LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institute)
DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF INSTRUCTION & EXAMINATION [LR-21]
(W.e.f Academic Year 2024– 25)
B.E. VII-Semester

S. No.	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			Credits
				L	T	P/D	Contact Hours/Week	CIE	SEE	Duration in Hours	
Theory Course											
1	U21CE701	PCC	Estimation Costingand Specifications	3	-	-	3	40	60	3	3
2	U21CE702	PCC	Pre-stressed Concrete	3	-	-	3	40	60	3	3
3	U21CE703	PCC	Foundation Engineering	3	-	-	3	40	60	3	3
4	U21CE704	PCC	Design of Steel Structures	3	-	-	3	40	60	3	3
5	-	PEC	Professional Elective-III	3	-	-	3	40	60	3	3
6	-	OEC	Open Elective – III	3	-	-	3	40	60	3	3
Project											
7	U21CE7P1	PROJ	Mini Project	-	-	6	6	50	50	-	3
Skill Development Course											
8	U21CE7L1	ESC	Computer Applications Lab	-	-	2	2	25	50	3	1
Total				**18**	**0**	**08**	**26**	**315**	**460**	**-**	**22.0**

L: Lecture(Hrs/Wk/Sem) **T**: Tutorial (Hrs/Wk/Sem) **P**: Practical **D**: Drawing(Hrs/Wk/Sem)
CIE: Continuous Internal Evaluation **SEE**: Semester End Examination (Univ. Exam)
PEC: Professional Elective Courses **PCC**: Program Core Courses **OEC:** Open Elective Courses
PROJ: Project **ESC**: Engineering Science Courses **CE**: Civil Engineering

Note:
1. Each contact hour isa Clock Hour.
2. The duration of the practical class is threehours, however it can be extended wherever necessary, to enable the student to complete the experiment.

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SCHEME OF INSTRUCTION & EXAMINATION [LR-21]
Professional Elective Courses

S. No.	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			Credits
				L	T	P/ I	Contact Hours/Week	CIE	SEE	Duration in Hours	
Theory Course											
1	U21CE506	PEC 1	Building Construction Practice	3	-	-	3	40	60	3	3
	U21CE507		Advanced Surveying	3	-	-	3	40	60	3	3
	U21CE508		Air and Noise Pollution Control	3	-	-	3	40	60	3	3
	U21CE509		Urban Transportation Planning	3	-	-	3	40	60	3	3
2	U21CE604	PEC 2	Construction Project and Planning	3	-	-	3	40	60	3	3
	U21CE605		Sustainable Construction Methods	3	-	-	3	40	60	3	3
	U21CE606		Solid and Hazardous Waste Management	3	-	-	3	40	60	3	3
	U21CE607		Public Transportation Systems	3	-	-	3	40	60	3	3
3	U21CE705	PEC 3	Contracts Management	3	-	-	3	40	60	3	3
	U21CE706		Advanced Concrete Technology	3	-	-	3	40	60	3	3
	U21CE707		Advanced RCC Design	3	-	-	3	40	60	3	3
	U21CE708		Traffic Engineering and Management	3	-	-	3	40	60	3	3
4	U21CE801	PEC 4	Ground Improvement Techniques	3	-	-	3	40	60	3	3
	U21CE802		Repair and Rehabilitation of Structures	3	-	-	3	40	60	3	3
	U21CE803		Environmental Impact Assessment	3	-	-	3	40	60	3	3
	U21CE804		Intelligent Transport Systems	3	-	-	3	40	60	3	3
5	U21CE805	PEC 5	Surface Hydrology	3	-	-	3	40	60	3	3
	U21CE808		Finite Elements Methods	3	-	-	3	40	60	3	3
	U21CE809		GIS and Remote Sensing	3	-	-	3	40	60	3	3
	U21CE810		Infrastructure Engineering	3	-	-	3	40	60	3	3

S. No.	Course Code	Category	Course Title
3	U21EE711	OEC 3	Introduction to Electrical Vehicles
	U21EE712		Design estimation and Costing of Electrical Systems
	U21CS711		Data Sciences
	U21IT705		Basics of Artificial Intelligence
	U21ME711		Renewable Energy Resources
	U21ME712		Cooling of Electronic Components
	U21CE711		**Environmental Systems****
	U21CE712		**Urban Transportation System****
	U21EC703		IOT and its protocols
	U21EC704		Television and Video Engineering
	U21MB702		Logistics Management
	U21MB703		Management of Start Up's
	U21SH701		DisplayDevices
	U21SH702		Comparative Study of Literature

S. No.	Course Code	Category	Course Title
4	U21EE804	OEC 4	Smart Building Systems
	U21EE805		Industrial Automation
	U21CS806		Basics of Machine Learning
	U21IT802		Cloud computing
	U21ME806		Automobile Engineering
	U21ME807		Power Plant Engineering
	U21CE806		**GreenBuilding Technology****
	U21CE807		**Environmental Impact Assessment****
	U21EC805		Fundamentals ofWireless Communication
	U21EC806		Fundamental Digital Design using Verilog HDL
	U21MB802		Entrepreneurship
	U21MB803		E - Marketing
	U21SH801		Corrosion Scienceand Technology
	U21SH802		Introduction To Philosophical Thoughts

*Open Elective subjects not offered to the students of Civil Department.

Course Code	Course Title						Core / Elective
U21CE701	ESTIMATION COSTING AND SPECIFICATION						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
---	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Acquire knowledge on specifications and detailed estimation of building used in construction
2. To equip thestudents with current practices in detailed estimation of roads, culvert ant canals.
3. To learn the estimation ofreinforcement quantities.
4. Learn toprepare rateanalysis for various items of works in construction
5. Evaluate theactual value of land and buildings

Course Outcomes

After Completion of this course, the student will be able to

1. Estimate the quantities of materials prepare a detailed estimate for different types of structures.
2. Prepare a detailed estimate for roads, culvert ant canals.
3. Compute and prepare bar bending schedules.
4. Prepare rate analysis for various quantities
5. Assess the value of land and buildings

UNIT – I

Specification: Definition, purpose and importance of specifications, Types of specification, general rules for the measurements and its units of different items of civil engineering work.

Detailed Estimation of Buildings: Types of estimates, various methods of approximate estimate of buildings, Detailed estimate for Flat roof building (load bearing and RCC framed) - long and short wall method - centre line method.

UNIT – II

Detailed Estimation of Roads, Culvert and Canals: Detailed estimate of road works for WBM roads, Bituminous and CC road (including earth work), single cell rectangular box culvert and earth work of irrigation canals (cutting and banking).

UNIT – III

Estimation of Reinforcement Quantities: Estimation of steel quantities and preparation of bar bending schedule (BBS) - RCC framed works for Slabs, Beams and Columns, Footings (Rectangular, Isolated), Stair Case, Overhead rectangular tank and Retaining wall.

UNIT – IV

Rate analysis of civil work: Preparation of analysis of rates and theoretical requirements of materials as per the Telangana State Standard Data and Schedule of Rates, for major items of works of buildings, bituminous and concrete roads.

UNIT – V

Valuation of Buildings: Introduction, Basic elements - Market Value, Book Value, Salvage Value, Replacement Cost, Earning Value, Potential Value, Written Down Value, Different Methods of Valuation - Land and Building Method - Land tenure - Freehold Land and Leasehold Land, Land Valuation, Replacement Cost of Building, Depreciation, Value as per Land and Building Method.

Text Books:

1. Dutta, B.N. Estimating and Costing in Civil Engineering Theoryand Practice. UBS Publishers' DistributersPvt. Ltd., New Delhi. (2016).
2. Chakraborthi, M. Estimating, Costingand Specifications in Civil Engineering. Chakraborthi, Kolkata. (2002).
3. Jagjit Singh. Estimatingand Costing in Civil Engineering. Galgotia Publications, NewDelhi, (1996).
4. B. S. Patil,‖ Civil Engineering Contracts andEstimation‖, Orient Black swan Private Ltd; Fourth edition 2015.

References:

1. Gurcharan singh & Jagdish singh, —Estimating Costing and Valuation‖, Standard Publishers Distributors,2012.
2. Kohli D.D. and Kohli R.C., AText Book of Estimating and Costing (Civil)S. Chand & Company,Limited, New Delhi, 2012.
3. Standard Scheduled Rates and Relevant BIS Codes (SP:27 &BIS: 1200)
4. Rangwala S.C., Elements of Estimatingand Costingin Civil Engineering, Charotar Publishing House, India,Gujarat,

2011.
5. Rangwala S.C., "Valuations of Real Properties"
6. Banerjee D.N., "Principles and Practices of Valuation", Eastern Law House, V Edition, 1998.
7. Vazirani, V.N. and Chandola S.P., "Estimating and Costing", Khanna Publishers, New Delhi.

Course Code	Course Title						Core / Elective
U21CE702	Prestressed Concrete						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
DRCS	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. The aim of this course is to introduce students to the basic principles about structural behaviour, of pre stressed concrete structures, with reference to IS 1343 code
2. The objective is to equip the students with a thorough understanding of the behaviour and analysis, design of prestressed concrete beam, slab and column.
3. Various time dependent factors, such as cracking, creep and shrinkage of concrete, and prestress losses, are discussed thoroughly.
4. Background to design equations and relevant modern research will also be discussed to provide the students with solid understanding of the topics covered.
5. To provide students with an opportunity to enhance their skills in pre stressed concrete design and applications. The specific implication, to the serviceability and ultimate limit states are covered.

