIABILITY ESTIMATION**9**

Creative thinking and creative judgment- positive or constructive discontent- Tangible and Intangible costs of implementation-False material-labour and overhead saving – Relationship between savings and probability of success- Reliability estimation-System reliability- Reliability elements in series and parallel.

UNITV VARIOUS PHASES**9**

General Phase-Information Phase – Type of costs- Function Phase – Evaluation of Functional Relationships- Checks for consistency-Function –cost-weight-matrix-VIP Index – High cost and Poor value areas- Creativity/Speculation Phase – Rules of creativity-Brainstorming- Idea activators- Result accelerators – Evaluation Phase – Estimation of costs of ideas- Evaluation by comparison.

TOTAL :45 PERIODS**COURSE OUTCOME**

- CO1 Establish the Value engineering methodology
- CO2 Recognize the various phases of value engineering
- CO3 Perform function cost worth analysis
- CO4 Create the ideas for solving the problems
- CO5 Analyze the functional importance and functional cost

REFERENCES

1. Arthur E Mudge, "Value Engineering", McGraw Hill Book Company, 1971
2. A.D.Raven, Profit Improvement through Value Analysis, value Engineering and Purchase Price Analysis, Cassell and Co. London.(1971)
3. Richard J Park, "Value Engineering – A Plan for Inventions", St.Lucie Press,London,1999
4. S Slyer," Value Engineering – A How to Manual", 3rd edition, New Age Publishers, Chennai, ISBN:978-81-224-2405-8,2006
5. Value engineering, Mukhopadhyaya, Anil Kumar, Response Books, New Delhi , ISBN: 0-7619-9788-1,2003.

IM4004**SAFETY IN CONSTRUCTION ENGINEERING****L T P C
3 0 0 3****OBJECTIVES:**

- To Understand and Explain the of construction accidents, safety programmes, contractual obligations, and design for safety.

UNITI CONSTRUCTIONACCIDENTS**9**

Accidents and their Causes – Human Factors in Construction Safety – Costs of Construction Injuries – Occupational and Safety Hazard Assessment – Legal Implications.

UNITII SAFETY PROGRAMMES**9**

Problem Areas in Construction Safety – Elements of an Effective Safety Programme – Job-Site Safety Assessment – Safety Meetings – Safety Incentives.

UNITIII CONTRACTUAL OBLIGATIONS**9**

Safety in Construction Contracts – Substance Abuse – Safety Record Keeping.

UNITIV DESIGNINGFOR SAFETY**9**

Safety Culture – Safe Workers – Safety and First Line Supervisors – Safety and Middle Managers – Top Management Practices, Company Activities and Safety – Safety Personnel – Sub contractual Obligation – Project Coordination and Safety Procedures – Workers Compensation.

UNITV OWNER'S ANDDSIGNERS'OUTLOOK**9**

Owner's responsibility for safety – Owner preparedness – Role of designer in ensuring safety – Safety clause in design document.

TOTAL :45 PERIODS

COURSE OUTCOME

CO1 Explain the construction accidents CO2 Explain the safety programme.

CO3 Describe contractual obligations. CO4 Explain the safety design.

CO5 Explain the outlook of owner and designer.

REFERENCES:

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

ST4072

DESIGN OF BRIDGE STRUCTURES

L T P C

3 0 0 3

OBJECTIVE:

- To study the loads, forces on bridges and design principles of several types of bridges.

UNIT I INTRODUCTION

9

Introduction-Selection of Site and Initial Decision Process - Classification of Bridges- General Features of Design- Standard Loading for Bridge Design as per different codes - Road Bridges – Railway Bridges - Design Codes - Working Stress Method- Limit State Method of Design

UNIT II SUPERSTRUCTURES

9

Selection of main bridge parameters, design methodologies -Choices of superstructure types - Orthotropic plate theory, load distribution techniques - Grillage analysis - Finite element analysis Different types of superstructure (RCC and PSC); Longitudinal Analysis of Bridge - Transverse Analysis of Bridge

UNIT III BRIDGE DESIGN PRINCIPLES

9

Analysis and Design of RCC solid slab culverts -Design of RCC Tee beam and slab bridges - Design principles of continuous girder bridges, box girder bridges, balanced cantilever bridges – Arch bridges – Box culverts – Segmental bridges–Design principles only

UNIT IV SUBSTRUCTURE, BEARINGS AND DECK JOINTS

9

Design of bridge bearings and substructure

UNIT V PRESTRESSED CONCRETE BRIDGES & STEEL BRIDGES

9

Design principles of PSC bridges – PSC girders –Design principles of steel bridges - Plate girder bridges – Box girder bridges – Truss bridges – Vertical and Horizontal stiffeners.

