6TH SEMESTER

Sl.no.	Course no.	Subject	L	T	P	Credit
1	CE601N	PCC3- STRUCTURAL ANALYSIS II	3	1	0	4
2		PCE3-	3	0	0	3
3		PCE4-	3	0	0	3
4		OCE2-	3	0	0	3
5		OCE3-	3	0	0	3
6	IC601N	Entrepreneurship	2	0	0	2
1	CE602N	Sessional- Transportation Engineering Lab	0	0	3	1
2	CE604N	Sessional- STEEL Structures Sessional	0	0	3	1
3	CE606N	Sessional- STRUCTURAL ANALYSIS lab	0	0	3	1
TOTAL CREDIT						**21**

Total contact hour= 27

PROFESSIONAL CORE ELLECTIVE III

[CE603N] Transportation Engineering
[CE605N] Soil dynamics
[CE607N] Modern surveying techniques
[CE609N] Airport Planning and Design
[CE611N] Bridge engineering

PROFESSIONAL CORE ELLECTIVE IV

[CE613N] Steel Structures-II,
[CE615N] Water Resources Engineering-II
[CE617N] Structural Dynamics
[CE619N] Systems Engineering & Economics
[CE621N] Metal Structure Behaviour
[CE623N] Masonry Structures

OPEN COURSE ELLECTIVE II

[CE625N] Environment Impact Assessment
[CE627N] Operational Research Technique
[CE629N] Rock Mechanics
[CE631N] Environmental Laws and Policy
[CE633N] Value and Ethics in engineering

OPEN COURSE ELLECTIVE III

[CE635N] Remote Sensing & Its Application,
[CE637N] Decision and Risk Analysis
[CE639N] Engineering Materials for Sustainability
[CE641N] Industrial Structure
[CE643N] Construction Technology and Management

CE601N	STRUCTURAL ANALYSIS II	PCC-III	3-1-0	4 Credits

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Analysis of fixed beams, continuous beam, simple frames and redundant frames with and without translation of points. Method of consistent deformation, Strain energy method, Slope deflection method, Moment distribution method.	**12**
2.	Analysis of two hinged arches. Suspension bridges with two hinged stiffening girder.	**10**
3.	Structural theorems:-Linearity principle of superposition,virtual work,energy theorems, reciprocal theorems, Muller's Breslau's principles.	**6**
4.	Basics of force and displacement matrix methods for beams,plane frame (rigid and pin-pointed)	**10**
5.	Influence lines:-Influence lines for propped cantilevers,continuous beams and two hinged arches	**10**

Course Outcomes: At the end of the course, the students will be able to

CO1	Analyze the reaction forces and design of building frames
CO2	To analyze the arches of various constraints and calculations of forces
CO3	To understand the various procedure for the analysis of beams and plane frames
CO4	To assess the importance and significance of influence line and their applications

Prerequisites:

Structural Analysis I

CE603N	TRANSPORTATION ENGINEERING	PCE-III	3-0-0	3 Credits

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Highway development and planning-Classification of roads, road development in India, Current road projects in India; highway alignment and project preparation.	**6**
2.	Geometric design of highways-: Introduction; highway cross section elements; sight distance, design of horizontal and vertical alignment; Grade compensation	**12**
3.	Traffic engineering & control- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; Design of signals, design of road intersections; design of parking facilities; highway lighting; problems	**10**
4.	Design of pavements- Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems	**12**
5.	Pavement materials- Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems	**8**

Course Outcomes: At the end of the course, the students will be able to

CO1	carry out surveys involved in planning and highway alignment
CO2	design the geometric elements of highways and expressways
CO3	carry out traffic studies and implement traffic regulation and control measures and intersection design
CO4	characterize pavement materials and design flexible and rigid pavements as per IRC

Prerequisites:

None

CE605N	SOIL DYNAMICS	PCE-III	3-0-0	3 Credits

Pre-requisites: Geotechnical Engineering

Course Outcomes: At the end of the course, the students will be able to

CO1	Acquire knowledge on the various types of dynamic forces acting and propagating through soil
CO2	Understand the mass spring damper system in solving the problems of soil dynamics
CO3	Acquainted with the various laboratory techniques and their working principle to understand the dynamics properties of soil
CO4	An in depth understanding of the liquefaction behaviour of soil.