Course Outcomes

After Completion of this course, the student will be able to

1. Applythe concept of prestressing and determine the losses of prestress.
2. Analyze the prestressed concrete beam and suggest the cable profile for beam.
3. Analyze the prestressed continuous beam and determine the concordant cable profile.
4. Design the prestressed concrete beam for flexure and shear.
5. Estimate the deflection of a prestressed concrete beam and design the end block.

UNIT – I

Introduction to Prestressed Concrete: Introduction to Prestressed Concrete: Materials - High strength concrete and High tensile steel - Pre-tensioning and Post tensioning methods – Systems of Prestressing.

Losses in Pre stress: Loss of Pre stress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel - Total Loss.

UNIT – II

Analysis of Prestress: Basic assumptions, analysis of prestress, resultant stress, pressure line, kern points, cable profiles, load balancing concept, stress diagrams for prestress, dead load and live load.

UNIT – III

Simply Supported Continuous Beams: Advantages of continuous member – codal provisions, concordant cable profile, analysis of continuous prestressed concrete beams.

Design of Section for Flexure: Analysis of members at ultimate strength: design of rectangular section using IS 1343 Codal Provisions

UNIT – IV

Design of Section for Shear: Analysis for shear - Components of shear resistance - Modes of Failure- Limit State of collapse for shear - Design of transverse reinforcement.IS 1343 Codal Provisions.

End Block: Different anchorage system and design of end block by latest IS codes

UNIT – V

Deflections: Importance of deflections, factors influencing deflections, codal provisions – short-term and long-term deflections of pre-stressed concrete beams with uniformly distributed and point loads.

Text Books:

1. Krishna Raju, N. "Pre stressed Concrete", Tata McGraw Hill Publishing Company, New Delhi 2006
2. Prestressed Concrete by N.Rajasekharan; - Narosa publications
3. Rajagopalan N, "Pre - stressed Concrete", Narosa Publishing House, New Delhi
4. J.R. Libby, Modern prestressed concrete, CBS Publishers, 2007.

References:

1. Praveen Nagarajan, "Advanced Concrete Design", Person Publishers
2. P. Dayaratnam, "Pre stressed Concrete Structures", Scientific International Pvt. Ltd.
3. Lin T Y and Burns N H, 'Design of Pre - stressed Concrete Structures' , John Wiley and Sons, New York
4. Pundit G S and Gupta S P, "Pre - stressed Concrete", C B S Publishers, New Delhi
5. IS: 1343: Indian Standard code of practice for Pre stressed concrete, BIS, New Delhi.
6. Krishna Raju. N., "Pre-stressed Concrete - Problems and Solutions", CBS Publishers and Distributors, Pvt. Ltd., New Delhi.
7. H. Arthur, Nilson, Design of prestressed concrete, Wiley India Pvt.ltd, 2011.

Course Code	Course Title						Core / Elective
U21CE703	FOUNDATION ENGINEERING						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Soil mechanics	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Learn the definition, necessity, types and suitability of different foundation systems.
2. Understandtheprocedures of geotechnical design of foundations.
3. Understand the necessity and usage of different foundation construction related aspects.
4. Learn about different methods of geotechnical investigationsand itsrole in selection and
5. Design of foundations

Course Outcomes

After completion of this course students will be able to

1. Evaluate the bearing capacity of soil and allowable settlement.
2. Analyse the stability of finite and infinite slopes using various methods
3. Examine the earth pressure theories and stability of retaining walls.
4. Analyse the capacity and settlement of shallow foundation.
5. Analyse the capacity and settlement of pile foundation.

UNIT – I

Soil Exploration: Soil exploration, objectives, depth of exploration, significant depth, methods of exploration, various methods of exploration, test pits, types of samples, types of samplers, design of samplers, borings, various methods of boring, geophysical methods, seismic refraction method, electrical resistivity method, penetration tests, standard penetration test, static cone penetration test.

UNIT – II

Stability of Slopes: Introduction and types of slopes, slope failure and its types, stability analysis of infinite slopes, stability analysis of finite slopes, total stress analysis/ Swedish circle method/Bishop's method/ Friction circle method/ Taylor's stability chart.

UNIT – III

Earth Pressure: Introduction and types of earth pressure, earth pressure at rest/ active pressure/ passive pressure, Rankine's theory of earth pressure, Bell's equation, stress variation for C-Φ back fill, depth of tension crack, unsupported depth of excavation, Coulomb's theory, best suitable backfill, graphical methods to determine lateral earth pressure, Rebhann's method/Culmann's method.

UNIT – IV

Shallow foundation: Types of foundations, terminology, types of failures-General shear failure/Local shear failure/Punching shear failure, determination of ultimate bearing capacity, Rankine's theory/Terzaghis's theory/Skempton's theory/Meyerhoff's theory, Effect of type of shear failure/ shape of the footing/water table, Plate load test, corrections for plate load test, under pinning.

UNIT – V

Pile Foundations: Necessity – types based on load transfer mechanism/ material/ method of installation / functional use – Estimation of vertical load carrying capacity of a single pile – static formulae / Dynamic formulae / Pile load tests – Pile groups – necessity– efficiency of Pile groups - estimation of group capacity – Negative Skin friction, introduction to under-reamed piles.

TextBooks:

1. Joseph E.Bowles, "Foundation analysis and Design", McGraw-Hill Publications, 2001.
2. Das, Braja M. "Principles of Foundation Engineering", cengage Publications, 2013
3. Arora, K.R., "Soil Mechanics & Foundation Engineering" Standard Publications, 2009.
4. Varghese, P.C,. "Foundation Engineering", PHI Publications, 2005
5. Bikash Chandra Chatyopadhay, Joyantha Maity Foundation Engineering 2014

References:

1. Basic and Applied Soil Mechanics by Gopal Ranjan & A. S. R. Rao, New age International Publishers,2016.
2. Soil Mechanics and Foundation Engineering byV. N. S. Murthy, CBS Publishers and Distributors, 2007.

3. Principals of Foundation Engineering by Braja, M. Das, Cengage Learning Publishers, 8th Edition, 2016
4. Geotechnical Engineering by S. K. Gulhati& Manoj Datta – Tata McGraw Hill Publishing company NewDelhi. 2005.
5. Pile Foundations in Engineering Practice by Shamser Prakash
6. Foundation Engineering by Pardeep Kumar Gupta
7. Advanced Foundation Engineering, V.N.S.Murthy

Course Code	Course Title						Core / Elective
U21CE704	DESIGN OF STEEL STRUCTURES						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3

Course Objectives

1. Learn and apply the design philosophies (working stress method and limit state method) for various steel structural components and their connections, as per the relevant standards
2. To understand the behavior of compression members and design column bases
3. To understand the modes of failure of tension members.
4. To understand the behavior of flexural members in the industry.
5. Learn the Behavior of trusses and design of purlins.

Course Outcomes

After completion of the course the student will be able to:

1. Design Bolted and Welded Connection, both simple and eccentric.
2. Design thetension members.
3. Design the Flexural member.
4. Design a column and column base.
5. Analyse and design a roof truss for Gravity loads and wind loads.

UNIT – I

Materials and Specifications: Chemical composition of steel, types of Structural Steel, Residual stresses, Stress Concentration.

Basis of Structural Design: Codes and Specifications, Design Philosophies, working Stress Method, Limit State Method.

Loading and Load Combinations: Characteristic Loads, Dead Loads, Imposed Loads, Earthquake Loads, Wind Loads and Load Combinations. Partial safety factors for materials and loads.

Bolted Connections (Limit state method): Bolted Connections, Behavior of Bolted Joints, Design Strength of Ordinary Black Bolts, Design Strength of High Strength Friction Grip Bolts, Pin Connections, Simple Connections and Eccentric Connections.

Welded Connections (Limit State Method): Advantages of Welding, Types of Welds and Joints, Simple Connections and Eccentric Connections.

UNIT – II

Design of Tension Members (Limit State Method): Types of Tension Members, Design of Strands, Slenderness Ratio, Modes of Failure, Factors Effecting Strength of Tension Members, Design of Tension Members (Angles, Other sections and Rods), Lug Angles, Tension Member Splice.

UNIT – III

Design of Beams (Limit State Method): Types of Beams, Section Classification, Lateral Stability of Beams, Buckling of Real Beams, Behavior of Beams in Bending, Design of Laterally Supported and Unsupported Beams, Design of Compound Beams, Shear Strength of Beams, Maximum Deflection, Web Buckling and Web Crippling.

UNIT – IV

Design of Compression Members (Limit State Method): Introduction, Possible Failure Modes, Behavior of Compression Members, Elastic Buckling of Slender Compression Members, Behavior of Real Compression Members, Sections of Compression Members, Effective Length, Design of Compression Members with Single Section and Built-up Sections (Symmetric in both directions), Lacing and Battening, Column Splices. Design of Column Bases (Limit state method): Design of Slab Base and Gusseted Base for Column.

UNIT – V

Design of Roof Trusses (Limit State Method): Types of Trusses, End Bearings, Spacing of Trusses and Purlins, Estimation of Loads with different Roof Coverings, Self-weight of Truss, Wind Effects, Design of I-Section Purlins for Dead Load, Imposed Load and Wind Loads.

