MASTER OF TECHNOLOGY

INFRASTRUCTURE ENGINEERING AND MANAGEMENT

Semester –I		Teaching Scheme					Examination Scheme					
							Theory			Practical		Total
Code	Subject	L	T	P	C	Hr/Wk	MSE	ESE	IA	LW	LE/ Viva	Marks
CE511T	Infrastructure Planning and Engineering-I	3	1	-	4	4	25	50	25	-	-	100
CE512T	Project Management	3	-	-	3	3	25	50	25	-	-	100
CE512P	Project Management Lab	-	-	2	1	2	-	-	-	50	50	100
CE513P	Project Design Studio-I	-	-	6	3	6	-	-	-	50	50	100
CE5XYT	Elective-I*(Department Elective)	3	-	-	3	3	25	50	25	-	-	100
CE5XYT	Elective – II# (Open Elective)	3	-	-	3	3	25	50	25	-	-	100
MA503T	Advanced Numerical Techniques & Computer Programming	3	1	-	4	4	25	50	25	-	-	100
MA503P	Advanced Numerical Techniques & Computer Programming	-	-	2	1	2	-	-	-	50	50	100
	Total Semester-I	15	2	10	22	27						800

SYLLABUS SUMMARY

Semester I

Comprises of courses like Infrastructure Planning and Engineering-I where the basic salient features and policies of the major infrastructure assets in India like Highways, Metro rails, Ports, Power Plants, Railways, Airports etc. Project Management course both theory and lab would give the exposure to the students about the latest tolls and techniques used for project monitoring, controlling and management. Project Design Studio-I would give exposure to the students about working in real life projects pertaining to water supply projects and solid waste management projects. Department Elective-I would give the exposure about a domain that is very much required as per the present trends in Infrastructure Engineering and Management. Open Elective –I would give the exposure a multidisciplinary course as per the current trends of Infrastructure Engineering and Management. Finally the Advanced Numerical Techniques and Computer Programming course would give exposure about the latest numerical methods.

Semester II

Comprises of courses like Infrastructure Planning and Engineering-II which gives exposure to the Multi Criteria Decision Making Tools in the field of Infrastructure Engineering and Management. Technology for Infrastructure Construction would give exposure to the latest technologies in the field of Infrastructure Engineering. Project Design Studio II would give exposure to the process of development of Public Private Partnership (PPP) models and development of 6D Building Information Modelling (BIM) Department Elective-II would give the exposure about a domain that is very much required as per the present trends in Infrastructure Engineering and Management. Open Elective –II would give the exposure a multidisciplinary course as per the current trends of Infrastructure Engineering and Management. Successful Research Development Programme course would give exposure about how to carry out research for the Seminar, Project and Dissertation floated for the next two semesters.

Semester III

Comprises of courses like Seminar where the students would choose a research topic of their interest but in the domain of Infrastructure Engineering and Management and carry out research based on primary data. Project would require the students to address a present problem that construction / infrastructure industry is facing and find out a prospective solution for the same.

Semester IV

Comprises of courses like Seminar where the students would choose a research topic of their interest but in the domain of Infrastructure Engineering and Management and carry out research based on primary data. Project and Dissertation would require the students to chose a research problem and work on the same with greater depth so that the outcome may be in form of a peer reviewed reputed journal paper.

20CE511T					Infrastructure Planning & Engineering-I					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

- To give overview of Indian infrastructure assets
- To learn the methodology for detailed planning and engineering of a complex mega infrastructure project like metro rail construction
- To learn methodologies for sustainable infrastructure and working of public private partnership models
- To learn about rural infrastructure

UNIT 1 OVERVIEW OF INDIAN INFRASTRUCTURE ASSETS 12 Hrs.

Introduction: Concept of infrastructure - Need for infrastructure planning and engineering- Infrastructure development scenario in India- Scope for infrastructure management.

Overview of Indian Infrastructure Assets: Urban infrastructure- Water- Dams- Bridges- Canals- Housing- Roads- Railways- Ports- Airports- Energy- Power

UNIT 2 ENERGY INFRASTRUCTURE AND MASS RAPID TRANSIT INFRASTRUCTURE 14 Hrs.

Energy Infrastructure- Components of energy- Power generation- Transmission- Distribution- Oil & gas- Coal- Renewable energy sources like solar, wind, tidal, geothermal- Case Study of Infrastructure planning & engineering of metro rail construction projects including methodology for traffic diversion, utility diversion, land acquisition, methodology for approval from concerned authorities, methodology for project delivery and implementation.

UNIT 3 SUSTAINABLE INFRASTRUCTURE AND PUBLIC PRIVATE PARTNERSHIP MODELS 13 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.

UNIT 4 RURAL INFRASTRUCTURE 13 Hrs.

Rural Infrastructure: Alternate construction materials- Rural housing technologies- Rural roads- Rural water supply and sanitation

Total 52 Hrs

COURSE OUTCOMES

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

CO1- **Outline** and learn 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- **Understand** in details the primary infrastructure assets like MRTS, Highways, Railways, Airports, Power sector, Renewable energy sector, Ports and Dams.

CO3 - **Develop** concepts about the methodology for detailed planning and engineering about a real life case study for operations of metro rail

CO4 - **Analyze** the potentialities and apply the methods of development of sustainable infrastructure.

