

COURSE STRUCTURE FOR M.TECH. CONSTRUCTION TECHNOLOGY AND MANAGEMENT FIRST YEAR SEM – I (w. e. f 2024-25)

SEMESTER-I (Subjects)				M.TECH. _____ Sem.-I										
Sr. No	Course Code	Category Code	Course Name	Teaching Scheme					Exam Scheme					Total Marks
				L	T	P	C	Hrs/wk	Theory			Practical		
									MS	ES	CE	LE	LE/Viva	
1		PCC	Construction Planning and Engineering	3	0	0	3	3	25	50	25	-	-	100
2		PCC	Project Management	3	0	0	3	3	25	50	25	-	-	100
3		PCC	Construction Financing and Management	3	0	0	3	3	25	50	25	-	-	100
4		PCC	Quantitative Techniques and Operations Research	3	0	0	3	3	25	50	25	-	-	100
5		PCC	Ground Improvement Techniques for Construction	3	0	0	3	3	25	50	25	-	-	100
6		PCC	Project Management Lab	0	0	2	1	2	-	-	-	50	50	100
7		PCC	Project Design Studio-1	0	0	2	1	2	-	-	-	50	50	100
8		Project	Communication and Technical Writing Skills	2	0	0	2	2	25	50	25	-	-	100
		Audit	Audit Course – I	1	-	-	P/NP	1	-	-	-	-	-	P/NP
Total				18	0	4	19	22						

MS = Mid Semester, ES = End Semester; CE = Continuous Evaluation LW = Laboratory work; LE = Laboratory Exam

Audit course I & II

1. Disaster Management
2. Sanskrit for Technical Knowledge
3. Value Education
4. Constitution of India
5. Pedagogy Studies
6. Stress Management by Yoga
7. Personality Development through Life Enlightenment Skills

COURSE STRUCTURE FOR M.TECH. CONSTRUCTION TECHNOLOGY AND MANAGEMENT FIRST YEAR SEM – II (w. e. f 2024-25)

SEMESTER-II (Subjects)				M.TECH. _____ Sem.-II										
Sr. No	Course Code	Category Code	Course Name	Teaching Scheme					Exam Scheme					
				L	T	P	C	Hrs/wk	Theory			Practical		Total Marks
									MS	ES	CE	LE	LE/Viva	
1		PCC	Advanced Construction Technology	3	0	0	3	3	25	50	25			100
2		PCC	Project Design Studio-2	0	0	2	1	2	-	-	-	50	50	100
2		PCE	Professional Core Elective_L – 1 (Advanced Construction Planning and Engineering)	3	0	0	3	3	25	50	25			100
3		PCE	Professional Core Elective_L – 2 (Remote Sensing and Geographical Information Systems)	3	0	0	3	3	25	50	25			100
4		PCE	Professional Core Elective_L – 3 (Value Engineering)	3	0	0	3	3	25	50	25			100
5		PCE	Professional Core Elective_L – 4 (Earthquake Engineering)	3	0	0	3	3	25	50	25			100
6		PCE	Professional Core Elective_P – 1 (Primavera P6)	0	0	2	1	2	-	-	-	50	50	100
7		Project	Research Methodology and IPR	2	0	0	2	2	25	50	25	-	-	100
		Project	Seminar	-	-	-	1	-	-	-	-	50	50	100
8		Audit	Audit Course – II	1	-	-	P/NP	1	-	-	-	-	-	P/NP
Total				17	0	4	20	22						

MS = Mid Semester, ES = End Semester;

CE = Continuous Evaluation LW = Laboratory work; LE = Laboratory Exam

<p>Track – 1 : Specific Domain - I</p> <ol style="list-style-type: none"> 1. Elective 1.1 Advanced Construction Planning and Engineering 2. Elective 1.2 Decision Sciences in Construction Management 3. Elective 1.3 Smart Infrastructure and Cities 4. Elective 1.4 Safety Management in Construction 	<p>Track – 2 : Specific Domain - II</p> <ol style="list-style-type: none"> 1. Elective 2.1 Remote Sensing and Geographical Information Systems 2. Elective 2.2 Environmental Impact Assessment 3. Elective 2.3 Solid Waste Management 4. Elective 2.4 Air Pollution Monitoring
<p>Track – 3 : Specific Domain - III</p> <ol style="list-style-type: none"> 1. Elective 3.1 Value Engineering 2. Elective 3.2 Building Information Modelling 3. Elective 3.3 Real Estate Valuation and Management 4. Elective 3.4 Contracts Management 	<p>Track – 4 : Specific Domain - IV</p> <ol style="list-style-type: none"> 1. Elective 4.1 Earthquake Engineering 2. Elective 4.2 Industry 4.0 3. Elective 4.3 Application of Artificial Intelligence and Machine Learning in Construction 4. Elective 4.4 Building Services Management

**COURSE STRUCTURE FOR M.TECH. CONSTRUCTION TECHNOLOGY AND MANAGEMENT SECOND YEAR SEM – III
(w. e. f 2024-25)**

SEMESTER-III (Subjects)				M.TECH. _____ Sem. - III										
Sr. No	Course Code	Category Code	Course Name	Teaching Scheme					Exam Scheme					Total Marks
				L	T	P	C	Hrs/wk	Theory			Practical		
									MS	ES	CE	LE	LE/Viva	
1		Project	Project Phase - I	-	-	-	14	-	-	-	-	50	50	100
2		Project	Summer Internship /IEP (6 Week)	-	-	-	1	-	-	-	-	50	50	100
Total				0	0	0	15	-						

**COURSE STRUCTURE FOR M.TECH. CONSTRUCTION TECHNOLOGY AND MANAGEMENT SECOND YEAR SEM – IV
(w. e. f 2024-25)**

SEMESTER-IV (Subjects)				M.TECH. _____ Sem. - IV										
Sr. No	Course Code	Category Code	Course Name	Teaching Scheme					Exam Scheme					Total Marks
				L	T	P	C	Hrs/wk	Theory			Practical		
									MS	ES	CE	LE	LE/Viva	
1		Project	Project Phase – II and Dissertation	-	-	-	16	-	-	-	-	50	50	100
Total				0	0	0	16	-						

MS = Mid Semester, ES = End Semester; CE = Continuous Evaluation LW = Laboratory work; LE = Laboratory Exam

Category-wise summary

Code	Category Description	Credits
PCC	Professional Core Course	21
PCE	Professional Core Elective	13
Project	Project work, Seminar or Internship in Industry or elsewhere	36
OE	Open Elective subject	0
Audit	Self-enrichment course	0
	Total	70

M. Tech (Civil: Construction Technology and Management)

Semester 1

<24CE511T>					<Construction Planning and Engineering-I>					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

1. To give overview of Indian construction and infrastructure assets
2. To learn the methodology for implementation of Building Information Modelling (BIM) in construction projects
3. To learn methodologies for sustainable infrastructure, working of public private partnership models and contracts management
4. To develop concepts about built environment