Text Books:

1. Subramanian. N, Design of Steel Structures, Oxford University Press, 2008.
2. Duggal S.K., Design of Steel Structures, 3rd Edition, Tata McGraw Hill Publishing, 2017.
3. Shiyekar M.R, Limit State Design in Structural Steel, 2nd Edition, PHI Learning Pvt. Ltd.,2013.
4. Steel Structures, Design & Behavior, By Salmon and Johnson

References:

1. Bhavikatti , S.S., Design of Steel Structures, 5th Edition, I.K. International Publishing HousePvt. Ltd. 2017.
2. P. Dayaratnam , Design of Steel Structures, S. Chand & Co. New Delhi, 2012.
3. IS- 800-2007 " General Construction in steel - Code of Practice" Bureau of Indian Standards,New Delhi, India.
4. Design of Steel Structures by Gaylord & Gaylord.
5. Kazim S M A and Jindal R S, "Design of Steel Structures", Prentice Hall of India, New Delhi.
6. IS 875 (Part 1): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 1 Dead Loads - Unit Weights of Building Materialsand Stored Materials, Bureau of Indian Standards, New Delhi.
7. IS 875 (Part 2): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 2 Imposed Loads, Bureau of Indian Standards, New Delhi.
8. IS 875 (Part 3): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 3 Wind Loads, Bureau of Indian Standards, New Delhi.

Course Code	Course Title						Core / Elective
U21CE705	CONTRACTS MANAGEMENT						PEC-3
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. To make students understand various contracts, their suitability and the procurement process involved in construction projects.
2. Acquire knowledge on various types of contracts used in construction
3. To make the student understand the process of tendering
4. To make student capable of understanding and reviewing various provisions included in the contract for effective management of the projects
5. To make the student understand various contract management processes involved in construction projects

Course Outcomes

After Completion of this course, the student will be able to

1. Learn the fundamentals of legal systems in construction.
2. Decide suitable contracts for a given project scenario and stakeholders of contract
3. Judge best form of contract for a specific project and design performance parameters
4. Summarize tender processing and assess various contractual provisions in a tender documents and develop bidding strategy
5. Formulate contract management processes involved in construction projects

UNIT – I

Introduction to Construction Contracts: Definitions and different type of construction contracts: Lump sum contracts, fixed price contracts, Percentage rate contracts, Cost plus contracts, Target contracts, Design-Build contracts. Condition of Contract, Parties to a Contract, Contract Formation, Advantages and disadvantages of Construction Contract

UNIT – II

Tendering: Definitions of tendering, tender form, tender documents, notice inviting tenders, work order. EOI, RFQ & RFP, Prequalification process, Project Delivery Methods: BOT, SBOO, BOOT, Tender submission and evaluation, Public Private Partnership (PPP), Detailed Project Report (DPR), Tender rejection, Contract agreement & contract documents.

UNIT – III

Contracts Clauses: Definitions of contract Clauses, General conditions & special conditions, Contract Documents, Contract conditions for payments, Time delay, Scope changes, Extra claims, Dispute Resolution, Termination of contracts, Insurance and Indemnity, Performance Bonds and Guarantees, Review and Conclusion, subcontracting.

UNIT – IV

Contract Administration: Elements of contract management, Major stake holders in construction contracts, Contract administration; Duties and responsibilities of parties, Stake holder agreements, Contract risk management, Management reporting, Dispute resolution mechanisms: Negotiation, Mediation

UNIT – V

Legal Issues in Contract: Definition and legal issues in contract, Essential requirement of a contract as per Indian Contract Act 1872, Characteristics of a good contract, Legal enforceability of contract, Breach & termination of contracts, Major stake holders in construction contracts, Overview of Activities in Contract Management.

Text Books:

1. Keith Collier, "Construction Contracts" Reston Publishing Company, Inc, Reston,Verginia.
2. Patil, B.S., "Building and Engineering Contracts" Mrs. S.B. Patil, Pune.
3. John Murdoch & Will Hughes, Construction Contracts - Law and Management" Spon Press, Taylor & Francis Group.
4. Gajerai, G.T., "Lawrelating to Building and Engineering Contracts in India" Butterworths
5. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000

References:

1. Govt of India, Central Public Works Department, "CPWD Works Manual 2003."

2. Govt of India, Central Public Works Department, "CPWD 7/8: General Conditions of Contracts."
3. V. K. Raina, Raina's Construction and Contract Management Vol.1 (Second Edition), SPD Publishers, 2009
4. JimmieHinze, Construction Contracts, Mc Graw Hill,2001.
5. Kwaku,A.,Tenah,P.E.JoseM.Guevara,P.E.,FundamentalsofConstructionManagementandOrganisation,Printice Hall, 1985.M.M.Tripathi Private Ltd., Bombay, 1982.
6. Patil.B.S ,Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited,2006.
7. Indian Contract Act 1892

Course Code	Course Title						Core / Elective
U21CE706	Advanced Concrete Technology						PEC-3
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Concrete Technology	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. To recognize the effects of the rheology and early age properties of concrete on its long-term behavior
2. Develop an advanced knowledge of durability and performance of cement concrete and how it can be controlled
3. Understand the importance of various mix designs and quality control of concrete
4. Impart the methods of proportioning of concrete mixtures
5. Understand factors affecting the strength, workability and durability of concrete

Course Outcomes

After Completion of this course, the student will be able to

1. Describe Elasticity, Creep and Shrinkage properties of concrete
2. Explain the importance of durability of concrete in various environments
3. Design and develop a concrete mix design for international codes.
4. Determine the application and use of various special concrete and formwork
5. Gain ideas on non-destructive testing of concrete

UNIT – I

Introduction to micro structure of concrete- Hydrated Cement Paste-calcium silicate hydrate and calcium hydroxide, Aggregate Phase, Voids, Water-capillary water, adsorbed water, interlayer water, Interfacial Zone-significance, Relationship between microstructure and properties of concrete. Micro structure variation with time, Micro structural aspects of special concretes.

UNIT – II

Durability of concrete- Durability concept, factors affecting, reinforcement corrosion, fire resistance, frost damage, sulfate attack, chloride attack, creep and shrinkage, deterioration of concrete, alkali silica reaction, concrete in sea water, quality control, acceptance criteria as per BIS code Durability aspects of special concrete-High strength concrete, Self compacting concrete, Geopolymer concrete, Self curing concrete.

UNIT – III

MIX DESIGN & QUALITY CONTROL: ACI method of mix design and British DoE method of mix design of mix, Acceptance criteria for compressive strength and flexural strength. Factors causing variation in the quality of concrete-Advantages of quality control

UNIT – IV

Special processes and technology for particular types of structure - Sprayed concrete; underwater concrete, mass concrete; slip form construction, Prefabrication techniques, Precast concrete and its ingredients, MIVAN shuttering, 3 D Printing in construction

UNIT – V

Concrete Fracture Mechanics Introduction Linear Elastic Fracture Mechanics, The Crack Tip Plastic Zone, Crack Tip Opening Displacement Fracture Process in Concrete Nonlinear Fracture Mechanics for Concrete Two-Parameter Fracture Model Size Effect Model The Fictitious Model by Hillerborg R-Curve Method for Quasi-Brittle Materials.

Text books:

1. Advanced concrete technology", Zongjin Li JOHN WILEY & SONS, INC Publisher.
2. Job Thomas., " Concrete Technology", Cenage learning,
3. R. Santhakumar ,, Concrete Technology", Oxford Universities Press, 2006
4. Shetty M. S., Concrete Technology", S. Chand & Co., 2006
5. Concrete Technology by M.L.Gambhir.–TataMc.GrawHillPublishers, New Delhi

References:

1. Mehta and Monteiro, „Concrete-Micro structure, Properties and Materials", McGraw Hill Professional
2. Neville A. M. and Brooks J. J., Concrete Technology, Pearson Education, 2010
3. Lea, Chemistry of Cement and Concrete", Butterworth-Heinemann Ltd, 5e, 2017
4. Bungey, Millard, Grantham – Testing of Concrete in Structures- Taylor and Francis, 2006
5. Design of Concrete Mixes by N.KrishnaRaju,CBS Publications,2000.
6. Concrete:Micro Structure,Properties and Materials byP.K.MehtaandP.J.Monteiro,.Mc.Gr aw-Hill Publishing Company Ltd.NewDelhi
7. Special Structural concretes by Rafat Siddique, Galgotia Publicatio

Course Code	Course Title						Core / Elective
U21CE707	ADVANCED RCC DESIGN						PEC-3
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
DRCS	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. To Understand the design of curved beams in plan
2. To understand the Analysis and Design and Detailing of Deep Beams.
3. To understand the behaviour of Domes, Circular slabs and their design.
4. To understand the design principles of Flat Slabs and Retaining walls.
5. To impart knowledge regarding the analysis and design of various typesof RCC tanks for storage of liquids

Course Outcomes

After Completion of this course, the student will be able to

1. Analyse and Design the beams curved and plan and design of Deep beams.
2. Analyse and Design the Domes and Circular Slabs.
3. Design of Flat slab system and retaining walls
4. Design of raft foundations.
5. Design underground and overhead RCC Rectangular and circular tanks.

UNIT – I

Beams curved in plan: Introduction – Design Principles – Structural Design of beams curved in plan of circular and rectangular types

Deep Beams: Introduction – flexural and shear stresses in deep beams. – I.S. Code provisions – design of Deep beams

UNIT – II

Domes: Introduction, Nature of Stresses in Spherical Domes, Analysis of Spherical Domes, Stresses due to Wind load, Design of RC Domes.