TOTAL: 45 PERIODS

OUTCOME:

- On completion of this course student will be able to
- CO1** Explain the different types of bridges and design philosophies
- CO2** Design a RC solid slab culvert bridge
- CO3** Design a RC Tee Beam and Slab bridge
- CO4** Design the bridge bearings and substructure
- CO5** Explain the design principles of PSC bridges, box girder bridges, truss bridges

REFERENCES:

1. Jagadeesh.T.R. and Jayaram.M.A., "Design of Bridge Structures", Second Edition, Prentice Hall of India Pvt. Ltd. 2009.
2. Johnson Victor, D. "Essentials of Bridge Engineering", Sixth Edition, Oxford and IBH Publishing Co. New Delhi, 2018.

REFERENCES:

1. ACI Report 440.2R-02, "Guide for the design and construction of externally bonded RP systems for strengthening concrete structures", American Concrete Institute, 2002.
2. Aitkens, High Performance Concrete, McGrawHill, 1999
3. Ashby, M.F. and Jones.D.R.H.H. "Engineering Materials 1: An introduction to Properties, applications and designs", Elsevier Publications, 2005.
4. Deucher, K.N, Korfiatis, G.P and Ezeldin, A.S, Materials for civil and Highway Engineers, Prentice Hall Inc., 1998.
5. Ganapathy, C. "Modern Construction Materials", Eswar Press, 2015.
6. Mamlouk, M.S. and Zaniewski, J.P., Materials for Civil and Construction Engineers, Prentice Hall Inc., 1999.
7. Santhakumar.A.R. "Concrete Technology", Oxford University press, New Delhi.
8. Shan Somayaji, Civil Engineering Materials, Prentice Hall Inc., 2001
9. Shetty M.S, Concrete Technology: Theory and Practice, S.Chand & Company Ltd., 2005.
9. Jerry Irvine, "Advanced Construction Techniques", C.A. Rockett, 1984
10. Sankar S.K. and Saraswathi. S, "Construction Technology", Oxford University Press, New Delhi, 2008

ST4071

ADVANCED PRESTRESSED CONCRETE

L T P C
3 0 0 3

OBJECTIVE:

- Principle of prestressing, analysis and design of prestressed concrete structures.

UNIT I PRINCIPLES OF PRESTRESSING

9

Basic concepts of Prestressing - Types and systems of prestressing - Need for High Strength materials, Analysis methods, losses of prestress – Short and Long term deflections – Cable layouts.

UNIT II DESIGN OF FLEXURAL MEMBERS

9

Behaviour of flexural members, determination of ultimate flexural strength – Various Code provisions - Design of flexural members, Design for shear, bond and torsion. Transfer of prestress – Box girders.

UNIT III DESIGN OF CONTINUOUS AND CANTILEVER BEAMS

9

Analysis and design of continuous beams - Methods of achieving continuity - concept of linear transformations, concordant cable profile and gap cables – Analysis and design of cantilever beams.

UNIT IV DESIGN OF TENSION AND COMPRESSION MEMBERS

9

Design of tension members - application in the design of prestressed pipes and prestressed concrete cylindrical water tanks - Design of compression members with and without flexure – its application in the design piles, flag masts and similar structures.

UNIT V DESIGN OF COMPOSITE MEMBERS

9

Composite beams - analysis and design, ultimate strength - their applications. Partial prestressing its advantages and applications.