CO5 –**Evaluate** and learn about working of public private partnership models

CO6 – **Build** concepts about the rural infrastructure in India

TEXT/REFERENCE BOOKS

1. Raghuram G, Infrastructure Development and Financing: Towards a Public Private Partnership, Macmillan Publishers, New Delhi, 2001.
2. Joshi P, Law Relating to Infrastructure Projects, Taxman Publishers New Delhi, 2001.
3. Alagiri D, Infrastructure Development, ICFAI University Press Hyderabad, 2007.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs**
Part A/Question: 10 Questions of 2 marks each-No choice	**20** Marks
Part B/Question: 2 Questions from each unit with internal choice, each carrying 16 marks	**80** Marks

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

- 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
- To learn the methodology for development of project organization structures and work breakdown structures
- To learn about the latest project planning and scheduling tools
- 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 1 CONCEPT, SCOPE OF PROJECT MANAGEMENT AND PHASES OF PROJECT LIFE CYCLE 08 Hrs.

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.

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.

UNIT 2 PROJECT PLANNING AND SCHEDULING 12 Hrs.

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. **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.

UNIT 3 RESOURCE ALLOCATON & LEVELLING, PROJECT APPRAISAL AND CONTROL 09 Hrs.

Resource Allocation and Levelling: Network scheduling with limited resources-Resource allocation; Resource levelling. **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.

UNIT 4 PROJECT MONITORING, RISK MANAGEMENT, LATEST PROJECT MANAGEMENT TRENDS 10 Hrs

Project Monitoring: Measurement of performance; Major functions of monitoring; Influence of decision making authority; Case studies. **Project Risk Management:** Risk identification; Risk analysis; Risk response planning and mitigation measures; Case studies. **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).

Total 39 Hrs.

COURSE OUTCOMES

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

CO1- **Understand** the 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- **Analyze** and solve 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 **analyze** and 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.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks 100 **Exam Duration: 3 hrs**

Part A/Question: 10 Questions of 2 marks each-No choice	**20** Marks
Part B/Question: 2 Questions from each unit with internal choice, each carrying 16 marks	**80** Marks

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

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

MICROSOFT PROJECT SOFTWARE **14 Hrs**

1. Work Breakdown Structure (WBS)
2. Project Organization Structure
3. AOA Networks, AON Networks, PDM Networks
4. Linear Time Monitoring Tools (Bar Charts / Gant Charts)
5. Editing Tasks
6. Mile Stone Charts
7. Resource Allocation and Resource levelling
8. Managing Data & Resources
9. Introduction to Base Line for Monitoring Projects
10. Managing Multiple Projects
11. Project Calendar
12. Use of Filters
13. Creating a Project Report
14. Case Studies from Industry

PROJECT RISK MANAGEMENT THROUGH RISK AMP-SOFTWARE **12 Hrs.**

1. Risk Analysis (Quantitative)
2. Simulation of Risk weightages through Monte Carlo Simulation
3. Simulation Application for Network Path Analysis
4. Monte Carlo Simulation Application for computation of Risk Time, Risk Cost, Expected Time Expected Cost of a Project

Total 26 Hrs

COURSE OUTCOMES

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

CO 1- **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. Kumar Neeraj Jha, 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.

Max. Marks 100

Part A/ Practical work (ongoing assignments)	50 Marks
Part B/ Viva	50 Marks

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	6	3	6	--	--	--	50	50	100

COURSE OBJECTIVES

- To learn through real life projects the concepts of mass rapid transit system (MRTS) projects
- To work in small groups on real life projects and undertake perception studies on urban water supply, urban wastewater and surface drainage planning for a city or part of a city.
- To develop small scale solid waste management systems
- To learn the procedures of tenders & contracts management for an infrastructure project.

UNIT 1MASS RAPID TRANSIT SYSTEM PROJECTS 20 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 2 WATER SUPPLY AND STORM WATER DRAIN PROJECTS 20 Hrs

Students will form small groups to carry out perception study related to urban infrastructure for drinking water supply, wastewater generated, and storm water drainage. Students will prepare a small note, situation notes and sketches, photographs, drawings and flow charts based on analysis. This exercise will equip them better understanding and analysing various design issues related to water supply and storm water drain projects.Modern software tools such as WaterCAD, SewerCAD and StormCAD should be used. In addition strategies for financial resources also need to be worked out.

UNIT 3 SOLID WASTE MANAGEMENT PROJECTS 19 Hrs

Students will work in small groups to study existing solid waste management systems of the city and work on developing small scale solid waste collection, segregation and management systems. Development of smart solid waste systems which might be implemented for smart cities may be explored.

UNIT 4 TENDERS AND CONTRACTS 19 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 78 Hrs

COURSE OUTCOMES

CO1- **Understand** from real life case studies the planning, engineering and management methodology for MRTS projects
CO2- **Understand,** learn and get detailed perception about urban water supply, waste water and storm water drain projects
CO3- **Analyze** existing solid waste management systems and create small scale solid waste management system for Ahmedabad / Gandhinagar city
CO4- **Develop** smart water supply / waste water / solid waste management systems applicable to smart cities
CO5- **Evaluate** and **assess** the various procedures of contracts management
CO6- **Create** ability to apply the contract procedures and clauses of FIDIC

TEXT/REFERENCE BOOKS

1. MetCalf and Eddy Inc, Waste Water Engineering Treatment, Disposal and Reuse, Tata McGraw Hill Publishing New Delhi, 2003.
2. CPHEEO Manual on Water Supply and Treatment, Central Public Health and Environmental Engineering Organization, Ministry of Urban Development, New Delhi, 2005.
3. Harris F & McCaffer R ,Modern Construction Management, BSP Professional Books Oxford/ London, 2003.
4. Lewis , H. Bids, Tenders & Proposals : Winning Business through Best Practice, 4th Edition, Kogan Publishers, London, Philadelphia, New Delhi, 2009.