Circular Slabs: Introduction, Slabs freely supported at edges and carrying UDL, Slabs fixed at edges and carrying UDL, Slabs simply supported at the edges with load UDL w Uniformly distributed along the circumference of a concentric circle, design of circular slabs.

UNIT – III

Flat slabs: Introduction, Components- I.S. Code Provisions – Design methods, Design for flexure and shear – Openings in Flat slabs

Retaining Walls: Retaining Walls. Types of retaining walls. Analysis and Design of Cantilever Retaining walls and counterfort retaining wall

UNIT – IV

Raft Foundations: Definitions, Types – Mat and Raft Foundation. – Structural analysis and design of Raft foundation for buildings with column grids up to three bays and two row of columns

UNIT – V

Water Tanks: Elastic Design and Detailing for RCC circular and Rectangular ground level and overhead tank. Intze tanks.

Text Books:

1.N.Krishna Raju, Advanced Reinforced Concrete Design, CBS Publishers 2016

2.H.J. Shah, Reinforced Concrete, Charoat Publishers.

3.P.C.Varghese, Advanced Reinforced Concrte Design, PHI, 2001.

4.B. C. Punmia, ―Reinforced concrete structures‖, 7th Edition, Laxmi Publications, 1992.

References:

1. A Nilson, D Darwin, C Dolan Design of Concrete Structures, McGraw-Hill Education; 14 edition (16 August 2009), 816 pages.

2. S. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design, 3rd Edition, 2009,Tata Mcgraw Hill.

3. IS: 456-2000, ―Code of Practice for Plain and Reinforced concrete‖, Bureau of Indian Standards, New Delhi, India

4. IS: 3370-2009 Part (I to IV), ―Concrete Structures for Storage of Liquids – Code ofPractice‖, Bureau of Indian Standards, New Delhi, India.

5. Design of Steel Structures, By Ram Chandra and Virendra Gehlot vol-II, 2007.

6. Design of Steel Structures, By Duggal - Tata McGraw-Hill publishers – 2010

7. Bhavikatti S. S. "Advance RCC Design", 3 rd Edition, New Age International PrivateLimited, 2008

Course Code	Course Title						Core / Elective
U21CE708	Traffic Engineering and management						PEC-3
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Transportation Engineering	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Introduce fundamental knowledge of traffic engineering
2. Deal with traffic issues including safety, planning, design, operation and control.
3. Describe basic techniques for collecting and analyzing traffic data, diagnosing problems.
4. Understand the highway capacity and performance characteristics
5. Learn the concepts of traffic design and regulations.

Course Outcomes

After Completion of this course, the student will be able to

1. Undertake various types of road traffic studies
2. Use of statistical concepts Applications in traffic engineering
3. Suggest preventive measures to avoid accidents by analyzing the traffic conditions at site.
4. Identify traffic stream characteristics and level of service
5. Design a pre-timed signalized intersection, and determine the signal splits

UNIT - I:

Basic Aspects of Traffic Engineering Aim of traffic engineering, traffic stream components and characteristics, road user characteristics, vehicle characteristics, acceleration characteristics, measure of quality, measures of separation, relationship among traffic parameters and empirical relationships, mechanics of traffic flow, macroscopic approach, microscopic approach and human factors approach, discrete distributions, binomial distribution, Poisson's distribution, exponential distribution, exponential distribution, normal distribution.

UNIT - II:

Traffic Studies, Measurement and Analysis; Volume studies, speed studies, parking studies, Accident studies. Travel forecasting principles and techniques, design hourly volumes and speed, origin and destination studies, presentation of data and analysis, testing of hypothesis relating to improvements.

UNIT - III:

Travel Time amid Delay Studies; Various uses, travel time and delay studies, various methods, data collection and analysis, density studies and headways, gap acceptance studies, intersection delay studies, traffic flow theory, queuing theory and simulation models.

UNIT - IV:

Capacity Analysis of Traffic Facilities; Uninterrupted facilities, interrupted facilities, Level of Service, quality of service as per HCM, factors affecting LOS, computation of capacity and LOS, Measure of effectiveness, highway capacity and performance characteristics, intersection design.

UNIT - V:

Traffic Control, Design and Regulation; Traffic signals, types, principles of phasing, tune diagram, signalized intersection, saturation flow, saturation headway, capacity of lane group, concept of critical lane group, signal timing, phase plan, phase diagram, splitting of phase, clearance interval, pedestrian requirement, guidelines for protected movements, signal coordination, emerging themes, inter-modalism, access management, congestion management, environmental impact assessment.

Text Books:

1. McShane, W.R., Roess, R.P. and Prassas, E.S., Traffic Engineering. Prentice Hall, Engle wood Cliffs,1997.
2. Highway Capacity Manual, Transportation Research Board, National Research Council, Washington, D.C.,2000.
3. Daganzo, C.R, Fundamentals of Transportation and Traffic Operations, Pergamon, Elsevier Science Inc.,New York,1997.
4. Traffic and Highway Engineering, Nicholas J. Garber, and Lester A. Hoel, Cengage Learning India, 2015, Fifth Edition.

References:

1. Salter, R.J., Traffic Engineering: Worked Examples, Macmillan, London,1989.
2. Pignataro, L.J., Traffic Engineering: Theory and Practice, Prentice Hall, Englewood lifts,1973.
3. Wohl, M. and Martin, B.V, Traffic System Analysis for Engineers and Planners, McGraw Hill,New York,1983.
4. Drew, D.R., Traffic Flow Theory, McGraw Hill, New York,1964
5. Traffic Engineering, Roger P. Roess, Elena S. Prassas, and William R. McShane, Pearson, 2019, Fifth Edition.
6. Demanding Traffic Control and Management in Next Generation Networks, Hamada Alshaer, Lap Lambert Academic Publishing, 2010.

Course Code	Course Title					Core / Elective
U21CE7P1	Mini Project					Core
Prerequisite	Contact Hours per Week			CIE	SEE	Credits
	L	T	P			
Internship	-	-	6	50	50	3

Course Objectives

The objectives of this course is to:

1. Enhance practical and professional skills.
2. Familiarize tools and techniques of systematic literature survey and documentation.
3. Expose the students to industry practices and team work
4. Encourage students to work with innovative and entrepreneurial ideas and its implementation.
5. Make students evaluate different solutions based on economic and technical feasibility

Course Outcomes

After Completion of this course, the student will be able to

1. Formulate a specific problem and give valuable and economical solution
2. Develop model/models either theoretical/practical/numerical form.
3. Solve, interpret/correlate the results and discussions
4. Conclude the results obtained
5. Write the documentation in standard format

Guidelines:

1. As part of the curriculum in the VII-semester of the programme each student shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.

2. Four students will be allotted to one faculty supervisor for mentoring.

3. Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.

4. Mini projects shall have inter-disciplinary/ industry relevance, which can be implemented practically.

5. The students can select a mathematical modelling based/Experimental investigations or Numerical modelling.

6. All the investigations should be clearly stated and documented with the reasons/ explanations/ Justifications.

7. The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and reference.

8. Project Review Committee: Supervisor and a minimum of two faculty members.

9. There shall be Continuous Internal Evaluation (CIE) for 50 marks and End Semester Examination for 50 marks.

10. Below mentioned Guidelines for awarding the marks both applicable for CIE & SEE

Guidelines for awarding the marks:		
Sl no.	**Description**	**Max Marks**
1	Contents and relevance	10
2	Presentation skills	10
3	Preparation of PPT slides	05
4	Questions and answers	05
5	Report in a prescribed format	20
Total Marks		**50**

Course Code	Course Title						Core / Elective
U21CE7L1	**Computer Application Lab**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
	2	**-**	**-**	**-**	**25**	**50**	**1**

Course Objectives

The objectives of this course is to:

1. To understand the application of software in Civil engineering.
2. To Analyze and Design of structural members using Excel.
3. To Use software knowledge for solving fluid mechanics &geotechnical related problems.
4. To introduce the civil engineering-based software Staad pro.

Course Outcomes

After Completion of this course, the student will be able to

1. Demonstrate the software skills to solve civil engineering related analysis and design
2. Make use of software tool to analyzeand design of RCC beams usinglimit state design
3. Develop computer programs for structural engineeringproblems
4. Analyze and solve problems related to hydraulic structures using software
5. Solve the bearing capacity and other geotechnical related problems using software.
6. Make use of Civil Engineering software STAAD PRO for analysis and design of basic elements of structure

List of Experiments to be performed:

1. Demonstration and explanation on basic commands used in Staad.pro
2. Analysis & Design determinate structures using software.
3. Analysis and design of fixed and continuous beam using software.
4. Analysis & Design of Plane Frames using STAAD Pro.
5. Analysis & Design of space frames subjected to DL & LL.
6. Analysis and design of simple steel truss using STAAD Pro.
7. Analysis and design of residential building subjected to all loads (DL, LL, WL, EL).
8. Demonstration of administrator settings of Geostudio
9. Analysis of slope stability with homogeneous and stratified soil condition.
10. Stability of slope with retaining wall
11. Settlement analysis of spread footing
12. Analysis of single pile settlement

List of Software Required

1. Staad.pro - Licensed version.
2. GEO5 - Educational version

Text Books:

1. P. Kumar Mehta and Paulo JM Monterio , „Concrete Microstructure properties and materials‟, Tata McGraw-hill Education, 2009.
2. CBRI, Building materials and components, India, 1990
3. https://www.finesoftware.eu/geotechnical-software/engineering-manuals/

References:

1. Gerostiza C.Z., Hendrikson C. and Rehat D.R., “Knowledge based process planning for construction and manufacturing”, Academic Press Inc., 1994
2. Koncz T., “Manual of precast concrete construction”, Vol. I, II and III, Bauverlag, GMBH, 1976.
3. “Structural design manual”, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009
4. SP 36 (Part-II): 1987 Compendium of Indian Standard on Soil Engineering: Part-I & II (Laboratory & Field) testing of soils Civil Engineering purposes.