TOTAL: 45 PERIODS

OUTCOME:

- On completion of the course, the student is expected to be able to

- CO1** Identify the various methods of prestressing
CO2 Design the beams for shear, bond and torsion
CO3 Design the continuous beams
CO4 Design the water tank, piles and masts
CO5 Analyze and design the composite beams

REFERENCES:

1. Arthur H. Nilson, "Design of Prestressed Concrete", John Wiley and Sons Inc, New York, 2004.
2. Krishna Raju, "Prestressed Concrete", Tata McGraw Hill Publishing Co., New Delhi, 6th Edition, 2018.
3. Lin.T.Y.andBurns.H "Design of Prestressed Concrete Structures", John Wiley and Sons Inc, 3rd Edition,2010.
4. Rajagopalan.N, "Prestressed Concrete", Narosa Publications, New Delhi,2014.
5. Sinha.N.C.and.Roy.S.K, "Fundamentals of Prestressed Concrete", S.Chand and Co.,1998

IM4006**ENVIRONMENTAL IMPACT ASSESSMENT FOR INFRASTRUCTURE PROJECTS****L T P C
3 0 0 3****OBJECTIVES :**

- To understand and Explain Overview, Prediction and Assessment, Health Assessment, Environmental management plan and Casestudies.

UNITI**OVERVIEW****9**

Sustainable Development challenges and need- Key approaches for Impact Assessment Assessing Environmental Impacts - E I A Approach: Historical development, Legal and Regulatory aspects in India, Types and Objectives, Components, Process of EIA.

UNITII**PREDICTIONANDASSESSMENT:****9**

Tools, impact on air ,water, soil & Noise, Role of Biodiversity impact Assessment, Identification Prediction &Evaluation of Impacts on Biodiversity, Techniques of Biodiversity impact assessment, E I A Report Preparation

UNITIII**HEALTHASSESSMENT****9**

Impact of Environment on Health, Developing framework for Health impact analysis, tools and techniques, Case studies. Socio-Economic Impact Assessment: Overview and Scope of Social Impact Assessment, S I A model and the planning process, Land acquisition -Legal aspects, Resettlement &Rehabilitation and Development

UNITIV**ENVIRONMENTAL MANAGEMENTPLAN****9**

Preparation and implementation, Mitigation and Rehabilitation plans, Post Project Audit. Integrated Analysis Of Environmental, Social And Health Impacts: Challenges for Integrated Approach, Scope for Integrated approach in economic analysis- C B A , Social C B A ,and Cost effectiveness Analysis, the Analytic Hierarchy process based approach to project appraisal, Emerging Dimensions and future Directions-Strategic Environmental Assessment, Technological Assessment and Risk Assessment.

UNITV CASE STUDIES 9
 Extraction of natural resources and power generation, Primary Processing and Material production, Material Processing, Manufacturing/Fabrication, Service Sectors, Physical Infrastructure including Environmental Services, Building/Construction Projects/Area Development Projects & townships.
TOTAL : 45 PERIODS

COURSE OUTCOMES

- CO1** Understand the necessity to study the impacts that will be caused by projects or industries and the methods to assess these impacts
- CO2** Describe the legal requirements of environmental impact assessment for projects
- CO3** Prepare terms of reference for environmental impact and socio- economic impact for any Developmental project
- CO4** Prepare environmental management plan and mitigation measures by considering environmental aspects, impacts and potential hazards respectively for any project
- CO5** Understand the primary processing and extraction of natural resources with case studies

REFERENCES

1. Canter,L.W., "EnvironmentalImpactAssessment", McGrawHill, NewYork, 1996.
2. Anjaneyulu, Yerramilli, and Valli Manickam, "Environmental impact assessment methodologies", Hyderabad: BS Publications, 2007.
3. Lawrence, D.P., "Environmental Impact Assessment- Practical Solution store current problems", Wiley-Interscience, NewJersey, 2003.
4. Petts, J., "Handbook of Environmental Impact Assessment", Vol., I and II, Blackwell science, London, 1999.

IM4007 URBAN ENVIRONMENTAL MANAGEMENT L T P C
3 0 0 3

OBJECTIVES :

- To understand and Explain Urban Environmental issues, Urban waste resources management, Urban water supply, Urban waste water management, Municipal solid waste management.

UNITI URBAN ENVIRONMENTAL ISSUES 9
 Urbanization- Population growth scenario migration-Pollution of surface water resources rivers, tanks, channels ground water exploitation - wastewater - characteristics - pollution problems - Solid waste - air pollution – CPCB norms. Urban master plans- Planning and organizational aspects.

UNITII URBAN WASTE RESOURCES MANAGEMENT 9
 Water in urban ecosystem – urban water resources planning and organization aspects- storm water management practices-types of storage-magnitude of storage-storage capacity of urban components - percolation ponds - temple tanks- rainwater harvesting.