Course Articulation Matrix:

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	3	-	-	-	2	-	-	-	2	-
CO2	3	-	-	3	-	-	2	-	-	-	-	-
CO3	-	2	-	2	-	-	-	-	-	3	-	-
CO4	2	-	-	2	3	-	2	-	2	-	-	2

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Principle of soil dynamics and vibration. Basic definitions related to dynamic analysis of machine foundations. Different types of machines.	**8**
2.	Different types of machine foundations mass spring system. Vibration of spring mass system with damping (free vibration). Forced vibration: Derivation of expression for forced vibration. Amplitude of deflection magnification factor, frequency ratio, damping, ration graphical repressor amplitude frequency relation for damped forced vibrations. Wave propagation in soil media, vibration Isolation and control. Bulb of pressure concept	**14**
3.	Natural frequency of foundation soil system block foundation. Degree of freedom of a block foundation. Barkaun's method of design of block foundation. General vibration for design of machine foundation vibration analysis of machine foundation	**10**
4.	Laboratory and in site determination of dynamic properties of soil. Determination of Mass, spring constant or stiffness and damping. Determination of natural frequency coefficient of elastic uniform compression design criteria for foundation of reciprocating machine. Indian standard code of practice for	**8**

	design of foundation for impact type machine, Reinforcement and construction details.	
5	Liquefaction of sands. Numerical problem related to soil dynamics and machine fluid.	**4**

Reading:

- Soil Dynamics and Machine Foundation by Swami Saran
- Fundamentals of Soil Dynamics by Braja M. Das.

CE603N	**MODERN SURVEY TECHNIQUES**	**PCE-III**	**3-0-0**	**3 Credits**

Detailed Syllabus:

MODULE	**CONTENTS**	**Hrs**
1.	Modern surveying electronic equipments: digital levels, digital theodolites, EDMs, Total stations; Principles, working and applications; Lasers in surveying.	**6**
2.	Photogrammetric terms; Applications; Type of photographs; Perspective geometry of near vertical and tilted photographs, heights and tilt distortions; Flight planning; Stereoscopy, base lining, floating marks, parallax equation and stereo measurements for height determination; Developments in photogrammetry: analogue, analytical and digital methods; photogrammetric instruments.	**12**
3.	Introduction- Remote sensing system- data acquisition and processing; Applications; Multi concept in remote sensing. Physical basis of remote sensing- Electro-magnetic radiation (EMR)- nature, nomenclature and radiation laws; Interaction in atmosphere- nature, its effects in various wavelength regions, atmospheric windows; Interaction at ground surface- soils and rocks, vegetation, water, etc.; Geometric basis of interaction. Platform and sensors- Terrestrial, aerial and space platforms; Orbital characteristics of space platforms, sun- and geo-synchronous; Sensor systems- radiometers, optomechanical and push broom sensor; Resolution- spectral, spatial, radiometric and temporal; Data products from various air and spaceborne sensors- aerial photographs, LiDAR, Landsat, SPOT, IRS, ERS, IKONOS, etc. Image interpretation- Elements of interpretation; Manual and digital interpretation; Field verification.	**16**
4.	Components of GIS- data acquisition, spatial and attribute data, pre-processing, storage and management; Data structures- raster and vector data; GIS analysis functions; Errors and corrections; Data presentation and generation of thematic maps; Applications	**08**

Course Outcomes: At the end of the course, the students will be able to

CO1	Learn the use of modern survey instruments and their use in surveying
CO2	Assess the importance of photogrammetric survey and its significance