Course Code	Course Title						Core / Elective
U21CE711	Environmental Systems						OEC-3
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Analyze the physical, chemical and biological processes in environmental systems.
2. Formulate and solve governing equations for pollutant transport.
3. Analyze the engineering transport system.
4. Plan and analyze treatment systems.

Course Outcomes

After Completion of this course, the student will be able to

1. Identify an appropriate method of treatment process.
2. Design of treatment units for population growth.
3. Identify the appropriate transport systems.
4. Design and analysis of treatment systems.

UNIT – I

Basic concepts of mole and mass concentration: notations and conventions, Review of mass balance concepts.
Diffusive transport: Diffusion and Fick's first law, Calculation of molecular diffusion coefficients in air and water.

UNIT – II

Constitutive transport equation: Derivation of general transport equation and special forms i.e. continuity and NS equations and similarity between equations of mass momentum and heat dispersion laws.
Theories of mass transport: Two film theory, penetration and surface renewal theory, Boundarylayer theory.
Mass transport correlations.

UNIT – III

Transport in sheared reactors: Fluid shear and turbulence, transport in steadysheared fluids, turbulent sheared fluids, shear rates in mixed reactors.
Particles and fractals: Introductions, particle size spectra, solid particles and fractal aggregate geometries, measuring and calculating fractal dimensions from particle size distributions.

UNIT – IV

Coagulation in natural and engineered systems: Introduction, general coagulation equations, factors affecting the stability of aquasols, coagulation kinetics, fractal coagulation models.

UNIT – V

Finite Differences: Finite difference and Finite volume procedures for solutions of partial differential equations of Mass, Momentum and Energy transport phenomenon

Text Books:

1. Environmental Transport Processes, Bruce E. Logan, 2nd Ed., Wiley, 2012
2. Introduction to chemical transport in the environment, John S. Gulliver, Cambridge University Press, 2007
3. V. M. Eulersand E. W. Steel, "Municipal and Rural Sanitation", 6th Ed., McGraw Hill Book Company, 1965
4. F. B. Wright, "Rural Water Supplyand Sanitation", 3rd Revised edition, McGraw-Hill Inc.,US, 1977

References:

1. Diffusion: Masstransfer in fluid systems, E.L. Cussler, 3rd Ed., Cambridge University Press, 2007.
2. Chemo dynamics and Environmental Modeling S. Trapp and M. Matthies, , Springer, 1998
3. Mathematics of Diffusion, Crank, J., 2nd Edition, Oxford University Press, 1975
4. Manual of water supplyand treatment, 3rd edition, CPHEEO, GOI, New Delhi.
5. "Manual on Water Supplyand Treatment", Ministry of Urban Development, New Delhi.
6. Manual on Sewerage and Sewage Treatment Systems, Part A, B and C", Central Public Health and Environmental Engineering Organization, Ministry of Urban Development.

Course Code	Course Title						Core / Elective
U21CE712	Urban Transportation System						OEC3
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Transportation Engineering	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. To discuss various urban transportation systems planning process and its components
2. To understand a variety of travel surveys and data collection procedures
3. To understand Concept of trip generation and trip distribution
4. To review different travel demand forecasting models
5. To understand computer application in Transportation planning.

Course Outcomes

After Completion of this course, the student will be able to

1. Apply the fundamental knowledge for forecasting and creating the transportation infrastructure facilities scientifically and ethically by collecting the appropriate sample data.
2. Identify the procedures for collecting the traffic related data for generating and validating transport demand models.
3. Apply four stage transportation demand modeling by creating mathematical models to understand the travel pattern and behavior of road users.
4. Apply the mathematical knowledge in solving the transportation planning related problems by analyzing transportation data.
5. Evaluate highway projects by using different economic methods and understand the role of computer applications in transportation planning.

UNIT - I:

Introduction to concepts of transportation planning process, interdependence of the land use and traffic, systems approach to transportation planning, stages in transportation planning, survey and analysis of existing conditions, forecast analysis of future conditions and plan synthesis, evaluation, program adoption and implementation.

UNIT - II:

Transportation Surveys – Introduction, definition of the study area, zoning, types of surveys, home interview, commercial vehicle, taxis, roadside interview, registration number of vehicle plate, tags on vehicles, mass transport, and analyzing the data from samples.

UNIT - III:

Trip Generation – Introduction and definition, trip purpose, factors governing trip production and attraction rates, regression methods – multiple linear regression analysis. Trip Distribution – concepts of trip distribution, methods of trip distribution, uniform (constant) factor method, average factor method, Fratar method, Furness method, advantages and disadvantages of growth factor methods, the gravity model.

UNIT - IV:

Modal split – General considerations, factors affecting modal split, modal split in the transportation planning process. Traffic assignment – purpose of traffic assignment, general principles, assignment techniques, all or nothing assignment, multiple route assignment, capacity restraint assignment, diversion curves.

UNIT - V:

Economic evaluation of highway projects – need, basics principles, methods - benefit cost ratio, net present value, First year rate of return and internal rate of return – comparison, Computer applications in Transportation planning, Potential areas of Highway Expansion

Text Books:

1) B. G. Hutchinson, "Principles of Urban Transport Systems Planning", McGraw –Hill, Newyork, 1974.

2) C. S. Papacostas and P. D. Prevedouros, "Transportation Engineering and Planning", Pearson education India,2015.

References:

1) L.R. Kadiyali "**Traffic Engineering and Transportation Planning**" Khanna Publishers, 2011.

2) Sarkar, Pradip Kumar, Maitri, Vinay, Joshi, G.J. "Transport Planning: Principles, Practice and Policies"PHILearning, 2017.

3) KhannaS.K.,JustoC.E.G.,VeeraraghavanA.,"**HighwayEngineering**",10thEdition, NemChand&Bros,2015.

4) R. Srinivasa Kumar ,**Transportation Engineering** (Railways, Airport,) Universities Press, 2014

LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institute)
DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF INSTRUCTION & EXAMINATION [LR-21]
(W.e.f Academic Year 2024 – 25)
B.E. VIII-Semester

S. No.	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			Credits
				L	T	P/D	Contact Hours/Week	CIE	SEE	Duration in Hours	
Theory Course											
1	-	PEC	Professional Elective-IV	3	-	-	3	40	60	3	3
2	-	PEC	Professional Elective-V	3	-	-	3	40	60	3	3
3	-	OEC	Open Elective – IV	3	-	-	3	40	60	3	3
Project											
4	U21CE8P1	PROJ	Project	-	-	16	16	50	150	-	8
5	U21CE8P2	PROJ	Comprehensive viva-voce	-	-	4	4	100	-	-	2
Total				**9**	**-**	**20**	**29**	**270**	**330**	**9**	**19.0**

L: Lecture (Hrs/Wk/Sem) **T**: Tutorial (Hrs/Wk/Sem) **P**: Practical **D**: Drawing (Hrs/Wk/Sem)
CIE: Continuous Internal Evaluation **SEE**: Semester End Examination (Univ. Exam)
PEC: Professional Elective Courses **OEC:** Open Elective Courses **PROJ:** Project
CE: Civil Engineering

Note:
1. Each contact hour is a Clock Hour.
2. The duration of the practical class is three hours, however it can be extended wherever necessary, to enable the student to complete the experiment

LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institute)
DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF INSTRUCTION & EXAMINATION [LR-21]
Professional Elective Courses

S. No.	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			Credits
				L	T	P/ D	Contact Hours/Week	CIE	SEE	Duration in Hours	
Theory Course											
1	U21CE506	PEC 1	Building Construction Practice	3	-	-	3	40	60	3	3
	U21CE507		Advanced Surveying	3	-	-	3	40	60	3	3
	U21CE508		Air and Noise Pollution Control	3	-	-	3	40	60	3	3
	U21CE509		Urban Transportation Planning	3	-	-	3	40	60	3	3
2	U21CE604	PEC 2	Construction Project and Planning	3	-	-	3	40	60	3	3
	U21CE605		Sustainable Construction Methods	3	-	-	3	40	60	3	3
	U21CE606		Solid and Hazardous Waste Management	3	-	-	3	40	60	3	3
	U21CE607		Public Transportation Systems	3	-	-	3	40	60	3	3
3	U21CE705	PEC 3	Contracts Management	3	-	-	3	40	60	3	3
	U21CE706		Advanced Concrete Technology	3	-	-	3	40	60	3	3
	U21CE707		Advanced RCC Design	3	-	-	3	40	60	3	3
	U21CE708		Traffic Engineering and Management	3	-	-	3	40	60	3	3
4	U21CE801	PEC 4	Ground Improvement Techniques	3	-	-	3	40	60	3	3
	U21CE802		Repair and Rehabilitation of Structures	3	-	-	3	40	60	3	3
	U21CE803		Environmental Impact Assessment	3	-	-	3	40	60	3	3
	U21CE804		Intelligent Transport Systems	3	-	-	3	40	60	3	3
5	U21CE805	PEC 5	Surface Hydrology	3	-	-	3	40	60	3	3
	U21CE808		Finite Elements Methods	3	-	-	3	40	60	3	3
	U21CE809		GIS and Remote Sensing	3	-	-	3	40	60	3	3
	U21CE810		Infrastructure Engineering	3	-	-	3	40	60	3	3