UNIT I: OVERVIEW OF INDIAN CONSTRUCTION AND INFRASTRUCTURE ASSETS	09 Hrs.
Introduction: Concept of construction and infrastructure - Need for construction and infrastructure planning and engineering- Construction and infrastructure development scenario in India- Scope for construction and infrastructure management. Overview of Indian Infrastructure Assets: Urban infrastructure- Water- Dams- Bridges- Canals- Housing- Roads- Railways- Ports- Airports- Energy- Power.	
UNIT II: APPLICATION OF BUILDING INFORMATION MODELLING IN CONSTRUCTION	12 Hrs.
Scope of Building Information Modelling, BIM: New tools and new processes; BIM as a lifecycle platform; Benefits of BIM; Problems addressed by BIM; BIM and lean construction; Future of designing and building with BIM ; Evolution to object-based parametric modelling; BIM environments, platforms, and tools; Different kinds of data exchange methods; BIM use in design processes; Considerations in adoption for design practice; BIM-enabled process change; 3D Visualization and coordination; 4D: Construction analysis and planning ; 5D: Quantity take-off and cost estimating production planning and control.	
UNIT III: SUSTAINABLE INFRASTRUCTURE, PUBLIC PRIVATE PARTNERSHIP MODELS AND CONTRACTS MANAGEMENT	10 Hrs.
Methodologies for development and management of sustainable infrastructure- Privatization of Infrastructure- Working of public private partnership models (Build Operate and Transfer, Build Operate Lease and Transfer, Build Own Operate)- Infrastructure laws for cost estimation, designing and maintaining infrastructure. Indian Contracts Act, Tendering and Bidding Process, FIDIC Contract Clauses (Red Book, Yellow Book, Orange Book)	
UNIT IV: BUILT ENVIRONMENT FOR SUSTAINABLE DEVELOPMENT	08 Hrs.
Definition and scope of Built Environment; Four traditions of built environment, Human-environmental dimensions, Land and climate, Designing with people, environment, technology; Collaborative and creative process.	
TOTAL HOURS: 39 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Demonstrate the salient features of the infrastructure assets of India and also learn the provisions under latest five-year plan under the recommendations of Niti Ayog
CO2	:	Explore in details the primary construction and infrastructure assets like MRTS, Highways, Railways, Airports, Power sector, Renewable energy sector, Ports and Dams
CO3	:	Develop concepts about the methodology for applications of BIM
CO4	:	Analyse the potentialities of PPP models applicable in Indian scenario
CO5	:	Evaluate the models available in contracts management and develop knowledge in the area of contracts management
CO6	:	Build concepts in the area of Built Environment

TEXT/REFERENCE BOOKS

1. Fleming, R., Roberts, S.H. **Sustainable Design for Built Environment**, Routledge, 2019.
2. McClure, R and Bartuska, T.J. **The Built Environment: A Collaborative Inquiry into Design & Planning**, Wiley, 2007.
3. Raghuram G, **Infrastructure Development and Financing: Towards a Public Private Partnership**, Macmillan Publishers, New Delhi, 2001.
4. Joshi P, **Law Relating to Infrastructure Projects**, Taxman Publishers New Delhi, 2001.
5. Alagiri D, **Infrastructure Development**, ICFAI University Press Hyderabad, 2007.

<20CE512T>					<Project Management>					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

1. To learn about the philosophy, concepts and scope of project management and salient features of the different features of a project life cycle. structures of project organization
2. To learn the methodology for development of project organization structures and work breakdown structures
3. To learn about the latest project planning and scheduling tools
4. To learn methodologies of project management for sustainable development and latest project management tools and techniques including risk management, Building Information Modelling (BIM), Integrated Project Delivery (IPD) and Critical Chain Project Management (CCPM)

UNIT I: CONCEPT, SCOPE OF PROJECT MANAGEMENT AND PHASES OF PROJECT LIFE CYCLE	08 Hrs.
<p>Introduction: Definition & scope of project- Parameters affecting a project; Project planning & implementation cycle; Definition, concept & scope of project management; Role of project manager; Enhancing the probability of success of a project; Phases of a project – Identification, feasibility, development, implementation and operation- Project life cycle.</p> <p>Project Organization: Factors responsible for organizational revolution; Formal & informal organization structures- Matrix organization structure- Selecting a project organization structure- Criteria to help determine a suitable organizational form in a given project environment.</p>	
UNIT II: PROJECT PLANNING AND SCHEDULING	12 Hrs.
<p>Work Break Down Structure (WBS): Typical hierarchy in the WBS of a project- Desirable characteristics of work packages- Project oriented WBS- Functionally oriented WBS- Integration of WBS & organization structure.</p> <p>Project Scheduling & Planning: Scheduling principles- Bar charts (Gantt charts)- Milestones charts- S-curve- Critical path method: Network logic diagram; Arrow diagram; Time estimates; Slack; Total, free & independent floats; Case studies of complex CPM networks; Project Evaluation & Review Technique (PERT); Beta distribution; Case studies.</p>	
UNIT III: RESOURCE ALLOCATON & LEVELLING, PROJECT APPRAISAL AND CONTROL	09 Hrs.
<p>Resource Allocation and Levelling: Network scheduling with limited resources-Resource allocation; Resource levelling.</p> <p>Project Appraisal: Economic evaluation of project proposals using ROR. Project Control: Time control; Cost control; Control curves; Time cost trade-off planning. Quality control: Need of QA/QC programs; Objectives of QA/QC; Quality assurance techniques.</p>	
UNIT IV: PROJECT MONITORING, RISK MANAGEMENT, LATEST PROJECT MANAGEMENT TRENDS	10 Hrs.
<p>Project Monitoring: Measurement of performance; Major functions of monitoring; Influence of decision-making authority; Case studies.</p> <p>Project Risk Management: Risk identification; Risk analysis; Risk response planning and mitigation measures; Case studies.</p> <p>Latest Trends in Project Management: Project management for sustainable development- Integrated project delivery (IPD)- Lean integrated project delivery (LIPD)- Application of Building Information Modelling (BIM) –Critical chain project management (CCPM).</p>	
TOTAL HOURS: 39 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Develop concepts and philosophy of project management and also about the different phases of the project life cycle
CO2	:	Build concepts about the methodology for formulation and application of work breakdown structure and organization structure
CO3	:	Develop problem solving ability and knowledge about various project planning and scheduling tools and techniques and complex critical path network diagrams
CO4	:	Analyse the problems pertaining to project evaluation and review technique
CO5	:	Create problem solving ability to solve resource allocation and levelling problems
CO6	:	Create ability to apply the project monitoring methods, project controlling methods, risk management and latest project management trends

TEXT/REFERENCE BOOKS

1. Jha Neeraj Kumar, **Construction Project Management**, Pearson Publishers, New Delhi, 2018.
2. Nicholas John M, **Project Management for Business and Technology: Principles and Practice**, 2nd Edition, Pearson Prentice Hall New Delhi, 2007.
3. Iyer P Parameshwar, **Engineering Project Management with case studies**. Wheeler Publishing New Delhi, 2001.
4. Joy PK, **Handbook of Construction Management**, Macmillan Delhi, 1990.
5. Harris F & McCaffer R, **Modern Construction Management**, BSP Professional Books Oxford/ London, 2003.
6. Wiest D.J. and Leivy K F, **A Management Guide to PERT and CPM: With GERT/ PDM / DCPM**, Pearson Prentice Hall Publishers, New Delhi, 2010.