CO3	Learn and apply the concept of remote sensing in geodetic survey
CO4	Understand the concept of GIS in survey

Prerequisites:

Survey

Reading:

- Surveying and Levelling Vol. II by T.P. Kanetkar

CE609N	AIRPORT PLANNING AND DESIGN	PCE-3	3-0-0	3 Credits

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Aircraft characteristics; Aircraft performance characteristics: Airport planning and air travel demand forecasting: Airport Site Selection; Geometric Design of the Airfield	**10**
2.	Determination of Runway Capacity and Delay - Taxiway and Gate Capacity - Holding Aprons - Terminal Aprons – Airport drainage - Function of Airport Passenger and Cargo Terminal	**10**
3.	Design of Air Freight Terminals - Airport access - Airport Landside planning - Capacity; Air Traffic Management: Navigational aids: ground based systems, satellite based systems	**10**
4.	Air traffic control and surveillance facilities – Airfield lighting – air traffic management.	**10**

Course Outcomes: At the end of the course, the students will be able to

CO1	Learn the importance of airport planning and design
CO2	Understand the runway capacity and function of airport terminal
CO3	Learn the design of airport freight terminals
CO4	Understand the function of air traffic control

Prerequisites:

Transportation Engineering

Reading:

CE611N	BRIDGE ENGINEERING	PCE-3	3-0-0	3 Credits

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	General; classification of bridges, site selection, geometric and hydraulic design consideration	**6**
2.	Loading standards for highway and railway bridges, general design consideration; optimum spans; Concrete bridges: culverts; Slab, T-beam, box girder bridges, balanced cantilever bridge, cable stayed bridge, extrados bridges; arch bridge;	**12**
3.	Special requirements for Prestressed Concrete bridges; Steel bridges: plate girder bridge, truss bridge, suspension cable bridge, cable stayed bridge; Substructures: design of piers and abutments, pile and well foundations, bearings and expansion joints, special wearing coats	**12**
4.	seismic design considerations; Aerodynamic stability considerations; special durability measures; provisions for inspection and maintenance;	**10**

Course Outcomes: At the end of the course, the students will be able to

CO1	Classify the various types of bridges based on various criteria
CO2	Assess the load on the bridge and its serviceability
CO3	Understand the requirements of a Prestressed concrete bridge
CO4	Understand the seismic design considerations for bridge design

Prerequisites:

Transportation Engineering

CE613N	STEEL STRUCTURE II	PCE-4	3-0-0	3 Credits

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Moment Resistant Connections : i. Eccentric Connections: Bolted Bracket Connections, Bracket Connection–type–I and type– II ii. Welded Bracket Connections iii. Bolted Framed Connections – Seat Connections, Design of Unstiffened seat connection. Stiffened Seat Connection, Beam to Column connection, Beam to Beam Connection. Welded Seat Connections	12
2.	Industrial Building :- i. Roof Truss : Types, Selection of the type of roof truss, General arrangements ii. Load on the roof truss - dead load, live load, snow load, wind load, load combination. iii. Design of purlins iv. Analysis and Design of Roof Truss v. Bracings of truss vi. Design of Gantry Girder: Introduction, Crane Girder, Loads acting on gantry : Vertical loads, Lateral Loads, Longitudinal Load, Impact Loads, Design procedure.	12
3.	Bridge : Steel foot bridge with rankers and lateral restraining including end bearings Water Tank : Pressed steal water tank: Introductions, Permissible stresses, Thickness specifications Design procedure, staging for tanks	10
4.	Towers : Introduction, transmission line towers, Microwave towers, design loads, classification, analysis and design of transmission line towers. Tubular Structures : Introduction to tubular structures	8

Course Outcomes: At the end of the course, the students will be able to

CO1	In depth understanding of moment resistant connection
CO2	Understand the various types of trusses
CO3	Assess the loading and design of bridges and water tanks
CO4	Analyze the design of towers

Prerequisites:

Steel Structure I

CE615N	WATER RESOURCE ENGINEERING II	PCE-4	3-0-0	3 Credits

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Irrigation Principles and planning Definition of Irrigation, development of irrigation in India. Benefits and ill effects of Irrigation. Types of method of irrigation system. quality of irrigation water, water requirements and irrigation scheduling, duty and data & base periods and their relationship, improvements of duty.	**10**
2.	Canal design and layouts , types of canal Canal alignment – Canal design – Kennedy's Silt theory method, Laceyes regime theory. RangaRaju and Misri Method. Basak Method, Tractive shear approach ,layout of canals. Conveyance losses.	**10**
3.	Diversion head Works, Layout of diversion head works, Components of head works, Bligh's and lane's theories, Khosla theory, Design of weir & Barrage	**8**
4.	Canal Regulation Works: Different types of regulation works, Types and Design of falls. Types and design of regulators, Cross regulator, head regulator, canal escapes, canal modulus etc.	**8**
5	Cross – Drainage Works Types of cross-drainage works and design of aqueducts. River Training Works Meandering of rivers, cut off, spurs, guide banks ,marginal embankment. Channel Improvements	**6**

Course Outcomes: At the end of the course, the students will be able to

CO1	In depth knowledge of irrigation principle and planning
CO2	Understand the canal design and layout
CO3	Assess the various design theories
CO4	Analyze the cross drainage work

Prerequisites:

Water Resources Engineering I

CE617N	STRUCTURAL DYNAMICS	PCE-4	3-0-0	3 Credits

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	THEORY OF VIBRATIONS Difference between static loading and dynamic loading – Degree of freedom – idealisation of structure as single degree of freedom, – Formulation of Equations of motion of SDOF system – D'Alemberts principles – effect of damping – free and forced vibration of damped and undamped structures – Response to harmonic and periodic forces.	**9**
2.	Two degree of freedom system – modes of vibrations – formulation of equations of motion of multi degree of freedom (MDOF) system – Eigen values and Eigen vectors – Response to free and forced vibrations – damped and undamped MDOF system – Modal superposition methods.	**9**
3.	Elements of Engineering Seismology – Causes of Earthquake – Plate Tectonic theory – Elastic rebound Theory – Characteristic of earthquake – Estimation of earthquake parameters – Magnitude and intensity of earthquakes – Spectral Acceleration.	**9**
4.	Effect of earthquake on different type of structures – Behaviour of Reinforced Cement Concrete, Steel and Prestressed Concrete Structure under earthquake loading – Pinching effect – Bouchinger Effects – Evaluation of earthquake forces as per IS:1893 – 2002 – Response Spectra – Lessons learnt from past earthquakes.	**9**
5	Causes of damage – Planning considerations / Architectural concepts as per IS:4326 – 1993 – Guidelines for Earthquake resistant design – Earthquake resistant design for masonry and Reinforced Cement Concrete buildings – Lateral load analysis – Design and detailing as per IS:13920 – 1993.	**9**

Course Outcomes: At the end of the course, the students will be able to

CO1	Understand the concept of dynamic vibration of structures
CO2	Assess the behavior of structure under dynamic loading
CO3	Understand the basic dynamic parameters of vibratory and impact forces
CO4	Assess the damage and design considerations for dynamic loads

Prerequisites:

Structural Engineering I

CE619N	SYSTEM ENGINEERING AND ECONOMICS	PCE-4	3-0-0	3 Credits

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Introduction to the formulation and solution of civilengineering problems.Engineering economy, mathematical modeling, andoptimization.	12
2.	Techniques, including classical optimization, linear and nonlinearprogramming, network theory, critical path methods, simulation, decision theory	14
3.	Dynamic programming applied to a variety of civil engineering problems.	12

Course Outcomes: At the end of the course, the students will be able to

CO1	To understand the formulation and the solution of civil engineering problems
CO2	The importance of mathematical modelling in Civil Engineering
CO3	The application of network theory and other techniques
CO4	The application of dynamic programming to civil engineering problems