End Semester Exam Max. Marks 100

Part A/ Practical work /Ongoing assignments/Continuous evaluation 50 Marks
Part B/ Viva 50 Marks

19MCT505					Department Elective: 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

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

UNIT 1 PHYSICAL AND CHEMICAL STABILIZATION **10 Hrs.**

Introduction: Compaction method used in the laboratory and the field- lab compaction methods-light- heavy- kneading- vibratoryfor soils and with admixtures Shallow stabilization with cement- lime-flyash and other chemical

UNIT 2 DYNAMIC COMPACTION AND GROUTING FOR IN-SITU SOIL **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 3 GEOSYNTHETICS FOR SOIL IMPROVEMENT **10 Hrs.**

Functions and Application of Geosynthetics- Geotextiles- Geogrids- geomembranes- soil reinforcement using strips- bars etc.

UNIT 4 MISCELLANEOUS PHYSICAL METHODS FOR IMPROVING EARTH STRUCTURE **07 Hrs.**

Soil nailing and ground anchors- dewatering techniques- earthmoving machines and earthwork principles-piling and diaphragm wall construction- tunnelling methods in soils etc.

Max. 39 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO 1: Classify different ground improvement methods and their suitability**.**

CO 2: Determine the suitability of physical and chemical soil stabilization techniques**.**

CO 3: Examine the use of dynamic compaction and grouting techniques for soil improvement**.**

CO 4: Select suitable geosynthetic materials for various ground applications**.**

CO 5: Design mechanically stabilized reinforced earth wall systems**.**

CO 6: Evaluate the suitability of ground anchors and dewatering techniques for soil stabilization**.**

TEXT/REFERENCE BOOKS

1. Purushottam Raj, Ground improvement Techniques, Penguin Books Ltd, New Delhi, 1999 2. Gulhati and Manoj Dutta, Geotechnical Engineering, Tata Mc-Graw Hills Manfired R. H., 2003.
2. "Engineering Principles of Ground Modification", McGraw-Hill Pub.Co.1990
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.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: <Unit I and Unit II> 55 Marks

Part B/Question: <Unit III and Unit IV> 45 Marks

20CE552T					Department 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

- To learn about smart cities development
- To learn about the planning of smart cities
- To learn about the smart city enablers and sustainable development
- To learn about smart technologies and big data analytics

UNIT 1 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 2 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 3 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 4 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 39 Hrs

COURSE OUTCOME

CO1- **Understand** the process of development of smart cities

CO2- **Outline** and learn about the planning process for smart cities

CO3- **Analyze** and learn about the enablers and framework of smart cities

CO4- **Analyze** 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-Bencheton, C. Smart Cities, Smart Future: Showcasing Tomorrow, Wiley, 2018.
3. Batty, M. Inventing Future Cities, MIT Press, 2018.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs**
Part A/Question: 10 Questions of 2 marks each-No choice	**20** Marks
Part B/Question: 2 Questions from each unit with internal choice, each carrying 16 marks	**80** Marks

20CE520T					Department Elective: Transportation Planning					
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

- To give an overview about importance of transportation planning for development.
- To learn the four step model of transportation planning.
- To learn different trip generation and efficient distribution methods.
- To study trip scheduling method for transferring people and goods.
- To study land use transportation planning models.

UNIT 1 :TRIP GENERATION AND DISTRIBUTION **10 Hrs.**

Trip generation models – Trip classification - productions and attractions – Trip rate analysis - Multiple regression models - Category analysis - Trip distribution models – Growth factor models, Gravity model and Opportunity modes.

UNIT 2 : ROUTE CHOICE AND TRIP ASSIGNMENT MODEL **10 Hrs.**

Modal split models – Mode choice behavior – Trip end and trip interchange models - Probabilistic models - Utility functions - Logit models - Two stage model. Traffic assignment – Transportation networks – Minimum Path Algorithms - Assignment methods – All or Nothing assignment, Capacity restrained assignment and Multi path assignment - Route-choice behavior.

UNIT 3 : TRIP SCHEDULING **10 Hrs.**

Statutory provision for road transport and connected organizations. Route scheduling, Freight transport, Vehicle scheduling, Optimum fleet size, Headway control strategies, Crew scheduling.

UNIT 4: LANDUSE PLANNING **09 Hrs.**

Landuse transportation models – Urban forms and structures - Location models - Accessibility – Landuse models - Lowry derivative models - Quick response techniques - Non-Transport solutions for transport problems. Preparation of alternative plans - Evaluation techniques - Plan implementation - Monitoring - Financing of Project – urban development planning policy - Case studies.

Total 39 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 –**Understand** the need and importance of proper transportation planning for development of nation.

CO2 – **Understand** base year and horizon year parameters which influencing planning

CO3 – **Apply** the knowledge in developing four step models.

CO4 – **Estimate** the present and future amount of trips to distribute.

CO5 – **Analyze** the transportation planning issues.

CO6 – **Create** method/Modal to distribute future people and freight transportation.

TEXT/REFERENCE BOOKS

1. Hutchinson, B.G., Principles of Urban Transport Systems Planning, Scripta, McGraw-Hill, NewYork, 1974.
2. Khisty C.J., Transportation Engineering - An Introduction, Prentice Hall, NJ, 2007.
3. Papacostas C.S. and Prevedouros, P.D., Transportation Engineering & Planning, PHI, New Delhi,2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs**
Part A : 10 Questions of 2 marks each-No choice	20 Marks
Part B : 2 Questions from each unit with internal choice, each carrying 16 marks	80 Marks

20CE514T/20EN507T/20MCT504					Open 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	
03	00	00	03	03	25	50	25	--	--	100

COURSE OBJECTIVES

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

10 Hrs.

UNIT 1 REMOTE SENSING

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 2 GEOGRAPHICAL INFORMATION SYSTEM **12 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 3 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 4 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 42 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 – **Analyze** 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

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs**
Part A/Question: 10 Questions of 2 marks each-No choice	**20** Marks
Part B/Question: 2 Questions from each unit with internal choice, each carrying 16 marks	**80** Marks

<Course Code>					Open Elective: Financial & Management Accounting for Engineers					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
03	00	00	03	03	25	50	25	--	--	100

COURSE OBJECTIVES

- 1Equip the students with technical and analytical skills in management of funds
- 2 Develop managerial decision-making with special emphasis on the practical aspects
- 3 Equip the students distinguish the relevant issues from the irrelevant matters
- 4Grasp the implication of the various factors in a given situation and marshal the thought process logically so as to be able to present information in a meaningful manner.
- 5 Display an understanding of the relative merits of each alterative.