UNITIII URBAN WATER SUPPLY 9
 Demandestimation-populationforecasting-sourceidentification-waterconveyance- storage reservoirs - fixing storage capacity -Distribution network - types - analysis – computer applications- Conservation techniques-Integrated urban water planning.

UNITIV URBAN WASTE WATER MANAGEMENT 9
 Sewage generation - storm drainage estimation-industry contribution-wastewater collection system-separate and combined system - hydraulic design of sewer and storm drain – waste water treatment-disposal methods-concept of decentralization- 3Rconcepts.

UNITV MUNICIPAL SOLID WASTE MANAGEMENT 9

Sources of solid waste - characteristics - rate of generation - segregation at source - collection of solid waste-methods of collection-route analysis-transfer and transfer stations - processing and disposal of solid waste. Case Studies-Environmental economics-Social and Physiological aspects of pollution-Successful Urban Management- models-Urban Management-Case studies from Developed Nations -Software

TOTAL : 45 PERIODS

COURSE OUTCOMES

- CO1 Explain planning of a city and identify various urban environmental issues
- CO2 Prepare project Plans to integrate urban water resource
- CO3 Explain water resource management using available water resources
- CO4 Develop sustainable wastewater management concepts comparing with successful models followed in developed nation
- CO5 Apply the principles of solid waste management

REFERENCES:

1. George Tchobanoglous, Hilary Theisen and Samuel A Vigil" Integrated Solid Waste Management", McGraw Hill Publishers, New York, 1993.
2. McGhee J., "Water supply and sewerage", McGraw Hill Publishers, 1991
3. Martin P. Wanelista and Yousef. "Storm Water Management and Operations", John Wiley and Sons, 1993.
4. Nei IS. Grigg., "Urban Water Infrastructure Planning- Management and Operations ", John Wiley and Sons, 1986.

**IM4008 LIFE CYCLE ANALYSIS AND DESIGN FOR THE ENVIRONMENT LT P C
3 0 0 3**

OBJECTIVES:

To impart knowledge and skills on the concept and methodology of Life Cycle Assessment as per international standards and its potential applications to develop sustainable products and promote sustainable consumption.

UNIT I LIFE CYCLE THINKING AND LIFECYCLE MANAGEMENT 9

Introduction to Life Cycle Thinking – Industrial ecology – Life cycle management (LCM) and Stakeholder Expectations - LCM drivers and issues - materials flow analysis - Life cycle of Products and services- International organizations and networks - History and definition of LCA - analytical tools for product and service systems —Value creation along the life cycle—technical characteristics – applications -limitations

UNIT II LCA GOAL, SCOPE AND INVENTORY 9

ISO 14040 framework for LCA - Life cycle goal and scope definition - function, functional unit and reference flow System boundaries, data categories, inputs and outputs, data quality, critical review and other procedural aspects - Inventory Analysis: Raw Material Extraction and Processing , Manufacturing and Production , Product Use and Consumption , End-of-life Management , Transportation and Distribution - Dealing with Allocation Issues - Solutions to the multi functionality problem - Flow diagram - Format and data categories - Attributional versus consequential LCI – LCA softwares and database - Data quality - Data collection and relating data to unit processes – Data validation - Cut-off and data estimation –

UNIT III LIFE CYCLE IMPACT ANALYSIS AND INTERPRETATION 9

Characterization factors and principle of characterization - Selection of impact categories, category indicators and characterization models – Classification -Characterization - Optional elements - normalization , grouping, weighting ,data quality analysis - Characterization models – Impact assessment Case studies -Simplified/streamlined Life Cycle Assessments - procedural approaches, numerical approaches - Examples of numerical approaches - contribution analysis,

perturbation analysis, uncertainty - analysis, comparative analysis, key issue analysis - Treatment of uncertainties - Elements in uncertainty handling - Sensitivity of LCA results - Sustainability analysis - Extending LCA - economic dimension, social dimension - Life cycle costing - Eco-efficiency - Combining LCA and LCC – Case studies