Prerequisites:

None

CE621N	METAL STRUCTURE BEHAVIOUR	PCE-4	3-0-0	3 Credits

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Introduction to the design of metal structures;	10
2.	Behavior ofmembers and their connections; and theoretical, experimental, and practical bases forproportioning members and their connections.	10
3.	Metal members under combined loads; connections, welded and bolted; moment- resistant connections;	10

4	Plate girders, conventional behavior, and tension field action.	**10**

Course Outcomes: At the end of the course, the students will be able to

CO1	To learn the designing of metal structures
CO2	To understand the behavior of structural members and their connections
CO3	To study the behavior of metal members under combined loading
CO4	To understand the stress calculations under various structural joints

Prerequisites:

None

CE623N	**MASONRY STRUCTURES**	**PCE-4**	**3-0-0**	**3 Credits**

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Introduction to analysis, design and construction of masonrystructures.	**8**
2.	Mechanical properties of clay and concrete masonry units, mortar, and grout	**8**
3.	Compressive, tensile, flexural, and shear behavior of masonry structural components.	**8**
4	Strength and behavior of unreinforced bearing walls. Detailed design of reinforced masonry beams, columns, structural walls with and without openings	**8**
5	Complete lateral-force resisting building systems.	**8**

Course Outcomes: At the end of the course, the students will be able to

CO1	Analyze the design of masonry structures
CO2	To assess the mechanical properties of clay mortar etc.
CO3	To assess the strength behavior of bearing walls
CO4	To analyze the lateral force resisting building system.

Prerequisites:

CE625N	ENVIRONMENT IMPACT ASSESSMENT	OCE-2	3-0-0	3 Credits

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Evolution of EIA: Concepts of EIA methodologies, Screening and scoping;	8
2.	Rapid EIA and Comprehensive EIA; GeneralFramework for Environmental Impact Assessment, Characterization and site assessment.Environmental Risk Analysis	8
3.	Definition of Risk, Matrix Method. Checklist method, Faulttree analysis, Consequence Analysis; Socioeconomic aspects, measures of effectiveness of pollution control activities	12
4	Environmental Legislation; Introduction to EnvironmentalManagement Systems; Environmental Statement - procedures; Environmental Audit: CostBenefit Analysis; Life Cycle Assessment; Resource Balance, Energy Balance & ManagementReview; Operational Control;	14
5	Case Studies on EIA.	2

Course Outcomes: At the end of the course, the students will be able to

CO1	Understand the need and importance of EIA
CO2	Understand the need for characterization and site assessment
CO3	gain a knowledge about the cost benefit analysis
CO4	to have a knowledge on the case studies on EIA

Prerequisites:

Environmental Engineering

CE627N	OPERATIONAL RESEARCH TECHNIQUE	OCE-II	3-0-0	3 Credits

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Introduction: History of operation research, nature and scope of operations research, allocation.	**10**
2.	Linear programming: Mathematical formulations of the problem, Graphical solution methods, mathematical solution of L-P problems, matrix formulation of general linear programming.	**10**
3.	Simplex Method: Algorithm and computational procedures, Two phase Simplex method, Problems of degeneracy, Principles of duality in simplex method, Sensitivity analysis, Transportation problem.	**10**
4	Game Theory: Introduction, Two persons zero sum games, the maxmini and minimax principles. Integer Programming: Formulation and solution of integer programming problems	**10**

Course Outcomes: At the end of the course, the students will be able to

CO1	Understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type
CO2	Generate mathematical formulation of L-P problems using Simplex method, Two Phase Simplex method
CO3	Interpret the principle of Dual Simplex And Sensitivity Analysis
CO4	Build and solve Transportation Models and Assignment Models
CO5	Build and solve Integer Programming Problems

Prerequisites:

None

Suggested Reading

1. Taha,H A, "Operations Research - An Introduction", Sixth Edition, Prentice Hall of India Private Limited, N. Delhi, 2004.