UNIT 1 **Management Accounting and Decision making-I** **10 Hrs.**

Management & Accounting Functions
Profit Planning
Incremental Analysis
Budgetary Control – Operation

UNIT 2 Management Accounting and Decision making-II **10 Hrs.**

Cost Control Through Variance analysis
Performance Reporting
Management Control System
Decision Models

UNIT 3 Financial Management-I **10 Hrs.**

Analysis and Interpretation of Published Statements
Capital Structuring and sourcing of Long Term Funds
Working Capital
Capital Budget:

UNIT 4 Financial Management-II **10 Hrs.**

Appraisal of Capital Expenditure Proposals
Internal Financing
Investment Management
Forecasting & Planning

Total 40 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – **Identify** the uses and needs of financial statements & their relationship
CO2 – **Identify** how strategic planning determines the path organisation chooses for attaining its long term goal;
CO3 – **Explain** the role that budgeting plays in overall planning and evaluation of performance of an organisation
CO4 – **Analyse** the performance against the operational goal using revenues and cost of various centres
CO5 – **Calculate** product line; business line & customer line profitability for overall profit planning of an organisation
CO6 – **Understand** the importance of KPI & its role in evaluating the performance of keys areas of an organisation

TEXT/REFERENCE BOOKS

1. Chandra Prasanna ,Financial Management ,Tata Macgraw Hill
2. Charles Horngren et al. Introduction to Management Accounting, Prentice Hall
3. https://maaw.info/MAAWTextbookMain.htm
4. Reading material of ICAI & ICWA

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs**
Part A/Question: 4Q * 5marks	20 Marks
Part B/Question: 8 Q * 10 marks	80 Marks

20MA 501T					ADVANCED NUMERICAL TECHNIQUES					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
03	01	00	04	04	25	50	25	--	--	100

COURSE OBJECTIVES

- To understand and acquaint the concept of various numerical methods.
- To develop numerical skills in solving problem of engineering interest.
- To enrich the concept of finite element techniques.
- To extract the roots of a polynomial equation.

UNIT 1 EIGEN VALUES EIGEN VECTORS AND INTERPOLATION 10 Hrs

Eigen values and eigen vectors: Numerical evaluation of largest as well as smallest (numerically) Eigen values and corresponding Eigen vectors.

Interpolation: Introduction, Newton Gregory Forward Interpolation Formula, Newton Gregory Backward Interpolation Formula, Central difference interpolation formula, Lagrange's Interpolation Formula for unevenly spaced Formula, Error in interpolation, Newton's Divided Difference Formula, cubic spline interpolation, surface interpolation.

UNIT 2 NUMERICAL SOLUTION NON LINEAR EQUATIONS AND POLYNOMIAL 8 HRS

Introduction, Solution of non linear simultaneous equations, Descarte's Sign rule, Horner's method, Lin-Bairstow's method, Graeffe's root squaring method, Muller's method, Comparison of various methods.

UNIT 3 NUMERICAL SOLUTION OF ODEs AND PDEs 14 HRS.

Taylor's method, Euler's method, Runge-Kutta methods of various order, Modified Euler's method, Predictor corrector method: Adam's method, Milne's method. Solution of Boundary value problems using finite differences. Finite difference approximation of partial derivatives, Classification of 2nd order PDEs, different type of boundary conditions, solutions of Elliptic, parabolic and hyperbolic equations of one and two dimensions, Crank- Nicholson method, ADI method.

UNIT 4 FINITE ELEMENT METHOD 8 HRS.

Introduction, Method of Approximation, The Rayleigh-Ritz Method, The Galerkin Method, Application to One dimensional and two dimensional problems.

Total 40 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – **Apply** a suitable numerical technique to extract approximate solution to the problem whose solution cannot be obtained by routine methods.

CO2 - **Estimate** the errors in various numerical methods.

CO3 - **Analyse/ interpret** the achieved numerical solution of problems by reproducing it in graphical or tabular form.

CO4 - Approximate the data generated by performing an experiment or by an empirical formula with a polynomial on which operations like division, differentiation and integration can be done smoothly.

CO5 - **Evaluate** a sufficiently accurate solution of various physical models of science as well as engineering interest whose governing equations can be approximated by nonlinear ODEs or PDEs or system of ODEs or PDEs.

CO6 - **Design/ create** an appropriate numerical algorithm for various problems of science and engineering.