Professional Electives with 5 Threads

S.No.	PE 1	PE 2	PE 3	PE 4	PE 5
1.	Building Construction Practice	Construction Project and Planning	Contracts Management	Ground Improvement Techniques	Surface Hydrology
2.	Advanced Surveying	Sustainable Construction Methods	Advanced Concrete Technology	Repair and Rehabilitation of Structures	Finite Elements Methods
3.	Air and Noise Pollution Control	Solid and Hazardous Waste Management	Advanced RCC Desig	Environmental Impact Assessment	GIS and RemoteSensing
4.	Urban Transportation Planning	Public Transportation Systems	Traffic Engineering and Management	Intelligent Transport Systems	Infrastructure Engineering

S. No.	Course Code	Category	Course Title
3	U21EE711	OEC 3	Introduction to Electrical Vehicles
	U21EE712		Design estimation and Costing of Electrical Systems
	U21CS711		Data Sciences
	U21IT705		Basics of Artificial Intelligence
	U21ME711		Renewable Energy Resources
	U21ME712		Cooling of Electronic Components
	U21CE711		**Environmental Systems****
	U21CE712		**Urban Transportation System****
	U21EC703		IOT and its protocols
	U21EC704		Television and Video Engineering
	U21MB702		Logistics Management
	U21MB703		Management of Start Up's
	U21SH701		Display Devices
	U21SH702		Comparative Study of Literature

S. No.	Course Code	Category	Course Title
4	U21EE804	OEC 4	Smart Building Systems
	U21EE805		Industrial Automation
	U21CS806		Basics of Machine Learning
	U21IT802		Cloud computing
	U21ME806		Automobile Engineering
	U21ME807		Power Plant Engineering
	U21CE806		**Green Building Technology****
	U21CE807		**Environmental Impact Assessment****
	U21EC805		Fundamentals of Wireless Communication
	U21EC806		Fundamental Digital Design using Verilog HDL
	U21MB802		Entrepreneurship
	U21MB803		E - Marketing
	U21SH801		Corrosion Science and Technology
	U21SH802		Introduction To Philosophical Thoughts

*Open Elective subjects not offered to the students of Civil Department.

Course Code	Course Title						Core / Elective
U21CE801	GROUND IMPROVEMENT TECHNIQUES						PEC-4
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Soil Mechanics	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. To understand the objectives, necessity and scope of ground improvement
2. To know different methods of insitu densification of cohesive / cohesion less grounds
3. To understand the need of ground improvement techniques
4. To know about the different techniques involved in densifying the soils

Course Outcomes

After Completion of this course, the student will be able to

1. To discuss different methods of insitu densification of cohesive / cohesion less grounds
2. Selection of ideal ground improvement technique appropriate for a given ground conditions
3. Competence in dealing with the applications of ground improvement in Infrastructure Engineering projects
4. knowledge about genesis and classification of Geosynthetic products
5. Identify the type of techniques required for various soils

UNIT – I

Introduction: Objectives and necessity of Ground Improvement – Formation of Rock and soils – Alteration of ground after its formation – Reclaimed soils – Ground improvement potential – Geotechnical processes.

UNIT – II

Cohesion less Soils: Densification of Cohesion less Soils: Surface and deep compaction –Vibration methods – Vibro-compaction, vibro-displacement, vibro-replacement methods.

UNIT – III

Cohesive Soils: Densification of Cohesive Soils: Drainage methods – selection of pumps and accessories, Pre- compression methods – consolidation properties of soils – Pre-loading technique – consolidation acceleration methods - consolidation aided with vertical drains – Sand Drains - Pre-fabricated vertical drains, Consolidation by Electro-osmosis and vacuum compression methods, Compression monitoring.

UNIT – IV

Grouting: Aspects of grouting – Types of grouting materials – grouting procedure – Applications of grouting in ground improvement Soil Stabilization: Types and suitability of stabilization methods - Mechanical, Cementing methods – Aggregates and dispersants – Stabilization procedure – quality control in Soil Stabilization.

UNIT – V

Reinforced Earth: Concept reinforced earth of– Types and suitability of reinforcement material -fiber reinforced earth– factors affecting reinforced earth.

Geo-Synthetics: Classification of Geosynthetics – Functions and applications –Concept of design by function. Reinforced Soil Walls – Gabions.

Text Books:

1. H.R. Hausmann, Principles of Ground Modification, Mc-Graw Hill Publications
2. Hausman, M. R. (1990). ―Engineering Principles of Ground Modification‖ Mc Graw Hills
3. P.Nicholson, Soil Improvement and Ground Modification Methods, Butterworth Heinemann Ltd.
4. Purushothama Raj, P. (2014). ―Ground Improvement Techniques‖. Lami Publishers (P), Ltd. New Delhi
5. R.M.Koerner, Designing with Geosynthetics, Prentice Hall Inc
6. Fang.H.S., (1985), Foundation Engineering Hand Book, CBS Publications

References:

1. Abusharar, S. and Han, J. (2011). Two-dimensional Deep-seated Slope Stability Analysis of Embankments overStone Columns. Engineering Geology,
2. Baez, J.I. and Martin, G.R. (1992). Quantitative Evaluation of Stone Column Techniques for Earthquake Liquefaction Mitigation. Proc. Tenth World Conference on Earthquake Engineering, A.A. Balkema, Brookfield,
3. Baez, J.I. (1993). Advances in the Design of Vibro Systems for the Improvement of Liquefaction Resistance. Proc.Symposium on Ground Improvement, Vancouver, British Columbia.
4. Collin, J.G. (2007). Evaluation of Rammed Aggregate Piers by Geopier Foundation Company Final Report, Technical Evaluation Report prepared bythe Highway Innovative Technology Evaluation Center, ASCE, 86p.

Course Code	Course Title						Core / Elective
U21CE802	Repair and Rehabilitation of structures						PEC-4
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Understand the basic concepts of deterioration of structures
2. Understand the corrosion aspect of steel structures
3. Learning the principle of retrofit techniques
4. Various repair techniques and rehabilitation methods.
5. Maintenance and causes for distress.

Course Outcomes

After Completion of this course, the student will be able to

1. Diagnosis and suggest methods to repair of cracks in structures.
2. Diagnosis and suggest methods to prevent deterioration of structures.
3. Diagnosis and suggest methods to Strengthen of Existing Structures.
4. Understand the repairing techniques and strengthen the existing masonry structures.
5. Identify a suitable technique for repair & rehabilitation of a structure and develop a practical solution for the problem.

UNIT – I

Introduction to Building Maintenance: Definitions of repair, renovation, remodelling, restoration, retrofitting and rehabilitation. Need for maintenance, types of maintenance, routine maintenance works in buildings.

Types of Defects and Damages in Structures: During pre-construction stage, construction stage and post construction stage. Cracks – Types, Causes and Characteristics.

UNIT – II

Mechanisms of Deterioration of Structures & Their Prevention: Concrete Structures: Defects in fresh concrete- Early frost damage, plastic shrinkage, plastic settlement (subsidence), subgrade settlement, formwork movements. Deterioration in hardened concrete: (a) Physical causes - aggregate shrinkage, drying shrinkage, crazing (b) Chemical causes: acid attack, sulphate attack, chloride attack, carbonation, alkali aggregate reaction, corrosion of reinforcement, (c) Thermal causes: Freeze-thaw, temperature variations, differential thermal expansions, humidity influences, (d) Structural causes: improper design loads, accidental overloads, creep Steel Structures: Causes and types of deterioration, mechanism of corrosion, prevention of deterioration.

UNIT – III

Condition Assessment and Non-destructive Testing & Evaluation: Definition, objectives and stages of condition assessment Destructive and partially destructive tests. Non-destructive tests (NDTs). Classification of NDT procedures, Visual Inspection, Ultrasonic Testing methods (Impact echo, Pulse velocity, Pulse echo), Rebound hammer (IS 13311), Windsor probe test, Halfcell potential measurement, Electrical resistivity measurement, Carbonation depth measurements, Petrographic Analysis, Electromagnetic methods for Rebar detection, Ground Penetrating radar, Infrared thermography, Radiography, Radio isotope gauges, Remote viewing, Hammer sounding, Chain drag techniques.

UNIT – IV

Repair Materials and Techniques: Repair Methodology, Repair materials (cement-based, polymer-based, resin based, microcrete, composites, etc.), compatibility considerations, Repair techniques: Using mortars, dry pack, epoxy bonded pack, pre-placed aggregate concrete, gunite, shotcrete, grouting, polymer impregnation, resin injection, routing & sealing, stitching, surface patching, overlays & surface coatings, autogenous healing, gravity filling, drilling and plugging.

UNIT – V

Retrofitting & Rehabilitation Procedures: Strengthening of Existing Structures – Overview, general procedures, Techniques: section enlargement, composite construction, post-tensioning, stress reduction, strengthening by reinforcement, methods of strengthening in beams, slabs, columns (plate bonding, RC jacketing, FRP methods, concrete overlays, etc.) strengthening of substructure (shoring, underpinning)

Text Books:

1. Johnson.S.M., (1980), Deterioration, Maintenance and Repair of Structures, Krieger Publishing, Melbourne, Florida.
2. Guha. P.K., (1998), Maintenance and Repairs of Buildings, New Central Book Agency Ltd., Kolkata.