<20CE513>					<Construction Finance and Management>					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

1. To give exposure to the students about the concepts and scope of infrastructure project finance
2. To give exposure about the long-term financing instruments, shares, debentures, asset-based financing and securities
3. To give exposure about working capital management
4. To give exposure about the financial models and concepts of PPP projects applicable for complex mega infrastructure projects

UNIT I: INTRODUCTION TO PROJECT FINANCE	10 Hrs.
Introduction: Project finance, Nature and scope of project finance, Goals of financial management, Sources of financing infrastructure, Preparation and interpretation of cash flow statement.	
UNIT II: SHARES, DEBENTURES, SECURITIES	09 Hrs.
Sources of Finance: Long term finance, Ordinary shares, Equity shares, Preference shares, Debentures, Term loans, Asset based financing, Securities.	
UNIT III: WORKING CAPITAL AND CAPITAL INVESTMENT	10 Hrs.
Working Capital Management: Policy for working capital, Estimating working capital needs, Sources, procedures and practices in infrastructure construction industry.	
Capital Investment Decisions: Techniques of capital budgeting, Types of budgets, Procedure for master budget, Cash flow forecast, Preparing a project financing plan.	
UNIT IV: TRENDS OF PROJECT FINANCE, PPP MODELS	10 Hrs.
Trends in Project Finance: Infrastructure development through Public Private Partnership (PPP), PPP-models for infrastructure projects, Ownership structures like BOT, BOT, BOOT, BOLT, DBFO etc., Government's role in successful PPP, Life cycle-Contractual package of PPP projects, Bankable concession agreements, Model concession agreements on highway and urban infrastructure projects.	
Case Studies in Project Finance: Case studies of Power sector, Highway sector, Mass Rapid Transit Systems, Water supply projects.	
TOTAL HOURS: 39 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Understand in depth the concepts of the infrastructure financing
CO2	:	Identify the long-term financing instruments, shares, debentures, asset-based financing, and securities
CO3	:	Understand and learn the asset-based financing and securities
CO4	:	Develop concepts about working capital management primarily for infrastructure projects
CO5	:	Apply the techniques of capital budgeting and develop ability to prepare a project finance plan
CO6	:	Evaluate the financial models pertaining to PPP models like BOT toll, BOT annuity, BOLT, BOO, BOOT models

TEXT/REFERENCE BOOKS

1. Prasana Chandra, **Financial Management: Theory & Practice**, Tata McGraw Hill New Delhi, 2008.
2. JC Van Horne, **Fundamentals of Financial Management**, Prentice Hall, New Delhi, 1997.
3. Degarmo E Paul, **Engineering Economy**, Prentice Hall Inc New Jersey ,1997.
4. Chawla Kishan, **Social Cost Benefit Analysis: An Introduction to Financial and Economic Appraisal of Projects**, Mittal Publishers Jaipur, 1987.
5. MY Khan & PK Jain, **Financial Management**, Tata McGraw Hill New Delhi, 2008.

<20CE514>					<Quantitative Techniques and Operations Research>					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

1. To understand fundamental mathematical concepts and their applications in quantitative analysis
2. To Gain proficiency in statistical analysis techniques for data interpretation and decision-making
3. To learn optimization methods for maximizing/minimizing objective functions and solving constrained optimization problems
4. To apply quantitative techniques to real-world problems in engineering, finance, and other domains
5. To enhance problem-solving abilities through hands-on exercises and simulations

UNIT I: INTRODUCTION TO QUANTITATIVE TECHNIQUES	09 Hrs.
Overview of quantitative techniques and their applications; Role of decision making in construction; Classification of quantitative techniques	
UNIT II: STATISTICAL ANALYSIS TECHNIQUES	10 Hrs.
Descriptive Statistics: Measures of central tendency, dispersion, and skewness. Inferential Statistics: Hypothesis testing, Acceptance sampling, confidence intervals, and regression analysis. Statistical Process Control: Applications of control charts in construction	
UNIT III: OPTIMIZATION AND NUMERICAL METHODS	10 Hrs.
Linear Programming: Formulation, graphical method, and simplex algorithm. Non-Linear Programming: Gradient-based methods, Newton's method, and genetic algorithms. Numerical Integration : Trapezoidal rule, Simpson's rule, and finite difference methods.	
UNIT IV: OTHER APPLICATIONS OF OPERATIONS RESEARCH	10 Hrs.
Transportation problems; Transshipment problems; Queuing theory and waiting line problems; Practical applications and case studies	
TOTAL HOURS: 39 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Develop concepts about fundamentals of quantitative techniques
CO2	:	Demonstrate proficiency in statistical analysis techniques for data interpretation and decision-making
CO3	:	Apply optimization methods to solve complex problems and optimize processes
CO4	:	Analyze problems related to transportation with transshipment
CO5	:	Solve problems related to queuing theory
CO6	:	Enhance problem-solving abilities for applications of quantitative techniques and operations research in construction

TEXT/REFERENCE BOOKS

1. Adrian, J. J. (1973). **Quantitative Methods in Construction Management**. United Kingdom: American Elsevier Publishing Company.
2. **Guidelines for the Use of Advanced Numerical Analysis**. (2002). United Kingdom: Thomas Telford.
3. O'Brien, A., Higgins, K. G. (2020). **The Management of Advanced Numerical Modelling in Geotechnical Engineering: Good Practice**. United Kingdom: CIRIA.
4. Tang, S., Ahmad, I. U., Ahmed, S. M., Lu, M. (2004). **Quantitative Techniques for Decision Making in Construction**. Hong Kong: Hong Kong University Press.
5. Woodward, J. F. (1975). **Quantitative Methods in Construction Management and Design**. United Kingdom: Palgrave Macmillan UK.

<20CE515T>					<Ground Improvement Techniques>					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

1. Explain the concepts and principles used for physical compaction of soil in laboratory and field; and stabilisation of weak soil using chemical admixtures.
2. Explain the principles of advance compaction methods using dynamic loads, stones columns, and different grouting processes.
3. Explain and make an awareness about the potential applications of different smart materials like geosynthetics, strips and bars in improving the physical soil properties.
4. Explain and make an awareness about different advance techniques of soil improvements like Soil nailing and ground anchors, dewatering techniques, piling techniques etc.