TEXT/REFERENCE BOOKS

1. B.S. Grewal, Numerical Methods in Engineering and Science with Programs in C & C++,Khanna Publishers (2010).
2. S.S. Sastry, Introductory Methods for Numerical Analysis,4th Ed., Prentice Hall of India (2009).
3. M.K. Jain, S.R.K. Iyenger and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5thEd., New Age International (2007).
4. C F Gerald and P O Wheatley, Applied Numerical analysis, Pearson education, 7th edition, 2003.
5. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley publication, 9th edition. 2005
6. R.K. Jain & S.R.K. Iyenger, Advanced Engineering Mathematics, 3rd Ed., Narosa (2002).
7. S C Chapra, Raymond P. Canale, Numerical Methods for Engineers, Tata McGraw Hill Pub. Co. Ltd.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Duration: 3 Hrs**
Part A : 4 questions of 6 marks each	24 Marks (40 min)
Part B: 4 questions of 10 marks each	40 Marks (80 min)
Part C: 3 questions of 12 marks each	36 Marks (60 min)

20CEXXXT					Advanced Project Management (Elective)					
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

- To learn about the concepts and scope of Building Information Modelling
- To learn the methodology for development of Integrated Project Delivery and Critical Chain Project Management
- To learn about the latest project planning and scheduling tools including sustainable development tools, cloud computing tools, Internet of Things (IoT)
- To learn about the multivariate tools and techniques of multivariate analysis in project management

UNIT 1 CONCEPT, SCOPE OF BUILDING INFORMATION MODELLING 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; Background of product data models; Interfacing technologies; Owner's role in a BIM project; Cost and time management; An owner and facility manager's building model; 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 takeoff and cost estimating production planning and control.

UNIT 2 INTEGRATED PROJECT DELIVERY AND CRITICAL CHAIN PROJECT MANAGEMENT 08 Hrs.

Integrated Project Delivery: Introduction to IPD concepts; The foundational elements and characteristics of IPD; Technology and process aspects of relational contracting forms such as IPD; Aspects and emerging issues that are rarely consciously considered in traditional project delivery due to the commercial imperative that drives firms and client organizations; Single Purpose Entity; Multi-party agreement; Construction management at risk.
Critical Chain Project Management: Overview of Critical Chain Project Management

UNIT 3 MULTIVARIATE ANALYSIS 10 Hrs.

Co-relation; Regression; Hypothesis testing; Acceptance sampling; Factor Analysis; Multivariate Analysis Techniques; Multi-Criteria Decision Making Techniques

UNIT 4 DIGITAL TRANSFORMATION AND SUSTAINABLE DEVELOPMENT **09 Hrs**

Digital transformation: Cloud computing applications; Applications of Internet of Things; Industry 4.0

Sustainable Development: Sustainable development goals; Sustainable Infrastructure; Tools for sustainable development

Max. 39 Hrs.

COURSE OUTCOMES

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

CO1- **Understand** the concepts and philosophy of Building Information Modelling (BIM)

CO2- **Learn** the methodology for formulation and application of BIM environment, tools and platforms

CO3- **Understand** and **learn** the methodology of Integrated Project Delivery (IPD)

CO4- **Learn** the methodology of Critical Chain Project Management (CCPM)

CO5- **Create** problem solving ability through multivariate analysis techniques

CO6- **Analyze** and apply the techniques for digital transformation of project management and sustainable development

TEXT/REFERENCE BOOKS

1. Sacks, R., Eastman. C., Lee, G., Teicholz, P. BIM Handbook: A Guide to Building Information Modelling for Owners, Designers, Engineers, Contractors, and Facility Managers, 3rd Edition, Wiley, London
2. Pease, J., Cheng, R. Integrated Project Delivery: An Action Guide for Leaders, 2019.
3. Kumar Neeraj Jha, Construction Project Management, Pearson Publishers, New Delhi, 2018.
4. Johnson, R. A. Probability and Statistics for Engineers, PHI Publishers
5. Hair, J.F., Black, W.C., Babin, B. J., Anderson, R.E. Multivariate Data Analysis: A Global Perspective, Pearson
6. Vasudevan, S.K., Nagarajan, A.S. Internet of Things, Wiley
7. Sachs, J. D. The Age of Sustainable Development, Columbia University Press

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks 100 **Exam Duration: 3 hrs**

Part A/Question: 10 Questions of 2 marks each-No choice	**20** Marks
Part B/Question: 2 Questions from each unit with internal choice, each carrying 16 marks	**80** Marks

Semester –II		Teaching Scheme					Examination Scheme					
							Theory			Practical		Total
Code	Subject	L	T	P	C	Hr/Wk	MSE	ESE	IA	LW	LE/ Viva	Marks
CE521T	Infrastructure Planning and Engineering-II	3	1	-	4	4	25	50	25	-	-	100
CE522T	Technology for Infrastructure Construction	3	1	-	4	4	25	50	25	-	-	100
CE523T	Infrastructure Financing and Management	3	-	-	3	3	25	50	25	-	-	100
CE524P	Project Design Studio-II	-	-	6	3	6	-	-	-	50	50	100
CE5ZXT	Elective-III**(Department Elective)	3	-	-	3	3	25	50	25	-	-	100
CE5ZXT	Elective – IV##(Open Elective)	3	-	-	3	3	25	50	25	-	-	100
CE527T	Successful Research Development Program	2	-	-	2	2	-	-	-			100
	Total Semester-II	**17**	**2**	**6**	**22**	**25**						**700**

20CE521T					Infrastructure Planning & Engineering-II					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

- To learn about the Multi-criteria Decision Making (MCDM) tools for taking appropriate decisions pertaining to infrastructure projects.
- 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.
- To learn about the environmental engineering systems
- To learn about waste disposal systems and solid waste management systems

UNIT 1 MULTICRITERIA DECISION MAKING FOR INFRASTRUCTURE PROJECTS 13 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 2 ENGINEERING ECONOMICS, LIFE CYCLE COST AND SOCIAL BENEFIT COST ANALYSIS 13 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 3 ENVIRONMENTAL ENGINEERING SYSTEMS 13 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 4 SOLID WASTE MANAGEMENT SYSTEMS 13 Hrs.