2. Hillier, F S, "Operations Research", First Indian Edition, CBS Publishers & Distributors, Delhi, 1994.

CE629N	ROCK MECHANICS	OCE-II	3-0-0	3 Credits

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Introduction Brief historical development; Mechanical nature of rock; Index properties of rocks and rock masses Continuum and discontinue.	10
2.	Classification of Rocks Geological and engineering classification of intact and in situ rocks; Classification of ..rock mass continuity; RQD, RMR and Q index; Comparison of various systems used in practice.	10
3.	Engineering Properties of Rocks and Rock Masses Mechanical properties of rocks; Stress-strain behavior in compression; Brittle and plastic failures; Engineering behaviourof intact and in situ rocks; Anisotropy, Deformability and elastic modulus;. Permeability.	10
4	Shear Strength of Rocks Triaxial compression test; Failure criteria; Shear strength of discontinuities; Dilatancy; Effective stress ill rocks. In Situ Stress ill Rock and Their Measurement, Nature of primitive stress, Stress measurement.	10

Course Outcomes: At the end of the course, the students will be able to

CO1	Distinguish various types of rocks
CO2	Classify the rocks based on various parameters
CO3	assess the stress strain behavior of rock mass
CO4	understand the rock support

Prerequisites:

Geotechnical Engineering I

***Value engineering (syllabus prepared and taught by production engineering department)**

CE633N	Values And Ethics In Engineering	OCE-II	3-0-0	3 Credits

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Human Values:Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.	10
2.	Engineering Ethics: Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories	10
3.	ENGINEERING AS SOCIAL EXPERIMENTATION Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.	10
4	SAFETY, RESPONSIBILITIES AND RIGHTS Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination	10
5	GLOBAL ISSUES Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors –	8

	Moral Leadership –Code of Conduct – Corporate Social Responsibility	

CE631N	**ENVIRONMENTAL LAWS AND POLICY**	**OCE-II**	**3-0-0**	**3 Credits**

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Overview of environment, nature and eco system,Concept of laws and policies, Origin of environmental law,	**14**
2.	Introduction to environmentallaws and policies, Environment and Governance, sustainable development and environment,understanding climate change, carbon crediting, carbon foot print etc.,	**12**
3.	Introduction to tradeand environment. International environmental laws, Right to Environment as Human Right International Humanitarian Law and Environment, environment and conflicts management,Famous international protocols like Kyoto.	**14**

Course Outcomes: At the end of the course, the students will be able to

CO1	To understand the laws to protect the environment
CO2	To have an in depth understanding of the environmental laws and policies
CO3	To understand the international humanitarian law and other laws
CO4	To gain knowledge about famous international protocols

Prerequisites:

Environmental Engineering

CE635N	**REMOTE SENSING & ITS APPLICATION**	**OCE-III**	**3-0-0**	**3 Credits**

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Introduction and definition of Remote sensing Technology photogrammetry types of photograph geometry of photograph stereophotogrammetry	**10**
2.	Remote Sensing: stages and success electromagnetic radiation and Spectrum spectrum signature atmospheric window characteristics of different types in cells images are of platforms orbital parameters of a satellite	**10**
3.	Interpretation of images principles of interpretation of satellite and area images equipment at 8 week ground truth collection and verification advantages of multi and multi band images Digital satellite data: Digital satellite data products and their characteristics Histogram and its utility enhancement different magnitude of digital satellite data interpretation	**12**
4	Application of Remote sensing applications in water resource management river morphology of Estimation and forecast snow survey blood joining and damage can land use mapping and monitoring environmental studies urban pollution atmospheric pollution studies environmental science and Highway planning engineering and regional planning natural resources service required to Graphic application	**10**

Course Outcomes: At the end of the course, the students will be able to

CO1	To understand the importance of electromagnetic spectrum in Civil survey
CO2	TO assess the remote sensing data acquisition
CO3	To interpret the data obtained for the civil engineering applications
CO4	To analyse the digital image processing