UNIT I	10 Hrs.
Introduction: Compaction method used in the laboratory and the field, lab compaction methods-light, heavy, kneading, vibratory, for soils and with admixtures Shallow stabilization with cement, lime, flyash and other chemical admixtures.	
UNIT II	12 Hrs.
Deep stabilization using vibroflotation, compaction piles, dynamic compaction, blasting, sand drains, stone columns, lime and cement columns, grouting by permeation, displacement and jet methods.	
UNIT III	10 Hrs.
Functions and Application of Geosynthetics- Geotextiles, Geogrids, geomembranes, soil reinforcement using strips, bars etc.	
UNIT IV	07 Hrs.
Soil nailing and ground anchors, dewatering techniques, earthmoving machines and earthwork principles, piling and diaphragm wall construction, tunnelling methods in soils etc.	
TOTAL HOURS: 39 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Understand the purpose of ground improvement and list different methods of ground improvement
CO2	:	List objectives of soil stabilisation and explain different stabilization like mechanical stabilization, chemical stabilization etc.
CO3	:	Identify uses of grouting, list basic functions of grouting, differentiate grouts based on various properties and explain different applications of grouting
CO4	:	List the classification of geosynthetics, identify the physical, chemical & mechanical properties; and explain the functions of geosynthetics like separation, filtration, drainage and reinforcement
CO5	:	Develop ability to understand dewatering and drainage of construction site; List the objectives of dewatering; Describe different dewatering methods and identify the most suitable methods of dewatering for different site conditions
CO6	:	Create and build theoretical concept of soil nailing, ground anchors, piling, diaphragm wall construction, tunnelling and its application in the field

TEXT/REFERENCE BOOKS

1. Purushottam Raj, **Ground improvement Techniques**, Penguin Books Ltd, New Delhi, 1999
2. Gulhati and Dutta, M. **Geotechnical Engineering**, Tata Mc-Graw Hills, 2003.
3. Koener R M., **Construction and Geotechnical Methods in Foundation Engineering**. McGraw Hill Pub Co New York, 1985.
4. Hausmann M R, **Engineering Principles of Ground Modifications**, McGraw Hill Pub Co New York, 1990.
5. Ingles O G and Metcalf J B. (1972), **Soil Stabilisation: Principles and practice**, Butterworths, London, 1972.
6. Ell F G., **Methods of Treatment of Unstable ground**, Newness Butterworths, London,1975.

<20CE513P>					<Project Design Studio-I>					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	2	2	--	--	--	50	50	100

COURSE OBJECTIVES

1. To learn through real life projects the concepts of mass rapid transit system (MRTS) projects
2. To learn the procedures of tenders & contracts management for an infrastructure project

UNIT I: MASS RAPID TRANSIT SYSTEM PROJECTS	13 Hrs.
Students will work in small groups to study the real life MRTS projects of various cities. The study should include traffic diversion schemes, utility diversion schemes, land acquisition schemes, environmental clearance schemes, temporary supporting structures like piles, struts, rock anchors, shotcreting and rock bolting and permanent structures like RCC box tunnel.	
UNIT II: TENDERS AND CONTRACTS	13 Hrs
From real life projects students will learn about tenders, contracts and specifications; Types of contracts; Contract procedures, General conditions of contract, Indian Contracts Act, Pre-qualification criteria for contractors, bid evaluation procedures, Bidding Models, FIDIC contract clauses, Case Studies, Preparation of project reports, contract documents and project appraisal reports.	
TOTAL HOURS:	26 Hrs

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Understand from real life case studies the planning, engineering and management methodology for MRTS projects
CO2	:	Evaluate and assess the various procedures of contracts management
CO3	:	Create ability to apply the contract procedures and clauses of FIDIC

TEXT/REFERENCE BOOKS

1. Harris F & McCaffer R, **Modern Construction Management**, BSP Professional Books Oxford/ London, 2003.
2. Lewis, H. Bids, **Tenders & Proposals: Winning Business through Best Practice**, 4th Edition, Kogan Publishers, London, Philadelphia, New Delhi, 2009.

<20CE512P>					<Project Management Lab>					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	--	--	--	50	50	100

COURSE OBJECTIVES

1. To learn the Microsoft project software to develop work break down structures for real life projects
2. To learn to develop, bar charts, mile stone charts, project networks and how to monitor a project progress
3. To learn the techniques for resource allocation and levelling through MSP software
4. To learn the simulation methods for project risk management

UNIT I MICROSOFT PROJECT SOFTWARE	14 Hrs.
Work Breakdown Structure (WBS), Project Organization Structure, AOA Networks, AON Networks, PDM Networks, Linear Time Monitoring Tools (Bar Charts / Gant Charts), Editing Tasks, Mile Stone Charts, Resource Allocation and Resource levelling, Managing Data & Resources, Introduction to Base Line for Monitoring Projects, Managing Multiple Projects, Project Calendar, Use of Filters, Creating a Project Report, Case Studies from Industry	
UNIT II: PROJECT RISK MANAGEMENT THROUGH RISK AMP-SOFTWARE	12 Hrs.
Risk Analysis (Quantitative), Simulation of Risk weightages through Monte Carlo Simulation, Simulation Application for Network Path Analysis, Monte Carlo Simulation Application for computation of Risk Time, Risk Cost, Expected Time Expected Cost of a Project	
TOTAL HOURS: 26 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Understand the features of Microsoft project software and learn to develop work breakdown structure (WBS) for real life structures
CO2	:	Understand and learn the applications for developing bar-charts, milestone charts and project networks
CO3	:	Develop ability for carrying out resource allocation and levelling
CO4	:	Apply the concepts and features of MSP software to develop a complete project report
CO5	:	Build ability to apply Monte Carlo simulation to carryout project network path analysis
CO6	:	Create and develop ability to apply Monte Carlo simulation for computation of Risk Time, Risk Cost, Expected Time Expected Cost of a Project (Expected Value Method of risk analysis)

TEXT/REFERENCE BOOKS

1. Jha Neeraj Kumar, **Construction Project Management**, Pearson Publishers, New Delhi, 2018.
2. Iyer P Parameshwar, **Engineering Project Management with case studies**. Wheeler Publishing New Delhi, 2001.
3. Nicholas John M (2007) **Project Management for Business and Technology: Principles and Practice**, 2nd Edition, Pearson Prentice Hall New Delhi, 2007.

Semester 2

<24CE522T>					<Advanced Construction Technology>					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

1. To learn about the techniques and methodology available for construction of metro rail corridors (underground and elevated)
2. To learn about the modern construction materials
3. To learn about the latest formworks available along with some latest construction methodologies
4. To learn about operation and management of latest construction equipments for complex mega infrastructure projects

UNIT I: CONSTRUCTION OF UNDERGROUND AND ELEVATED CORRIDOR FOR METRO RAIL PROJECTS	10 Hrs.
Underground Corridor: Traffic diversion; Utility diversion; Soldier piles and king piles; Timber lagging; Deep excavation; Diaphragm walls; Strutting; Construction decks; Rock excavation; Shotcreting; Rock bolting; Rock anchors; Sub floor drainage; Waterproofing; Dewatering; Permanent structure -Construction of RCC single & twin boxes. Elevated Corridor: Segment casting, Segment transportation, Segment erection with launching girder.	
UNIT II: MODERN CONSTRUCTION MATERIALS	09 Hrs.
Ready mixed concrete; High Performance concrete; Fibre reinforced concrete; Light weight concrete; Ferrocement; Polymer concrete; Self compacting concrete; Applications of geosynthetics (geotextiles, geogrids, geomembranes and geocomposites) in construction; Green building materials.	
UNIT III: FORMWORKS, SCAFFOLDING, ENABLING STRUCTURES	10 Hrs.
Formwork and Scaffolding: Modular wooden formwork: Doka Total formwork system; Modular aluminium formwork; Slipform; Jump formwork; Automated climbing formworks. Deep foundations and Enabling Structures: Cassions; Wells; Piles; Cofferdams; Strutting; Tunneling: By tunnel boring machine (TBM);By New Austrian tunneling method (NATM); Tunnel form technology.	
UNIT IV: PRESTRESSING, CONSTRUCTION EQUIPMENTS, SAFETY MANAGEMENT	10 Hrs.
Precasting & Pre-stress Concreting: Precasting; Prestressing (pre-tensioning & post tensioning); Case Study of Elevated corridor construction for metro rail operations. Highway Construction: Construction of flexible and rigid pavements; Highway maintenance and drainage. Modern Construction Equipments: Selection of equipments; Owning & operating costs; Compacting & stabilizing equipments; Excavating equipments; Hauling equipments; Cranes. Site Safety Management: Personal protective equipments; Work place structural integrity; Safe working of cranes and other construction equipments.	
TOTAL HOURS: 39 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Demonstrate the latest techniques and methodologies available for construction of underground and elevated metro rail corridors
CO2	:	Explore the benefits, applications, and usage of modern construction materials including green building materials and materials for sustainable development
CO3	:	Develop ability to apply the modern formworks available including Doka formwork and modular aluminium formwork
CO4	:	Build concepts about the methods of selection for modern construction equipments and develop ability to compute owning and operating costs
CO5	:	Analyse the application of cranes and some major construction equipments in construction sites
CO6	:	Create concepts pertaining to safety practices in construction sites