Case Studies of waste disposal systems and solid waste management for urban infrastructure

Total 52 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**, **analyze** 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. K Khanna and Justo CEG "Highway Engineering" Khanna Publishers, Roorkee, 2001
3. MetCalf and Eddy Inc "Waste Water Engineering Treatment, Disposal, Reuse " Tata McGraw Hill Publishing Co. Ltd, New Delhi, 2003
4. Manual on Water Supply and Treatment" Central Public Health and Environmental Engineering, Organization Ministry of Urban Development, New Delhi
5. Namavati, H. Roshan. Theory and Practice of Valuation, Lakhani Book Depot Mumbai 400004, 1998
6. George, A. Taylor. Managerial and Engineering Economy – Van Nostrand Reinhold Company; Affiliated East-West Press (Pvt.) Ltd. East-West Student Edition 1969.
7. Degarmo, E. Paul. Engineering Economy, Prentice Hall International Inc., New Jersey, 1997.
8. Chawla, Kishan. Social Cost – Benefit Analysis: An Introduction to Financial and Economic Appraisal of Projects. Mittal Publishers, 1987.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs**
Part A/Question: 10 Questions of 2 marks each-No choice	**20** Marks
Part B/Question: 2 Questions from each unit with internal choice, each carrying 16 marks	**80** Marks

20CE522T					Technology for Infrastructure Construction					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

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

UNIT 1 CONSTRUCTION OF UNDERGROUND AND ELEVATED CORRIDOR FOR METRO RAIL PROJECTS **13 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 2 MODERN CONSTRUCTION MATERIALS **13 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 3 FORMWORKS, SCAFFOLDING, ENABLING STRUCTURES **13 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; Coffer dams; Strutting; Tunneling: By tunnel boring machine (TBM);By New Austrian tunneling method (NATM); Tunnel form technology

UNIT 4 PRESTRESSING, CONSTRUCTION EQUIPMENTS, SAFETY MANAGEMENT **13 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 52 Hrs

COURSE OUTCOMES

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

CO1- **Understand** and Learn about the latest techniques and methodologies available for construction of underground and elevated metro rail corridors

CO2- **Identify** the benefits, applications and usage of modern construction materials including green building materials and materials for sustainable development

CO3- **Develop** ability and learn 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-**Analyze** 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.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs**
Part A/Question: 10 Questions of 2 marks each-No choice	**20** Marks
Part B/Question: 2 Questions from each unit with internal choice, each carrying 16 marks	**80** Marks

20CE523					Infrastructure 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

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

UNIT 1 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 2 SHARES, DENENTURES, SECURITIES 09 Hrs

Sources of Finance: Long term finance, Ordinary shares, Equity shares, Preference shares, Debentures, Term loans, Asset based financing, Securities

UNIT 3 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 4 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 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.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs**
Part A/Question: 10 Questions of 2 marks each-No choice	**20** Marks
Part B/Question: 2 Questions from each unit with internal choice, each carrying 16 marks	**80** Marks

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	6	3	6	--	--	--	50	50	100

COURSE OBJECTIVES

- 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.
- To learn the methodology for computation of productivity of manpower and construction equipments and also the apply Value Engineering tools in construction projects.
- To learn the methodology for carrying out 6 dimensional Building Information Modelling (BIM) for building facilities and infrastructure projects.
- To give exposure to the applications of Primavera P6 software in infrastructure projects

UNIT 1 PPP MODELS, SMART CITIES, SEZ, SIR 20 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 2 PRODUCTIVITY AND VALUE ENGINEERING 19 Hrs

Students will form small groups to carry out study related to productivity analysis for manpower and construction equipments deployed in real estate and infrastructure project sites. Students should also learn to apply value engineering tools in construction projects including Multi-Criteria Decision Making (MCDM) tools in construction industry, Life Cycle Costing Analysis (LCCA) and Social benefit Cost Analysis (SBCA).

UNIT 3 6 D BUILDING INFORMATION MODELLING 19 Hrs

Students will work in small groups to analyze, 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.

UNIT 4 APPLICATIONS OF PRIMAVERA P6 20 Hrs

Students will learn the applications and salient features of Primavera P6 software.

Total 78 hrs

COURSE OUTCOMES

CO1- **Understand** and develop PPP models for infrastructure projects and also understand the methodology for planning and development for smart cities.

CO2- **Analyze** and learn the methodology for computation of productivity of manpower and construction equipments

CO3- **Apply** Value Engineering tools in construction projects including MCDM, LCCA, SBCA.

CO4- **Develop** concepts about the methodology for computation of conceptual and detailed energy analysis with BIM tool

CO5- **Build** concepts about the methodology for computation of daylight analysis, airflow analysis with BIM tool

CO6- **Create** concepts to apply Primavera P6 for project planning and scheduling

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. Miles, L. D., Techniques of Value Analysis and Engineering, E. M. Walker Publishers, 1972.
4. Raghuram G, Infrastructure Development and Financing: Towards a Public Private Partnership, Macmillan Publishers, New Delhi, 2001.
5. Kensek, K.M. and Noble, D. , Building Information Modeling : Current and Future Practice, Wliey, 2014.

Max. Marks 100

Part A/ Practical work /Ongoing assignments/Continuous evaluation	50 Marks
Part B/ Viva	50 Marks

20CE526					Department 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

- To learn about the scope of real estate management
- To understand and learn about the real estate market and role of real estate consultants and managers
- To learn the method of valuation of real estate properties
- To learn real life case studies about real estate development

UNIT 1 INTRODUCTION TO REAL ESTATE MAMAGEMENT 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 2 REAL ESTATE MARKET, ROLE OF CONSULTANTS AND MANAGERS 09 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 3 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 4 CASE STUDIES OF REAL ESTATE DEVELOPMENT 10 Hrs.