UNIT IV DESIGN FOR ENVIRONMENT AND ECOLABELLING 9

Sustainable consumption – Eco-efficiency - green consumerism - product stewardship and green engineering - Extended producer responsibility – Design For Environment Strategies, Practices, Guidelines, Methods, And Tools. Ecodesign strategies –Design for Disassembly - Dematerialization, rematerialization, transmaterialization – Green procurement and green distribution - Analysis framework for reuse and recycling – Typical constraints on reuse and recycling - Communication of Life Cycle Information - Indian ecomark scheme - Environmental product declarations – Environmental marketing

UNIT V LCA SOFTWARES AND CASE STUDIES 9

LCA Softwares - LCA Software Demo: SimaPro, GREET, BEES, CMU EIO, GABI - Advances in LCA: Hybrid LCA, Thermodynamic LCA - LCA case studies on Product Design, Product Improvement, Product Comparison and Policy development.

TOTAL: 45 PERIODS

OUTCOMES:

- CO1** Explain the various functional elements of Life Cycle Analysis and Design for Environment
- CO2** apply the knowledge of science and engineering fundamentals to characterize the environmental interactions of products and services
- CO3** design of engineering systems taking into account the material flow and pollutant interactions between engineering decisions and the environment
- CO4** select appropriate LCA tools to support product/process design and decision making, taking into account the impact of the solutions in a sustainability context
- CO5** conduct research pertinent to Life Cycle Management and communicate effectively to different stakeholders in terms of eco labels as well as engage in independent life-long learning

REFERENCES:

1. ISO 14040-2016-Environmental management - Life cycle assessment - Principles and framework, International Organization for Standardization, 2016
2. T. E. Graedel, Braden R. Allenby, Industrial Ecology and Sustainable Engineering, Prentice Hall, 2010
3. Ralph Horne, Tim Grant, Karli Verghese, Life Cycle Assessment: Principles, Practice and Prospects, Csiro Publishing, 2009
4. ISO/TR 14047:2003, Environmental management - Life cycle impact assessment - Examples of application of ISO 14042, International Organization for Standardization, 2007
5. International Organization for Standardization: ISOTR 14062 Environmental management - Integrating environmental aspects into product design and development, 2002.
6. European Commission - Joint Research Centre - Institute for Environment and Sustainability: International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment - Detailed guidance. Luxembourg. European Union; 2010
7. Catherine Benoît, UQAM/CIRAIG, and Bernard Mazijn, Guidelines for Social Life Cycle Assessment of Products, United Nations Environment Programme, 2009

OBJECTIVES :

- To Understand and Explain Sustainable Development, Environmental sustainability, Empowerment, Urban planning and Built in Environment

UNIT I INTRODUCTION TO SUSTAINABLE DEVELOPMENT: 9

Definitions and principles of Sustainable Development - History and emergence of the concept of Sustainable Development - Environment and Development linkages- Globalization and environment – Millennium Development Goals: Status (global and Indian) Impacts on approach to development policy and practice in India, future directions.

UNIT II ENVIRONMENTAL SUSTAINABILITY: 9

Land, Water and Food production - Moving towards sustainability: Energy powering Sustainable Development - Financing the environment and Sustainable Development.

UNIT III EMPOWERMENT: 9

Empowerment of Women, Children, Youth, Indigenous People, Non-Governmental Organizations, Local Authorities, Business and Industry - Sustainability indicators – Hurdles to sustainability-Operational guidelines-Interconnected prerequisites for sustainable development - Science and Technology for sustainable development - Performance indicators of sustainability and Assessment mechanism – Constraints and barriers for sustainable development.

UNIT IV URBAN PLANNING AND ENVIRONMENT: 9

Environment and Resources, Sustainability Assessment, Future Scenarios, Form of Urban Region, Managing the change, Integrated Planning, Sustainable Development

UNIT V THE BUILT IN ENVIRONMENT: 9

Urban Form, Land Use, Compact Development, Principles of street design- complete streets, Transport Integrated Urban land use Planning, Guidelines for Environmentally sound Transportation

TOTAL: 45 PERIODS**COURSE OUTCOMES**

- CO1 Describe the concept and socio-economic policies of Sustainable Development
 CO2 Identify the strategies for implementing eco development programmes
 CO3 Identify different approaches for resource conservation and management
 CO4 Suggest action plans for implementation of sustainable development CO5 Explain Urban Planning environment
 CO5 Understand the built in environment principles