TEXT/REFERENCE BOOKS

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., **Construction Planning, Equipment and Methods**, 6th Edition, Tata McGraw-Hill, New Delhi, 2015
2. Sarkar, S.K. and Saraswati, S. **Construction Technology**, Oxford University Press, New Delhi, 2008.
3. Kaushik SK, Asawa GL & Ahuja AK, **Civil Engineering Practices Volume-III**, New Age International Publishers, 1998.
4. **CE & R Development in Concreting Technology in India – A Compilation of Reprints from CE&R (1991-97)**, Civil Engineering & Construction Review New Delhi, 1998.
5. Dewar JD and R Anderson (2008) **Manual of Ready Concrete**, Blackie Publishers Glasgow/ London, 2008
6. Sushil Kumar, **Building Construction**, Standard Publishers, New Delhi, 2007.

<20CE553T>					<Elective: Decision Sciences in Construction Management>					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

1. To understand the significance of decision sciences within the realm of construction management
2. To learn to utilize decision-making methodologies and tools effectively in construction management contexts
3. To develop the skills to analyse complex problems in construction management using quantitative and qualitative data
4. To apply decision science concepts to real-world construction management scenarios through case studies and practical exercises

UNIT I: INTRODUCTION TO DECISION SCIENCES IN CONSTRUCTION MANAGEMENT	09 Hrs.
Overview of decision sciences and its importance in construction management, Introduction to decision-making methodologies, Decision support systems in construction management.	
UNIT II: QUANTITATIVE AND QUALITATIVE DECISION-MAKING TECHNIQUES	10 Hrs.
Probability theory and its application in construction decision-making, Decision trees and expected value analysis, Sensitivity analysis and risk assessment in construction projects, multi-criteria decision making (MCDM) and its application to construction decision-making in construction management, Case studies illustrating the use of qualitative decision-making techniques in construction projects.	
UNIT III: DECISION SUPPORT TOOLS AND SOFTWARE	10 Hrs.
Introduction to decision support software relevant to construction management, Hands-on exercises utilizing decision support tools for construction decision-making, Application of engineering economics in decision making	
UNIT IV: APPLICATION OF DECISION SCIENCES IN CONSTRUCTION MANAGEMENT	10 Hrs.
Case studies analysing real-world construction management problems, Application of Social Benefit Cost Analysis (SBCA) in decision making, Application of Life Cycle Costing Analysis (LCCA) in decision making, Discussion on the integration of decision sciences into construction management practices.	
TOTAL HOURS: 39 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Enhance decision-making skills in construction management through the application of quantitative and qualitative analysis techniques
CO2	:	Develop proficiency in utilizing decision support tools to evaluate and optimize construction project outcomes
CO3	:	Improve risk assessment and mitigation strategies by integrating decision sciences principles into construction management practices
CO4	:	Foster critical thinking and problem-solving abilities in addressing complex construction management challenges
CO5	:	Develop concepts about application of Social benefit cost analysis (SBCA) in decision making
CO6	:	Develop concepts about application of Life cycle cost analysis (LCCA) in decision making

TEXT/REFERENCE BOOKS

1. Arthur, A. C. (2021). **Construction Risk Management Decision Making: Understanding Current Practices**. United Kingdom: Wiley.
2. Haidar, A. D. (2015). **Construction Program Management – Decision Making and Optimization Techniques**. Germany: Springer International Publishing.
3. Hendrickson, C., Au, T. (1989). **Project management for construction: fundamental concepts for owners, engineers, architects, and builders**. United States: Prentice Hall.
4. Singh, A. (2017). **Quantitative Risk Management and Decision Making in Construction**. United States: American Society of Civil Engineers.
5. Tam, C. M., Tong, T. K. L., Zhang, H. (2007). **Decision Making and Operations Research Techniques for Construction Management**. Hong Kong: City University of Hong Kong Press.
6. Tang, S., Ahmad, I. U., Ahmed, S. M., Lu, M. (2004). **Quantitative Techniques for Decision Making in Construction**. Hong Kong: Hong Kong University Press.

<20CE552T>					<Elective: Smart Infrastructure and Cities>					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

1. To learn about smart cities development
2. To learn about the planning of smart cities
3. To learn about the smart city enablers and sustainable development
4. To learn about smart technologies and big data analytics

UNIT I: INTRODUCTION AND DEVELOPMENT OF SMART CITIES	09 Hrs.
Definition, Drivers, Barriers and benefits of smart cities, Characteristics and factors of smart cities, Understanding Liveability, Affordability and Inequality, Development standards, Smart indicators, Smart city rankings, Emerging trends and technologies.	
UNIT II: SMART CITY FRAMEWORK AND ENABLERS	10 Hrs.
Smart Cities Framework: Aligning Responsibilities and Enablers, Built environment, Energy, Telecommunications, Transportation, (health and human services) Water and wastewater, public safety and payments. Smart City Enablers: Instrumentation and control, Connectivity, Interoperability, Security and privacy, Data management, Computing resources and analytics process of building a smart cities roadmap.	
UNIT III: SMART AND SUSTAINABLE URBAN DEVELOPMENT	10 Hrs.
Principles of Sustainable Development and smart growth, Low carbon and renewable energy technologies, Water, Waste and carbon management, Pollution prevention, Climate adaptation and resilience and integrated environmental systems management, Smart buildings and infrastructure.	
UNIT IV: BIG DATA AND SMART TECHNOLOGIES	10 Hrs.
Big Data Analytics: Big data platforms and cloud computing urban informatics GIS and spatial analysis measuring impact and data visualization, Smart Technologies: Internet of things, remote sensing and communication technologies, ICT initiatives in Indian cities. Are we ready for smart cities? Smart people, economic development, smart city technologies: inventory and standardization, potential of commercialization and emerging.	
TOTAL HOURS: 39 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Understand the process of development of smart cities
CO2	:	Outline and learn about the planning process for smart cities
CO3	:	Analyse and learn about the enablers and framework of smart cities
CO4	:	Analyse and understand the principles of sustainable and smart urban development
CO5	:	Develop concepts about big data analytics
CO6	:	Build concepts about the smart technologies

TEXT/REFERENCE BOOKS

1. Townsend, A.M. **Smart cities: Big Data, Civic Hackers and the Quest for a new Utopia**, Norton & Company Inc, New York, 2014
2. Barlow, M. and Levy-Bencheon, C. **Smart Cities, Smart Future: Showcasing Tomorrow**, Wiley, 2018.
3. Batty, M. **Inventing Future Cities**, MIT Press, 2018.