Case Studies of real estate development, valuation, investment in Indian context

Total 39 Hrs

COURSE OUTCOMES

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

CO1- **Understand** in depth the concepts of the real estate management
CO2- **Understand** the principal functions of real estate participants and stakeholders.
CO3- **Identify** and learn about the 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. Goeters, J.E, Environmental Issues in Real Estate, Amazon Books
2. Kahr J. and Thomsett, M.C. , R.E. Market Valuation and Analysis, Wiley Publishers, 2005.
3. Gelbtuch, H.C. Mackmin, D. and Milgrim, M.R., Real Estate Valuation in Global Markets Amazon Books.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs**
Part A/Question: 10 Questions of 2 marks each-No choice	**20** Marks
Part B/Question: 2 Questions from each unit with internal choice, each carrying 16 marks	**80** Marks

20CV411T /20CE5XX					Department Elective: Air Pollution Monitoring					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
4	0	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

1. Introduction to various aspects of Air Pollutants
2. Assessing the impact of meteorology on air pollution
3. Measuring and estimating various air pollutants
4. Mitigating air pollution through various devices and modeling approach

UNIT I AIR POLLUTANTS 08 Hrs.

Classification of air pollutants, properties of gaseous and particulate matter, effects of Air pollution on plants, animals, materials, human health, Sources of Air pollution and emission inventory, Air quality standards and Air Quality Index, Introduction to Air Pollution Legislation

UNIT II AIR POLLUTION METEOROLOGY 10 Hrs.

Atmospheric energy balance, environmental lapse rates and atmospheric stability, winds, wind profiles, plume behaviour, turbulence, Dispersion of Air pollutants, Prediction of effective stack height - physics of plume rise, Holland's equation, Briggs equation, modifications of Gaussian dispersion models

UNIT III AIR POLLUTION MEASUREMENTS 10 Hrs.

Instruments used in monitoring the air pollution, sampling and analysis of indoor air, ambient air and stack gas, design of sampling network design, application of satellite data for air pollution assessment, case studies for different cities of India

UNIT IV AIR POLLUTION MODELLING AND CONTROL 11 Hrs.

Introduction to various air quality models (like Envi-MET, WRF-CHEM, LandGEMS, AERMOD, CALPUFF) for simulating air quality concentration, Introduction to Industrial air pollution control devices like settling chambers, cyclones, spray towers, electrostatic precipitators, etc., Indoor Air Quality enhancement

Total 39 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – **Identify** the sources of air pollutants in a city

CO2 – **Estimate** the damage due to air pollutants

CO3 – **Relate** air pollution with meteorology

CO4 – **Estimate** air pollution concentration

CO5 – **Simulate** air quality concentration

CO6 – **Design** air pollution control framework

TEXT/REFERENCE BOOKS:

1. Rao, M.N. and Rao, H.V.N. Air Pollution, Tata McGraw Hill, 2017
2. Stern, A.C. Fundamentals of Air Pollution, Academic Press, 1994
3. Seinfeld, J.H. and Pandis, S.N. Atmospheric Chemistry and Physics, Wiley Interscience Publication, 2006
4. Garg, S. K. Sewage Disposal and Air Pollution Engineering, Khanna Publishers, 2016
5. Jacob, D. Introduction to Atmospheric Chemistry, Pinceton University Press, 1999
6. Arcadio P., Environmental Engineering, Prentice Hall of India, 1999.
7. Rao, C.S., Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs**
Part A/Question: 10 Questions of 2 marks each-No choice	**20** Marks
Part B/Question: 2 Questions from each unit with internal choice, each carrying 16 marks	**80** Marks

20CE559T					Department Elective: Value Engineering 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

- To understand the concepts of value engineering
- To learn the methodology for value engineering job plan
- To learn the methods for value engineering in decision making
- To apply value engineering in construction projects

UNIT 1 INTRODUCTION TO VALUE ENGINERING 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 2 VALUE ENGINEERING JOB PLAN AND FAST DIAGRAM 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 3 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 4 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 39 Hrs

COURSE OUTCOMES

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

CO1 Understand and learn the concepts of value engineering

CO2 Analyze and apply the concepts of value engineering job plan and FAST diagramming methods

CO3 Analyze and apply the concepts of ROR analysis, breakeven analysis and sensitivity analysis
CO4 Learn the methodology for computation of Social benefit cost analysis (SBCA)

CO5 Learn the methodology for computation of Life cycle cost analysis (LCCA)

CO6 Apply valuation methods for valuation of properties and building facilities

TEXT/REFERENCE BOOKS

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

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs**
Part A/Question: 10 Questions of 2 marks each-No choice	**20** Marks
Part B/Question: 2 Questions from each unit with internal choice, each carrying 16 marks	**80** Marks

Pandit Deendayal Petroleum University School of Technology

20CE525T (Open Elective)					Earthquake Engineering for Infrastructure					
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

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

UNIT 1 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 2 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 analsysis - IS 5249:1992 Determination of dynamic property of soil-method of test

UNIT 3 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 4MACHINE 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 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.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs**
Part A/Question: 10 Questions of 2 marks each-No choice	**20** Marks
Part B/Question: 2 Questions from each unit with internal choice, each carrying 16 marks	**80** Marks

Semester –III		Teaching Scheme					Examination Scheme					
							Theory			Practical		Total
Code	Subject	L	T	P	C	Hr/Wk	MSE	ESE	IA	LW	LE/ Viva	Marks
MT611	Seminar	-	-	-	5	-	-	-	-	50	50	100
MT612	Project	-	-	-	14	-	-	-	-	50	50	100
MT613	Industrial Training	-	-	-	-	-	-	-	-	-	-	PP/ NP
	Total Semester-III	**-**	**-**	**-**	**19**	**-**						**200**

MT611					Seminar					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	0	5	--	--	--	--	50	50	100

COURSE OBJECTIVES

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

COURSE CONTENTS

Each student is required to choose a topic of his interest from Infrastructure 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.