REFERENCES

1. Gilg A W and Yarwood R, "Rural Change and Sustainability-Agriculture, the Environment and Communities", CAB International, Edited by S J Essex, September 2005.
2. Ganesha Somayaji and Sakarama Somayaji, "Environmental Concerns and Sustainable development: Some perspectives from India", Editors:, publisher TERI Press, ISBN 8179932249.
3. James H. Weaver, Michael T. Rock, Kenneth Kustere, "Achieving Broad-Based Sustainable Development: Governance, Environment, and Growth with Equity", Kumarian Press, West Hartford, CT. Publication Year, 1997.
4. Kirkby. J, O'Keefe P. and Timberlake, "Sustainable development" Earth Scan Publication, London, 1996.
5. Kerry Turner. R, "Sustainable Environmental Management", Principles and Practice Publisher: Belhaven Press, ISBN: 1852930039.
6. Munier N, "Introduction to Sustainability", Springer 2005

OBJECTIVES :

- To understand and Explain Green building concepts, Smart urban transport systems, Water supply and drainage, E-Governance and IOT.

UNIT I INTRODUCTION 9

Understanding – Dimensions – Global experience, Global standards and performance benchmarks, Practice codes. India 100 smart cities policy and mission, Smart city planning and development, Financing smart cities development, Governance of smart cities.

UNIT II GREEN BUILDING CONCEPTS AND SUSTAINABLE DEVELOPMENT 9

Green projects in smart cities, sustainability – green building – Rating system – Energy efficient building – energy saving systems.

UNIT III SMART URBAN TRANSPORT SYSTEMS 9

Elements of Infrastructure (Physical, Social, Utilities and services), Basic definitions, concepts, significance and importance; Data required for provision and planning of urban networks and services; Resource analysis, Provision of infrastructure. Role of transport, types of transport systems, evolution of transport modes, transport problems and mobility issues. Urban form and Transport patterns, land use – transport cycle, concept of accessibility. Hierarchy, capacity and geometric design elements of roads and intersections. Basic principles of Transport infrastructure design. Urban transport planning process – Transport, environment and safety issues. Principles and approaches of Traffic Management, Transport System Management.

UNIT IV WATER SUPPLY AND DRAINAGE 9

Water – sources of water, treatment and storage, transportation and distribution, quality, networks, distribution losses, water harvesting, recycling and reuse, norms and standards of provision, institutional arrangements, planning provisions and management issues. Sanitation – points of generation, collection, treatment, disposal, norms and standards, grey water disposal, DEWATS, institutional arrangements, planning provisions and management issues. Municipal and other wastes – generation, typology, quantity, collection, storage, transportation, treatment, disposal, recycling and reuse, wealth from waste, norms and standards, institutional arrangements, planning provisions and management issues. Power – Sources of power procurement, distribution networks, demand assessment, norms and standards, planning provisions and management issues

UNIT V E- GOVERNANCE AND IOT 9

The concept of management, concept of e-management & e-business, e-Government Principles, Form e-Government to e-governance, e-governance and developing countries, Designing and Implementing e-Government Strategy, E governance: Issues in implementation. IOT-fundamentals, protocols, design and development, data analytics and supporting services, case studies.

TOTAL : 45 PERIODS**COURSE OUTCOME**

- CO1 Explore and understand the fundamental concepts of smart and sustainable cities.
 CO2 Explain the component of smart cities and dwell into their technological advancement.
 CO3 Appreciate the involvement of stake holders in the design and implementation of responsive smart cities.
 CO4 Explain the importance of different linkages and their roles including government, urban planners, universities, city developers and communities.
 CO 5 Identify and recognize the role of ICT and data analytics in addressing the urban challenges and key issues

REFERENCES:

1. Allen G.Noble, (Eds), 'Regional Development and Planning for the 21st Century: New Priorities and New Philosophies', Aldershot, USA,1988.
2. Andy Pike, Andres Rodriguez-Pose, John Tomaney, 'Handbook of Local and Regional Development', Taylor & Francis,2010
3. Andreas Faludi and Sheryl Goldberg, 'Fifty years of Dutch National Physical Planning, Alexandrine Press, Oxford,1991.
4. Daniel G. Parolek, AIA, Karen Parolek, Paul C. Crawford, FAICP, Form Based Codes: A Guide for Planners, Urban Designers, Municipalities, and Developers, John Wiley & Sons, 2008

IM4011

PAVEMENT MANAGEMENT SYSTEM

**L T P C
3 0 0 3**

OBJECTIVE:

- To introduce the concepts of design, evaluation and performance of existing and new flexible and rigid pavements with due emphasis on systems approach and performance prediction models.