<24CE521T>					<Advanced Construction Planning and Engineering>					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

1. To learn about the Multi-criteria Decision Making (MCDM) tools for taking appropriate decisions pertaining to infrastructure projects.
2. To learn about the methodology for developing Social Benefit Cost (B-C) ratio and Life Cycle Costing (LCC) for infrastructure projects. Also, the students should learn the valuation methods applicable for construction projects.
3. To learn about the environmental engineering systems
4. To learn about waste disposal systems and solid waste management systems

UNIT I: MULTICRITERIA DECISION MAKING FOR INFRASTRUCTURE PROJECTS	09 Hrs.
Multi-criteria decision-making models including Factor Comparison Method (FCM), Analytical Hierarchy Process (AHP), Fuzzy-AHP, Interpretative Structural Modeling (ISM), Fuzzy-ISM, Tools for Value Engineering, and analysis. Case studies of transportation planning, Traffic forecasting and application of MCDM to infrastructure transportation project.	
UNIT II: ENGINEERING ECONOMICS, LIFE CYCLE COST AND SOCIAL BENEFIT COST ANALYSIS	10 Hrs.
Engineering Economics: Application of time value of money, Analysis of series with arithmetic or geometric gradient; Rate of Return analysis, Breakeven analysis, financial models for PPP projects. Decision Making Models: Social benefit cost ratio analysis (SBCA), Life cycle costing analysis (LCCA) Valuation: Methods of valuation and town planning concepts, Case studies of Rental method, Profit method and Land & Building method of valuation. Preparation of Alternative Plans: Evaluation techniques, Plan implementation, Monitoring.	
UNIT III: ENVIRONMENTAL ENGINEERING SYSTEMS	10 Hrs.
Introduction: Definitions, Environmental ecology, Description of environmental settings, Environmental audit procedures, Pre audit activities, Post audit activities. Environmental Impact Assessment: Prediction and assessment of impacts on the air environment surface water environment, soil and ground water environment; Environmental management systems –ISO 14000, Audit procedures, Certification; Case studies.	
UNIT IV: SOLID WASTE MANAGEMENT SYSTEMS	10 Hrs.
Case Studies of waste disposal systems and solid waste management for urban infrastructure.	
TOTAL HOURS: 39 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Understand and develop ability to apply MCDM tools for decision making and also about planning of some transportation related infrastructure engineering systems
CO2	:	Evaluate and compute social Benefit Cost ratios for infrastructure projects
CO3	:	Evaluate, analyse and compute Life Cycle Cost for infrastructure projects
CO4	:	Apply techniques of valuation for construction projects
CO5	:	Develop EIA models and also understand the process for environmental audits and ISO certification process
CO6	:	Build ability to develop models for waste disposal systems and solid waste management systems

TEXT/REFERENCE BOOKS

1. L. R. Kadiyali “**Traffic Engineering and Transportation Planning**” Khanna Publishers, Delhi, 2005
2. MetCalf and Eddy Inc “**Waste Water Engineering Treatment, Disposal, Reuse**” Tata McGraw Hill Publishing Co. Ltd, New Delhi, 2003
3. **Manual on Water Supply and Treatment**” Central Public Health and Environmental Engineering, Organization Ministry of Urban Development, New Delhi
4. Namavati, H. Roshan. **Theory and Practice of Valuation**, Lakhani Book Depot Mumbai 400004, 1998
5. George, A. Taylor. **Managerial and Engineering Economy – Van Nostrand Reinhold Company**; Affiliated East-West Press (Pvt.) Ltd. East-West Student Edition 1969.
6. Degarmo, E. Paul. **Engineering Economy**, Prentice Hall International Inc., New Jersey, 1997.
7. Chawla, Kishan. **Social Cost – Benefit Analysis: An Introduction to Financial and Economic Appraisal of Projects**. Mittal Publishers, 1987.

<20CE514T/20EN507T/20MCT504>					<Elective: Remote Sensing and Geographical Information System>					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

1. To understand the fundamental of RS and Image processing
2. To understand the fundamentals of GIS and Processes.
3. To understand the utilization of GPS and UAV for engineering mapping
4. To learn the complex engineering application using Geospatial Techniques

UNIT I: REMOTE SENSING	09 Hrs.
Basic principles of remote sensing, Electromagnetic energy and spectrum, Spectral characteristics, Laws of radiation, Interaction with atmosphere and surface, Data and image interpretation, Sensors and platforms, Visible and infrared sensors, IR and MW sensors, Resolutions, visual image analysis and processing, Supervised and unsupervised classifications, LIDAR remote sensing, Passive and active microwave remote sensing, Hyper spectral remote sensing, Improving the utilization of remote sensing data, Emerging issues, UAV and Drone techniques.	
UNIT II: GEOGRAPHICAL INFORMATION SYSTEM	10 Hrs.
Introduction, History of GIS, Basic GIS concepts, Representation of earth features, Map basics, Map projections, Raster and vector data models, representation of GIS, GIS data sources, Map and models, Methods of vector and raster inputs, Remote sensing inputs, Surveys and GPS inputs, Field surveys, Data storage and editing, Errors and corrections of errors.	
UNIT III: SPATIAL ANALYSIS TOOLS AND TECHNIQUES FOR DATA MODELLING	10 Hrs.
Spatial analysis, Location and identifying spatial objects, Measurements, Surface mapping, Nontopographical surfaces, Terrain analysis, Spatial arrangements, Map overlays, Cartographic modeling, Types of cartographic models, GIS design and applications, Decision support tools for engineers Spatial and Attribute Data Modelling.	
UNIT IV: CASE STUDY AND APPLICATION	10 Hrs.
Software tools: ERDAS, ENVI, Q-GIS and ARC GIS; Application and case studies of a RS and GIS techniques in Infrastructure management, Environmental Engineering, Transportation Engineering, Disaster management.	
Indian Satellite Missions: Chnadrayaan- 1and 2, NISAR, Vedas, Mars orbiter Mission, ASTROSAT, Gaganyaan, RISAT-1A, Aditya-L1, Shukrayaan-1	
TOTAL HOURS: 39 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Understand the basic concept of Remote Sensing and GIS techniques
CO2	:	Classify the advance instrument techniques in surveying
CO3	:	Analyse a data using spatial analysis techniques
CO4	:	Illustrate the application of RS and GIS in decision making activities
CO5	:	Appraise the use of advance software techniques for map making activities
CO6	:	Create an art of map making activities

TEXT/REFERENCE BOOKS

1. Thomas M. Lillesand, Ralph W. Kiefer, **Remote sensing and image interpretation**
2. Haywood L, Cornelius S and S Carver (1988) **An Introduction to Geographical Information Systems**, Addison Wiley Longmont, New York.
3. Burrough PA, McDonnell PA (2000) **Principles of Geographical Information systems**, London: Oxford University Press.
4. LoCP, Young KW Albert (2002) **Concepts and Techniques of Geographic Information Systems**, Prentice-Hall of India Pvt Ltd, New Delhi.