CE637N	**DECISION AND RISK ANALYSIS**	**OCE-3**	**3-0-0**	**3 Credits**

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Development of modern statistical decision theory and riskanalysis, and application of these concepts in civil engineering design and decision making;	**10**
2.	Bayesian statistical decision theory, decision tree, utility concepts, and multi-objectivedecision problems;	**8**
3.	Modelling and analysis of uncertainties, practical risk evaluation, and formulation of risk-based design criteria,	**12**
4	Risk benefit trade-offs, and optimal decisions.	**10**

Course Outcomes: At the end of the course, the students will be able to

CO1	To understand the importance of risk analysis in Civil Engineering
CO2	To understand the various risk assessment theories
CO3	To assess the formulation of risk based design criteria
CO4	To analyses the benefits of optimal decisions in Civil Engineering

Prerequisites:

None

CE639N	**ENGINEERING MATERIALS FOR SUSTAINABILITY**	**OCE-3**	**3-0-0**	**3 Credits**

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Environmental impact of materials used in infrastructure development	**10**

2.	Life-cycle assessment durability and sustainability, material selection to optimize structural performance such as use of plastic in roads, fly ash in filling, recycled aggregates in construction and renovative chemicals etc.	**15**
3.	Design, evaluation, and production of green construction materials.	**15**

Course Outcomes: At the end of the course, the students will be able to

CO1	To assess the impact of industrial waste on environment
CO2	To study the materials for sustainable construction
CO3	To understand the importance of using green construction materials

CE641N	**INDUSTRIAL STRUCTURES**	**OCE-3**	**3-0-0**	**3 Credits**

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Detailed Design of Steel Gantry Girders. Detailed Design of Portal Frames-Single bay two storey.	**9**
2.	Detailed Design of Gable Structures. Detailed Design of Knee Brace.	**9**
3.	Detailed Design of Light weight metal structures. Design of connections-Shear and Flexure Design.	**9**
4	Detailed Design of Steel Bunkers. Detailed Design of Silos.	**9**
5	Detailed Design of Self Supported Chimneys.	**9**

Reading:

1. Design of Steel Structures, Arya and Azmani, Nem Chand Brothers, Roorkee, 2004

2. Punmia B.C, Ashok Kr. Jain, Arun Kr. Jain, RCC Designs (Reinforced Concrete Design), 10th Edition, Lakshmi Publishers, 2006.

3. Ramachandra, Design of Steel Structures, 12th Edition, Standard Publishers, 2009

CE643N	**CONSTRUCTION TECHNOLOGY AND PROJECT MANAGEMENT**	**OCE-5**	**3-0-0**	**3 Credits**

MODULE	CONTENTS	Hrs
1.	Importance of Project Management, Role of Project manager, Stakeholders in construction project, Different types of projects, similarities & dissimilarities in projects	**8**
2.	Time, Scope & Money, Knowledge areas & Processes involved in construction projects, WBS of a major work, with examples	**8**
3.	Planning, monitoring & executing, Planning, sequencing, scheduling, Bar Charts, Networks, CPM, PERT, Upgrading, Cash flow diagram, resource levelling & resource allocation	**8**
4	Crashing of project, Cost Optimization, Invoicing, Preparation of RA bill, Safety in construction, Estimation, Tenders & Contracts.	**8**
5	Equipment for construction, Construction Finances – decision making, Construction of piles, Construction of Tunnels, Construction of cofferdams.	**8**

Reading:

1. Puerifoy R.L. - Construction Planning Equipment & methods.
2. Punmia and Khandelwal K.K. - Project Planning and Control - Laxmi Publ. Delhi.
3. Srivatsava, 1998. Management in Construction Industry.
4. Antil & Woodh - Critical Path Method in Construction - Wiley International.
5. Mahesh Varma - Construction Planning and Equipment - Metropolitan Co.