UNIT I PAVEMENT MANAGEMENT PROCESS

9

Historical background – general nature and applicability of systems methodology – basic components of Pavement Management System –Network and Project level of PMS - PMS functions- planning pavement investments.

UNIT II FUNCTIONAL EVALUATION AND PERFORMANCE

9

General concepts – economic and functional evaluation – evaluation of pavement performance– pavement distresses – condition surveys – safety evaluation visual rating of distresses, image processing; pavement friction, texture depth and skid resistance -LCMS laser crack management system- PCI development-application of GIS in pavement evaluation- case studies.

UNIT III PAVEMENT STRUCTURAL EVALUATION

9

Factors affecting Structural Condition of Flexible and Rigid Pavements- Pavement Deterioration- Evaluation by Non-Destructive Tests such as FWD, Benkelman Beam Rebound Deflection, Plate Load Test, Evaluation by Destructive Test Methods, and Specimen Testing - Structural analysis of Airfield pavements

UNIT IV PERFORMANCE PREDICTION MODELS

9

Pavement performance prediction - concepts, Techniques for developing prediction models – ranking and optimization methodologies- AASHO, CRRRI and HDM models – computer applications – ANN, MATLAB–deterioration modeling- Pavement prioritization techniques.

UNIT V MAINTENANCE AND REHABILITATION

9

Repair of pavement defects – types of maintenance of flexible and rigid pavements - Preservation and surface treatments - fog seals, crack sealing, slurry sealing and Overlays - Design of Overlays- Whitetopping, microsurfacing ,thin overlays . Use of Geo synthetics in Pavement.

TOTAL: 45 PERIODS

OUTCOME:

- CO1** Apply the knowledge on methods of pavement management.
- CO2** Conduct research on the functional evaluation and performance of pavements
- CO3** Conduct research on the Structural performance of pavements
- CO4** Apply the mathematical theories and concepts in predicting the performance of pavements.
- CO5** Understand and Select various maintenance and rehabilitation methods with real time case studies.

REFERENCES:

1. Sahini M.Y., Chapman and Hall," Pavement Management for Airports, Roads and Parking Lots", NewYork,1992.
2. SrinivasaKumar.R," Pavement Evaluation, Maintenance & Management system, Universities Press India P Ltd,2014
3. Ralph Haas, W. Ronald Hudson and John Zaniewski, Modern Pavement Management, Kreigar Publishing Company, NewYork,1994
4. Michael Sargious, Pavements and Surfacing for Highways and Airports, Applied Science Publishers Limited, London,1975

IM4012**AIRPORT SYSTEM PLANNING AND DESIGN****L T P C
3 0 0 3****OBJECTIVE:**

- Provides a basic understanding on Airport Systems Planning and Operation

UNIT I AIRPORT PLANNING**10**

Planning of airports and its impact on metropolitan city development– Accessibility – Transport Connections – Road and Rail, Expansion – Feasibility Studies – Environmental and Social Issues – Forecasting Future Traffic – Airfield Capacity and Delay - Aircraft characteristics – Airport Site Selection

UNIT II AIRPORT COMPONENTS**10**

Airport Classification, Planning of Airfield Components – Runway, Taxiway, Apron, Hangar- Passenger Terminals- Geometric design of runway and taxiways-Runway pavement Design- Difference between Highway and airport pavements- Introduction to various design methods- Airport drainage.

UNIT III AIRPORT PLANNING AND AIRLINE ECONOMICS**9**

Demand driven dispatch – Airline Fleet Planning Models – Network Revenue Management – Airport Performance, Slot Issues, Hub Operation, Demand Management, Multi-airport Systems- Pricing – Privatization and Deregulation, Willingness to pay and Competitive Revenue Management

UNIT IV PASSENGER CHOICE, SCHEDULING AND FLEET ASSIGNMENT**7**

Load Factor Analysis, Airline Schedule Development, Introduction to PODS Passenger Choice Models, Decision Window Model, Fleet Assignment

UNIT V CASE STUDIES**9**

Multi airport system – location of airport with respect to urban growth- case studies.