3. Richardson. B.A., (1980), Remedial Treatment of Buildings, Construction Press, London.
4. Agarwal. P., and Shirkhande. M., (2006), Earthquake Resistant Design of Structures, Prentice Hall India, New Delhi.

References:

1. SP: 25-1984, (1999), Handbook on Causes and Prevention of Cracks in Buildings,BIS, New Delhi.
2. Chudley. R., (1981), The Maintenance and Adaptation of Buildings, Longman Group Ltd., New York.
3. Macdonald.S, (2003), Concrete – Building Pathology, Blackwell Science Ltd., Oxford.
4. M. S. Shetty, Concrete Technology – Theory and Practice, S. Chand & Co. Ltd., New Delhi.
5. Strecker. P.P., (1987), Corrosion Damaged Concrete – Assessment and Repair, Butterworths, London.
6. Peter H. Emmons, (2001), Concrete Repair and Maintenance Illustrated, Galgotia Publications, New Delhi.
7. Gambhir. M.L, (2004), Concrete Technology, Tata McGraw-Hill, New Delhi, 2004.

Course Code	Course Title						Core / Elective
U21CE803	Environmental Impact Assessment						PEC-4
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Describe the ideas behind environmental impact assessments and how to use them in projects.
2. Enumerate and describe a variety of indicators, including socioeconomic, aquatic, terrestrial, and indicators of subsystems, and be able to choose indicators for environmental impact assessments.
3. Describe the effects on the environment of components related to transportation.
4. Capable of providing examples of environmental impact assessment approaches

Course Outcomes

After Completion of this course, the student will be able to

1. Give an explanation of environmental imbalances, indicators, and the EIA concept.
2. Determine and characterize the natural and man-made environments that will be impacted by the planned developments and/or are likely to have a negative influence on the project.
3. Determine the adverse effects and suggest mitigating or providing infrastructure.
4. Analyze the environmental effects of different advancements.
5. Provide an overview of the methods used to conduct environmental impact assessments.

UNIT- I

The Need for EIA: Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification(2000)

UNIT- II

EIA Methodologies: Environmental attributes -Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods. EIA review- Baseline Conditions - Construction Stage Impacts, post project impacts.

UNIT- III

Environmental Management Plan: EMP preparation, Monitoring Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, Monitoring Methods, Pre- Appraisal and Appraisal.

UNIT- IV

Environmental Legislation and Life cycle Assessment: Environmental laws and protection acts, Constitutional provisions-powers and functions of Central and State government, The Environment (Protection) Act 1986, The Water Act 1974, The Air act 1981, Wild Life act 1972, Guidelines for control of noise, loss of biodiversity, solid and Hazardous waste management rules. Life cycle assessment: Life cycle analysis, Methodology, Management, Flow of materials-cost criteria-case studies.

UNIT-V

Case Studies: Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Air ports.

TEXT BOOKS:

1. Anjaneyulu. Y and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2007

2. Barthwal, R. R., Environmental Impact Assessment, New Age International Publishers, 2002

3. Environmental Impact Assessment, Canter, L.W., McGraw Hill Pub. Co., 1997

4. Environmental Impact Assessment- Theory and Practice, Wathern.P., Routledge Publishers, London, 2004.

REFERENCE BOOKS:

1. Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold Co., New York, 1991.

2. Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996.

3. Environmental Impact Assessment & Management, Hosetti, B. B., Kumar A, Eds, Daya Publishing House, 1998

4. UNESCO, Methodological Guidelines for the Integrated Environmental Evaluation of Water Resources Development, UNESCO/UNEP, Paris, 1987

5. EIA Notification 2016

Course Code	Course Title						Core / Elective
U21CE804	**Intelligent Transportation Systems**						**PEC- 4**
Prerequisite	Contact Hours per Week				**CIE**	**SEE**	Credits
	L	**T**	**D**	**P**			
Transportation Engineering	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

The objectives of this course is to

1. Understand ITS & ATIS
2. Know the functional areas of ITS such as ATMS, CVO, AVCS and APTS, ARTS
3. Study of ITS architecture and its applications
4. Appreciate the technological requirements for ITS.
5. Gain knowledge of ITS standards and specifications.

Course Outcomes:

After completing this course, the student will be able to:

1. Plan and specify the requirements using ITS
2. Plan and management aspects for ITS
3. Prepare architecture and application for ITS
4. Illustrate the functional areas of ITS and their user needs and services
5. Explain the overview of ITS in-highway incident management systems

UNIT – I

Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.

UNIT – II

Telecommunications in ITS–Importance of telecommunications in the ITS system, Information Management, Traffic Management Centre(TMC). Vehicle – Road side communication – Vehicle Positioning System.

UNIT – III

Functional areas – Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS).

UNIT – IV

ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management.

UNIT – V

Automated Highway Systems -Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries. Traffic and incident management systems – ITS and sustainable mobility, travel demand management, electronic toll collection.

Text Books:

1. Chowdhury, M. A., Sadek, A. and Boston, M.A., ―Fundamentals of Intelligent TransportationSystemsPlanning‖, Artech House, Inc., USA, 2003
2. Joseph, S.S., ―Perspectives on Intelligent Transportation Systems‖, Springer publishers, USA, 2008.
3. Kan Paul Chen, John Miles, "Recommendations for World Road Association (PIARC)" ITS HandBook 2000.

References:

1. Ghosh, S., Lee, T.S., ―Intelligent Transportation Systems: New Principles and Architectures‖, CRCPress, 2000
2. US Department of Transportation, "National ITS Architecture Documentation", 2007(CDROM).
3. Sussman, J. M., "Perspective on ITS", Artech House Publish.

Course Code	Course Title						Core / Elective
U21CE805	SURFACE HYDROLOGY						PEC-5
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Hydrology	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Understand theoretical concepts of water and sediment movements in rivers
2. Understand the hydrologic extremes of floods and the mitigation measures to combat them.
3. Understand the concepts of Statistical methods and its applications in Engineering.
4. Understand the concepts of urbanization and its impact on the natural water cycle

Course Outcomes

After Completion of this course, the student will be able to

1. Able to apply the knowledge of soil erosion and sedimentation to estimate the life of the reservoir
2. Develop the flood inundation modeling and suggest suitable flood control measures.
3. Able to estimate the various losses of precipitation, stream flow and runoff.
4. Development of Rainfall-Runoff relationship
5. Able to understand the planning and operation of Urban water management

UNIT – I

Formation of surface water Resources-Streams, rivers, lakes, swamps, caves, seas and oceans: Definition of river, river basins and water divides, formation of river valleys, fluvial deposits, alluvial fans, meandering of rivers, formation of different types of lakes, deltas and valleys. Sediment discharge, Sediment transport, Sediment yield of watersheds, suspended load and bed load measurements, reservoir sedimentation-sediment movement and deposition, reduction in reservoir capacity, reservoir sedimentation control.

UNIT- II:

Flood Routing- Introduction, basic equation, Hydrologic storage routing, attenuation, Hydrologic channel routing, Hydraulic methods of flood routing. Flood Control- Structural and non-structural methods, flood control in India, national and state bodies involved for mitigation and management of floods as a natural disaster.

UNIT- III:

Stream flow Measurement – Stage and Velocity Measurement – Gauges – Current meter and Doppler flow velocity meter - Discharge measurement – direct methods (Area-Velocity method, Dilution techniques, electromagnetic method, ultrasonic method), indirect methods (Slope-area method, discharge measuring Structures(weirs, flumes and gated structures),Stage-Discharge relationship , Selection of a Stream Gauging Site.

UNIT- IV:

Statistics in Hydrology- Introduction, Statistical parameters, central tendency parameters, dispersion characteristics, skewness, probability distribution, discrete and continuous distribution, frequency analysis, log Pearson type III distribution, regression and correlation, standard forms of bivariate equations, multivariate linear regression and correlation, analysis of time series, selection of a design return period, determination of permissible risk.

UNIT- V:

Urban Water Management- urban hydrology, major issues in urban storm water management, objectives and limitations, airport drainage design, urban water resource management models, urban storm water management practices, rainwater harvesting.

TEXT BOOKS

1. Chow V.T., Maidment D.R., Mays L.W., "Applied Hydrology", McGraw Hill Publications, New York, 1995.
2. Subramanya K., "Hydrology,Tata McGraw Hill Co., New Delhi, 1994.
3. Patra.K.C, "Hydrology and Water Resources Engineering",Narosa Publications, 2008, 2ndEdition, NewDelhi.
4. Jay Rami Reddy.P, "Hydrology‖, Laximi Publications, New Delhi, 2004

REFERENCE BOOKS

1. Raghunath H.M., ―Hydrology‖, New Age International Publishers, New Delhi, 2014.
2. Martin, P. Wanelista and Yousef, A. Yousef., Storm Water Management, John Wiley and sons,1993

Jay L.Devore, ―Probability and statistics for Engineering and the Sciences‖, 5th Edition, Thomson and Duxbury, Singapore, 2002.