<20CE525T>					<Elective: Earthquake Engineering >					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

1. To understand fundamentals of earthquake and ground motion parameters
2. To understand free and forced vibration and their analysis
3. To explain the provisions for earthquake resistant structural design with research and development
4. To explain fundamental of machine foundation and mechanism of liquefactions

UNIT I: EARTHQUAKE FUNDAMENTALS	09 Hrs.
Basic earthquake principles Philosophy of building codes -Seismic Hazards: Surface rupture - liquefaction - landslides - fire-hazards - Tsunami - Lessons learned from previous earthquakes - plate tectonics - fault mechanisms - seismic waves - earthquake measurement and monitoring Earthquake ground motion: Amplitude parameters - frequency content parameters - duration parameters.	
UNIT II: EARTHQUAKE RESISTANT FEATURES OF STRUCTURE AND LOCAL SITE EFFECTS	10 Hrs.
Planning aspects – symmetry – simplicity - regularity. Resistance of structural elements and structures for dynamic load - design criteria - strength and deflection - Overview of seismic design codes: Provisions of IS 1893 i soft storey - Design spectrum of IS 1893 - evaluation of lateral loads - buildings research and development - Local Site Effects and Design Ground Motion - Effects of local site conditions on ground motion - design parameters - Ground Response analysis - IS 5249:1992 Determination of dynamic property of soil-method of test.	
UNIT III: STRUCTURAL DYNAMICS	10 Hrs.
Free vibrations of single degree-of-freedom systems: Dynamic loads and dynamic analysis - degrees of freedom - free vibrations - multiple elastic forces - viscously damped vibrations - equations of motion and solution, logarithmic decrement. Forced vibrations of single degree-of-freedom systems - Forced vibrations (harmonic loading) of single degree of freedom systems - Undamped and viscously damped vibrations - equations of motion and solution - Force transmitted to foundation – transmissibility - response to harmonic support excitations.	
UNIT IV: MACHINE FOUNDATION AND LIQUEFACTION POTENTIAL	10 Hrs.
Soil Liquefaction: General Concepts - liquefaction susceptibility - Evaluation of liquefaction potential (Hazards) - effects of liquefaction – mitigation.	
Machine Foundation: Introduction - Types of Machines and Foundations - General requirements - Permissible Amplitude – Design.	
TOTAL HOURS: 39 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Explain the earthquake fundamentals and ground motion parameters
CO2	:	Demonstrate the seismic design provisions and recent development
CO3	:	Explain the effect of local ground on earthquake ground motions
CO4	:	Analyse free and forced vibration with its applications
CO5	:	Demonstrate basic principle of earthquake resistant design
CO6	:	Evaluate liquefaction potential and machine foundation

TEXT/REFERENCE BOOKS

1. A.K. Chopra, **Dynamics of structures**, Prentice Hall, 2000.
2. I.S. 1893 - 2016, **Criteria for Earthquake Resistance design of Structures**.
3. Pankaj Agarwal and Manish Shrikhande, **Earthquake resistant design of structures**, PHI 2006.
4. Kramer, S. L., **Geotechnical Earthquake Engineering**, Pearson Education, 2003.
5. Day, R. W., **Geotechnical Earthquake Engineering handbook**, McGraw Hill, 2003.
6. Kamlesh Kumar, **Basic Geotechnical Earthquake Engineering**, New Age, 2008.

24CE526					Elective: Real Estate Valuation and Management					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

1. To learn about the scope of real estate management
2. To understand and learn about the real estate market and role of real estate consultants and managers
3. To learn the method of valuation of real estate properties
4. To learn real life case studies about real estate development

UNIT I: INTRODUCTION TO REAL ESTATE MANAGEMENT	10 Hrs.
Real Estate Scope; Classification of real estate activities and peculiarities; Factors affecting real estate market; Role of Government in real estate market; Statutory provisions, laws, rules and regulations application, land use controls in property development, registration and licensing requirements; Functions of real estate projects, risk management, facilities management, marketing/advertising, post construction management etc.; Interests in real estate; Documentation in real estate processes; Transfer of titles and title records; Real Estate appraisal and valuation; Role scope, working characteristics and principal functions of real estate participants and stakeholders.	
UNIT II: REAL ESTATE MARKET, ROLE OF CONSULTANTS AND MANAGERS	10 Hrs.
Real estate consultants and their activities; Types of agreements between the consultants and principal; knowledge base for assessment and forecasting the Real Estate market; Role and responsibilities of property managers; Real estate investment, sources and related issues; Code of ethics for Real Estate participants; Environmental issues related to Real Estate transactions; Closing the Real Estate transactions Good practices and managerial responsibilities. Environmental Laws Applicable to Real Estate Development; Environmental Audit In Real Estate.	
UNIT III: REAL ESTATE VALUATION	10 Hrs.
Valuation for sale and purchase of freehold & leasehold properties; Valuation for mortgage, valuation for acquisition, valuation for taxation of properties contemporary trends of valuation of property, Disputes and arbitration in real estate properties.	
UNIT IV: CASE STUDIES OF REAL ESTATE DEVELOPMENT	09 Hrs.
Case Studies of real estate development, valuation, investment in Indian context	
TOTAL HOURS: 39 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Explore in depth the concepts of the real estate management
CO2	:	Explore the principal functions of real estate participants and stakeholders.
CO3	:	Demonstrate the principles of real estate market and the sources of investment
CO4	:	Develop ability to apply the methods of real estate valuation
CO5	:	Analyze the causes of disputes and arbitration in real estate properties.
CO6	:	Build concepts of real estate development and management through real life case studies

TEXT/REFERENCE BOOKS

1. J. E. Goeters, **Environmental Issues in Real Estate**, Amazon Books
2. J. Kahr and M. C. Thomsett, **Market Valuation and Analysis**, Wiley Publishers, 2005.
3. H. C. Gelbtuch, D. Mackmin, and M. R. Milgrim, **Real Estate Valuation in Global Markets** Amazon Books.