TOTAL: 45 PERIODS**OUTCOME:**

- CO1 Conduct Feasibility studies and plan an airport.
- CO2 Design various Airport components.
- CO3 Explain Airport Management and economics.
- CO4 Develop scheduling and various models for Airport management.
- CO5 Explain Airport planning and Design.

REFERENCES:

1. Robert Honjeff and Francis X.Mckelvey, "Planning and Design of Airports", McGraw Hill, NewYork,1996
2. Richard De Neufille and AmedeoOdoni, "Airport Systems Planning and Design", McGraw Hill, NewYork,2003
3. Airport Planning and Systems–<http://airportssystem.com/Course/index.html>

AUDIT COURSES

AX4091

ENGLISH FOR RESEARCH PAPER WRITING

L T P C
2 0 0 0

OBJECTIVES

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

UNIT III TITLE WRITING SKILLS 6

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

TOTAL: 30 PERIODS

OUTCOMES

- CO1 – Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

OBJECTIVES

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION**6**

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS**6**

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA**6**

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT**6**

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT**6**

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS**OUTCOMES**

- CO1: Ability to summarize basics of disaster
- CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- CO5: Ability to develop the strengths and weaknesses of disaster management approaches

REFERENCES

1. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.
2. Nishitha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "NewRoyal book Company, 2007.
3. Sahni, Pardeep Et. Al. , " Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi, 2001.

OBJECTIVES

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION

History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION

Preamble, Salient Features

UNIT III 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 IV ORGANS OF GOVERNANCE

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION

District's Administration head: Role and Importance, □ Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT VI ELECTION COMMISSION

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING

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

UNIT I	சங்க இலக்கியம்	6
	1. தமிழின் துவக்க நூல் தொல்காப்பியம் - எழுத்து, சொல், பொருள்	
	2. அகநானூறு (82) - இயற்கை இன்னிசை அரங்கம்	
	3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி	
	4. புறநானூறு (95,195) - போரை நிறுத்திய ஔவையார்	
UNIT II	அறநெறித் தமிழ்	6
	1. அறநெறி வகுத்த திருவள்ளுவர் - அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புரவறிதல், ஈகை, புகழ்	
	2. பிற அறநூல்கள் - இலக்கிய மருந்து - ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)	
UNIT III	இரட்டைக் காப்பியங்கள்	6
	1. கண்ணகியின் புரட்சி - சிலப்பதிகார வழக்குரை காதை சமூகசேவை இலக்கியம் மணிமேகலை - சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை	
UNIT IV	அருள்நெறித் தமிழ்	6
	1. சிறுபாணாற்றுப்படை - பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஔவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள்	
	2. நற்றிணை - அன்னைக்குரிய புன்னை சிறப்பு	
	3. திருமந்திரம் (617, 618) - இயமம் நியமம் விதிகள்	
	4. தர்மச்சாலையை நிறுவிய வள்ளலார்	
	5. புறநானூறு - சிறுவனே வள்ளலானான்	
	6. அகநானூறு (4) - வண்டு நற்றிணை (11) - நண்டு கலித்தொகை (11) - யானை, புறா ஐந்திணை 50 (27) - மான் ஆகியவை பற்றிய செய்திகள்	

1. உரைநடைத் தமிழ்,
 - தமிழின் முதல் புதினம்,
 - தமிழின் முதல் சிறுகதை,
 - கட்டுரை இலக்கியம்,
 - பயண இலக்கியம்,
 - நாடகம்.
2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும்,
3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும்,
4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,
5. அறிவியல் தமிழ்,
6. இணையத்தில் தமிழ்,
7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.

TOTAL: 30 PERIODS

தமிழ் இலக்கிய வெளியீடுகள் / புத்தகங்கள்

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2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia) - <https://ta.wikipedia.org>
3. தர்மபுர ஆதீன வெளியீடு
4. வாழ்வியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்
5. தமிழ்கலைக் களஞ்சியம் - தமிழ் வளர்ச்சித் துறை (thamilvalarchithurai.com)
6. அறிவியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்