COURSE OUTCOMES

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 analyze the data by applying appropriate research tool

CO6- **Develop** and derive specific conclusions and make appropriate recommendations for the research problem addressed

Max. Marks 100

Part A/ Practical work /Mid Semester Review/Continuous evaluation 50 Marks
Part B/ Final Viva / End Semester Review 50 Marks

MT612					Project					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	0	5	--	--	--	--	50	50	100

COURSE OBJECTIVES

- To understand and learn the present day problems faced by construction / infrastructure industry
- To develop and propose a prospective solution to the identified problem in terms of feasibility study and project planning and scheduling
- To create and develop a prospective solution in terms of social impact assessment and environmental impact assessment

COURSE CONTENTS

The project work can be a planning, design, laboratory of field project on any of the topics related to Civil Infrastructure Engineering& Management area. Each student would choose a topic addressing a current problem of the infrastructure / construction industry and prepare a project report consisting of major learnings. The spiral bound copy of the project report will be prepared and submitted to Department through guide. One copy of the report signed by guide and Head of the Department will be submitted to Department library for originality and record. The project work will be reviewed by a committee consisting of minimum 2-faculty members and the guide.

COURSE OUTCOMES

CO1- **Understand** and learn about the present problems faced by construction / infrastructure industry

CO2- Collect and **compile** primary data for the present research work

CO3- **Develop** a project planning and scheduling model through MSP software and Primavera

CO4- **Develop** technical and financial project feasibility study report

CO5-**Create / design** a social impact assessment model

CO6- **Create / design** an environment impact assessment model

Max. Marks 100

Part A/ Practical work /Mid Semester Review/Continuous evaluation 50 Marks
Part B/ Final Viva / End Semester Review 50 Marks

MT613					Industrial Training					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	0	0	--	--	--	--	50	50	100

COURSE OBJECTIVES

- To learn and understand the industry practices
- To develop ability to handle multidisciplinary complex infrastructure projects through techno-managerial skills

COURSE CONTENTS

The students need to undertake about 6 weeks project training in any construction /infrastructure industry organization. The students are expected to learn about the planning and scheduling of the major activities (use of MSP and Primavera P6 software is must), means of improving the efficiency and productivity of the individual activities of the project and hence for the overall project. The training can be undergone in consulting or contracting organization. At the end of the successful completion of the training, the students need to prepare a comprehensive project training report and have to appear before a panel of jury members comprising of minimum two faculty members.

COURSE OUTCOMES

CO1- **Understand** and study the present practices of construction / infrastructure industry

CO2- **Understand** the Work Breakdown Structure (WBS)

CO3- **Analyze** and learn the methodology of resource allocation and levelling

CO4- **Develop** concepts about project scheduling through MSP software and Primavera

CO5- **Build** concepts about the methodology adopted for materials management

CO6- **Create** concepts to improve efficiency and productivity

Max. Marks 100

Part A/ Practical work /Continuous evaluation 50 Marks
Part B/ Final Viva / End Semester Review 50 Marks

Semester –IV		Teaching Scheme					Examination Scheme					
							Theory			Practical		Total
Code	Subject	L	T	P	C	Hr/Wk	MSE	ESE	IA	LW	LE/ Viva	Marks
MT621	Seminar	-	-	-	5	-	-	-	-	50	50	100
MT622	Project & Dissertation	-	-	-	24	-	-	-	-	50	50	100
	Total Semester-IV	-	-	-	**29**	-						**200**
	Grand Total	**32**	**4**	**26**	**92**	-						**1900**

MT621					Seminar					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	0	5	--	--	--	--	50	50	100

COURSE OBJECTIVES

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

COURSE CONTENTS

Each student is required to choose a topic of his interest from Infrastructure 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.

COURSE OUTCOMES

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 analyze the data by applying appropriate research tool
CO6- **Develop** and derive specific conclusions and make appropriate recommendations for the research problem addressed

Max. Marks 100

Part A/ Practical work /Mid Semester Review/Continuous evaluation 50 Marks
Part B/ Final Viva / End Semester Review 50 Marks

MT622 (Semester IV)					Project and Dissertation					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	0	24	--	--	--	--	50	50	100

COURSE OBJECTIVES

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

COURSE CONTENTS

Students need to choose a research topic related to the current practices in Infrastructure Engineering and Management. The broad areas can be Project Management, Project Risk Management, Building Information Modelling, Lean Construction & Management, Project Finance, Real Estate Management, Transportation Planning & Management, Environmental Management Systems, Statistical Quality Control and Process Control, Quality Control & Assurance, Enterprise Resource Planning, Applied Geotechnical Engineering, Applied Structural Engineering, Geographical Information Systems.

The student need to choose a guide from the Department and the area / topic of research should be mutually convenient to the student and guide.

The hard bound copy of the thesis will be prepared as per PDPU format and submitted to Department through guide. One copy of the thesis signed by guide and Head of the Department will be submitted to Department library for originality and record. The project & dissertation work will be reviewed by a committee consisting of minimum 2-faculty members and guide for the internal review component and the external review panel would comprise of external examiner, head of department and guide.

COURSE OUTCOMES

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 analyze the data by applying appropriate research tool
CO6- **Develop** and derive specific conclusions and make appropriate recommendations for the research problem addressed

Max. Marks 100

Part A/ Practical work /Continuous evaluation 50 Marks
Part B/ Final Viva / End Semester Review 50 Marks