24CE559T					Elective: Value Engineering					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

1. To understand the concepts of value engineering
2. To learn the methodology for value engineering job plan
3. To learn the methods for value engineering in decision making
4. To apply value engineering in construction projects

UNIT I: INTRODUCTION TO VALUE ENGINEERING	10 Hrs.
Introduction to value engineering – Concepts- Value- Types of value-Function-types of function-Evaluation of function-Evaluation of costs-Evaluation of worth-Determination and evaluation of economic parameters of value.	
UNIT II:	10 Hrs.
Concepts of job plan – Information phase- Function phase – Creation phase – Evaluation phase – Investigation phase – Implementation phase – Speculation phase – Analysis phase – Case studies FAST Diagram: FAST diagram techniques – Application of FAST diagramming method to infrastructure projects.	
UNIT III: VALUE ENGINEERING DECISION MAKING TOOLS	10 Hrs.
Engineering economics: Time value of money – Rate of Return (ROR) analysis – Breakeven analysis – Sensitivity analysis Social Benefit Cost Analysis (SBCA)- Life Cycle Cost Analysis (LCCA) – Multi-Criteria Decision Making (MCDM), Case studies. Cost Models : Type of cost models – Cost matrix – Development of cost models for infrastructure projects, Case studies.	
UNIT IV: METHODS OF VALUATION	09 Hrs.
Methods of Valuation: Rental method, Profit method, Case studies in rental and profit method of evaluation; Land and Building method – Cost of construction; Estimate on area basis; Estimate on cubic basis; Estimate by cost index; Residual or demolition value of old buildings; Case studies.	
TOTAL HOURS: 39 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Explore the concepts of value engineering
CO2	:	Analyze the concepts of value engineering job plan and FAST diagramming methods
CO3	:	Apply the concepts of ROR analysis, breakeven analysis and sensitivity analysis
CO4	:	Demonstrate the methodology for computation of Social benefit cost analysis (SBCA)
CO5	:	Build concepts for computation of Life cycle cost analysis (LCCA)
CO6	:	Apply valuation methods for valuation of properties and building facilities

TEXT/REFERENCE BOOKS

1. L. D. Miles, **Techniques of Value Analysis and Engineering**, E. M Walker Publications, 1989
2. A. Dell'Isola, **Value Engineering Practical Applications**, RS Means Publishers, 1997.
3. E. Paul Degarmo, **Engineering Economy**, Prentice Hall International Inc., New Jersey, 1997.
4. K. Chawla, **Social Cost – Benefit Analysis: An Introduction to Financial and Economic Appraisal of Projects**. Mittal Publishers, 1987.

<20CE524P>					<Project Design Studio-II>					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	2	2	--	--	--	50	50	100

COURSE OBJECTIVES

1. To learn the methodology for development of PPP models and also concepts of planning and development of smart cities, special economic zones and special investment regions
2. To learn the methodology for carrying out 6-dimensional Building Information Modelling (BIM) for building facilities and infrastructure projects

UNIT I: PPP MODELS, SMART CITIES, SEZ, SIR	13 Hrs.
Students will work in small groups to understand and learn the methodology for development of Public Private Partnership (PPP) models like BOT, BOLT, BOO for infrastructure projects. Students will also learn and understand the concepts for development of smart cities, Special Economic Zones (SEZ), Special Investment Regions (SIR).	
UNIT II: 6 D BUILDING INFORMATION MODELLING	13 Hrs.
Students will work in small groups to analyse, learn and study the methodology for 6 D (dimensional) BIM model which would primarily include conceptual energy analysis, detailed energy analysis, daylight analysis, airflow analysis, orientation analysis.	
TOTAL HOURS: 26 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Understand and develop PPP models for infrastructure projects and also understand the methodology for planning and development for smart cities
CO2	:	Develop concepts about the methodology for computation of conceptual and detailed energy analysis with BIM tool
CO3	:	Build concepts about the methodology for computation of daylight analysis, airflow analysis with BIM tool

TEXT/REFERENCE BOOKS

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., **Construction Planning, Equipment and Methods**, 6th Edition, Tata McGraw-Hill, New Delhi, 2015.
2. Prasana Chandra, **Financial Management: Theory & Practice**, Tata McGraw Hill New Delhi, 2008.
3. Raghuram G, **Infrastructure Development and Financing: Towards a Public Private Partnership**, Macmillan Publishers, New Delhi, 2001.
4. Kensek, K.M. and Noble, D., **Building Information Modeling: Current and Future Practice**, Wiley, 2014.

<24CE525P>					<Primavera>					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	0	2	2	--	--	--	50	50	100

COURSE OBJECTIVES

1. To understand the fundamentals of project management and core functionalities of Primavera P6 software
2. To develop the ability to create and manage construction schedules effectively using Primavera P6
3. To learn advanced resource allocation methods within Primavera P6 for efficient project management
4. To engage in practical exercises and case studies to apply Primavera P6 concepts to real-world construction planning scenarios

UNIT I: INTRODUCTION TO PRIMAVERA AND PROJECT MANAGEMENT FUNDAMENTALS	07 Hrs.
Overview of project management principles and methodologies, Introduction to Primavera software and its capabilities.	
UNIT II: NAVIGATING THE PRIMAVERA INTERFACE AND CREATING PROJECT SCHEDULES	07 Hrs.
Understanding the Primavera workspace, customizing settings and preferences, defining project activities and milestones, Establishing activity relationships and constraints.	
UNIT III: RESOURCE MANAGEMENT, PROJECT TRACKING AND PERFORMANCE MONITORING IN PRIMEVERA	06 Hrs.
Assigning resources to activities, managing resource calendars and availability, updating project progress in Primavera, analysing schedule and cost variances.	
UNIT IV: REPORTING, ANALYSIS AND REAL-WORLD APPLICATIONS AND CASE STUDIES	06 Hrs.
Generating standard and custom reports, analysing project data using Primavera's reporting tools, applying Primavera to real-world project scenarios, addressing common project management challenges.	
TOTAL HOURS: 26 Hrs.	

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Develop comprehensive construction schedules using Primavera P6
CO2	:	Analyze critical paths and identify key project milestones
CO3	:	Optimize resource allocation to minimize project duration
CO4	:	Develop ability to track project progress using Primavera P6 features
CO5	:	Design insightful reports for stakeholders on schedule and resource utilization
CO6	:	Build project schedules and present analyses confidently to stakeholders

TEXT/REFERENCE BOOKS

1. Harris, P. E. (2010). **Project Planning and Control Using Primavera P6**. Australia: Eastwood Harris Pty Limited.
2. Maharana, D. (2017). **Primavera P6 Professional Project Management**. (n.p.): CreateSpace Independent Publishing Platform.
3. Okoro, C. (2020). **Project Management, Planning & Scheduling with Primavera P6: A Practical Guide**. (n.p.): Amazon Digital Services LLC - Kdp.
4. Williams, D. (2012). **Oracle Primavera P6 Version 8**. United Kingdom: Packt Publishing, Limited.

<>					<Seminar>					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	0	1	--	--	--	--	50	50	100

COURSE OBJECTIVES

5. To understand and learn the present-day problems faced by construction / infrastructure industry
6. To identify a research problem that would benefit the construction / infrastructure industry
7. To develop and propose a prospective solution to the identified research problem

UNIT I:
Each student is required to choose a topic of his interest from Construction Engineering and Management area. This topic may be from syllabus or out of syllabus provided faculty has agreed to guide the same. They will prepare a presentation on the chosen topic for about 30-45 minutes and their work will be assessed by a jury consisting of minimum 2 faculty members belonging to the respective area of research and the guide. Internal assessment marks are awarded based on the relevance of the topic, presentation skills, quality of the report, participation of the students, and innovative ideas emerged from the work.
TOTAL HOURS: 00 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1	:	Understand and learn about the present problems faced by construction / infrastructure industry
CO2	:	Analyze critically the past research work from published literature
CO3	:	Identify the research gap and formulate research objectives and scope of the present research work
CO4	:	Compile primary data for the present research work
CO5	:	Evaluate and analyse the data by applying appropriate research tool
CO6	:	Develop and derive specific conclusions and make appropriate recommendations for the research problem addressed