Course Code	Course Title						Core / Elective
U21CE808	FINITE ELEMENT METHODS						PEC-5
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Structural Analysis-II	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to impart knowledge of:

1. To learn basic principles of finite element analysis procedure .
2. To learn the theory and characteristics of finite elements that represent engineeringstructures.
3. To introduce the transition from 2D to 3D structural problems (linear and non-linear).
4. Analysis of all kind of loads and their respective effects.
5. To introduce a high-end computer oriented numerical analysis tool.

Course Outcomes

After completing this course, the student will be able to:

1. Apply the fundamentals of FEM, elements of theory of elasticity for 2D, 3D and axisymmetric problems.
2. Apply Principle of minimum potential energy and Principle of Virtual work; analyze simple problems using Rayleigh Ritz Method and Galerkin's method.
3. Formulate the local and global stiffness matrix, load matrix for 1D bar elements and 2D truss elements and analyze simple problems.
4. Develop the stiffness matrix for beams and rigid jointed plane frames and solve problems withdegree of freedom not exceeding three.
5. Select displacement functions, formulate the stiffness matrix, load matrix for CST elements. Use Iso-parametric elements and quadrilateral elements and evaluate definite integral by Gauss Quadrature.

UNIT- I:

Introduction to FEM: General description of the method, brief history of the method, applications of the method, advantages of the finite element method, steps in the finite element method. Types of elements, Types of forces, and Boundary conditions. Strain displacement, and stress- strain relations for 2-D, 3-D problems & Plane stress and plane strain situations and derivation of elasticity matrices.

UNIT- II:

Finite Element Formulation: Principle of minimum potential energy, Principle of virtual displacement, Raleigh Ritz method, Weighted Residual method- Galerkin's method. Coordinate system - Global coordinate, local coordinate and natural coordinate system.

UNIT- III:

Bar Elements: Shape functions, stiffness matrix for a 2- noded bar element, axial bar subjected to point loads, surface forces and body forces - constant cross section and varying cross section bar.

Truss Elements: Transformation matrix, Stiffness matrix of truss member in local and global coordinates, analysis of trusses with kinematic indeterminacy not exceeding two.

UNIT- IV

Beam Elements: Shape functions, beam element stiffness matrix, element load vector, and analysis of continuous beams with kinematic indeterminacy not exceeding two. Element stiffness matrix in local coordinates, Transformation or Rotation matrix, and stiffness matrix and load vector in global coordinates.

UNIT-V:

Displacement models: Selection of displacement models, geometric invariance, conforming and nonconforming elements. 2-D Triangular Elements (CST) and Rectangular Elements: Determination of strain-displacement matrix, shape functions, determination of element stiffness and load matrices, assembling global stiffness and load matrices.

Iso-parametric elements: Iso-parametric concept, Iso-parametric, Sub parametric and Super parametric elements. Gauss Quadrature of numerical integration.

Text Books:

1.O.C. Zienkiewicz and R.L. Taylor, The Finite Element Method, Vol. I, McGraw Hill,1989.

2.K.J. Bathe, Finite Element Procedures, Pearson Education,2006.

3. S. M. Jalaludeen, Finite Element Analysis, Anuradha Publications,2016.

4. T.R. Chandrupatla, Finite Element Analysis for Engineering and Technology,Universities Press, 2004.

References:

1 A first course in the Finite Element Method Logan, D. L Cengage Learning 6th Edition2016

2 .Finite Element Method in Engineering Rao, S. S Pergaman Int. Library of Science 5th Edition 2010

3 . Finite Element Method with applications in Engineering / YM Desai, Eldho & Shah /Pearson publishers,2006.

4. Concepts and Application of Finite Elements Analysis Cook R. D., et al. Wiley & Sons 4th Edition 2003

5. David V. Hutton, "Fundamentals of Finite Element Analysis", McGraw Hill Education (India) Private Limited, Delhi, 2014.

6. P. N. God bole," Introduction to Finite Element Method", I. K. International Publishing House Pvt. Ltd. New Delhi, 2013.

7. P. Seshu, "Finite Element Analysis", Prentice Hall of India Private Limited, New Delhi, 2010.

Course Code	Course Title						Core / Elective
U21CE809	GIS and Remote Sensing						PEC-5
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Know the concept of Geographical Information System (GIS), coordinate system GIS Data and its types
2. Understand the students managing the spatial Data Using GIS
3. Understand Implementation of GIS interface for practical usage.
4. Develop maps based on queries using GIS software's
5. Know the concepts of Remote Sensing, its interpreting Techniques and concepts of Digital images

Course Outcomes

After Completion of this course, the student will be able to

1. Evaluate the accuracy of Data and implementing a GIS
2. Understand the applicability of RS and GIS for various applications
3. Apply the knowledge of GIS in decision making by evaluation of data and find appropriate solutions to complex problems.
4. Describe different concepts and terms used in Remote Sensing and its data
5. Describe different concepts and terms used in Remote Sensing and its data

UNIT – I

Introduction to GIS: History of development of GIS- Geo Spatial Data - GIS operations- Standard GIS packages, Applications of GIS; Datum and Map Projections: Concept of Datum, Coordinate Systems and Map Projections Transformations.

Data Models: Spatial and Non-Spatial Data models; Spatial Digital formats Spatial Data Creation: Scanners, digitizers; Digital Elevation Models; Sources of Errors & Corrections- Rotation and Resampling methods.

UNIT- II:

GIS – Components of GIS – Hardware, Software and Organizational Context.

Maps – Projection – Types of Projection - Data Input – Digitizer, Scanner – Editing – Raster and Vector data structures – Comparison of Raster and Vector data structure – Data Output – Printers and Plotters.

UNIT- III:

Spatial Data Analysis: Raster data analysis, Vector data analysis - Buffering, Overlay, Union, Intersect, Merging, splitting operations. Terrain Modelling & Analysis: Contouring, Vertical profiling, Hill shading, 3D perspectives; Slope & Aspect analysis, Viewshed & watershed analysis.

Concepts of Remote Sensing: Basics of remote sensing- Remote Sensing Principles & methods of remote sensing - Active and Passive remote sensing, elements involved in remote sensing, electromagnetic spectrum, Remote Sensing platforms -Electromagnetic radiation- Spectrum- Block body radiation – planks law – Stefan – Boltzmann law - remote sensing terminology & units, energy resources, energy interactions with earth surface features & atmosphere, atmospheric effects, satellite orbits, Sensor Resolution, types of sensors. Remote Sensing Platforms and Sensors, IRS satellites.

UNIT- IV:

Satellites classification – Based on orbit- sun synchronous and Geosynchronous based on purpose Earth Resources satellites, communication satellite Weather satellites Spy satellites Sensors Description of sensor in landscape, spot, IRS series and current satellites- Radar SLAR-and SAR.

Remote Sensing Data Interpretation: Visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation, spectral properties of soil, water and vegetation.

UNIT- V:

Concepts of Digital image processing: Image enhancements, qualitative & quantitative analysis and pattern recognition, classification techniques and accuracy estimation.

Image enhancement – Filtering – Classification - Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS

Urban Applications - Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS – Water resources – Urban Analysis – Watershed Management – Resources Information Systems

TEXT BOOKS

1. Remote Sensing and GIS by Basudeb Bhatta, Oxford University Press, 2nd Edition, 2011.

2. Introduction to Geographic Information systems by Kang-tsung Chang, McGraw Hill Education (Indian Edition), 7th Edition, 2015.

3. Fundamentals of Geographic Information systems by Michael N. Demers, 4th Edition, Wiley Publishers, 2012.

4. Chor Pang Lo and Albert K.W. Yeung, "*Concepts and Techniques of Geographic Information systems*" Pearson, 2016.

REFERENCE BOOKS

1. Remote Sensing and Image Interpretation by Thomas M. Lillesand and Ralph W. Kiefer, Wiley Publishers, 7th Edition, 2015.

2. Geographic Information systems – An Introduction by Tor Bernhardsen, Wiley India Publication, 3rd Edition, 2010.

3. Advanced Surveying: Total Station, GIS and Remote Sensing by Satheesh Gopi, R. Sathi Kumar, N. Madhu, Pearson Education, 1st Edition, 2007.

4. Textbook of Remote Sensing and Geographical Information systems by M. Anji Reddy.

5. Michael N. Demers, "*Fundamentals of Geographic Information systems*", John Willey Publishers, 2012.

6. Remote Sensing and Image Interpretation by Thomas M. Lillesand and Ralph W. Kiefer, Wiley Publishers, 7th Edition, 2015.

Course Code	Course Title						Core / Elective
U21CE810	Infrastructure Engineering						PEC-5
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Description of the design aspects of different types spillways.
2. Knowledge regarding the design of energy dissipation arrangements.
3. Awareness about urban storm drainage and concepts of dam safety.

Course Outcomes

After Completion of this course, the student will be able to

1. Explain the basic concepts related to Infrastructure Projects.
2. Explain the role of private sector in infrastructure growth.
3. Develop Infrastructure modeling and Life Cycle Analysis Techniques.
4. Describe the strategies for successful Infrastructure Project implementation
5. Explain Strategies for Successful Infrastructure Project Implementation

UNIT – I

Infrastructure engineering: Definitions of infrastructure, Governing Features, Urban Infrastructure and Rural Infrastructure in general. An Introduction to Special Economic Zones, Organizations and Players in the field of Infrastructure, The Stages in an Infrastructure Project, Concept of Lifecycle., etc., An Overview of Infrastructure Projects in power Sector, Water Supply and Sanitation Sector, Road, Rail, Air and Port Transportation Sectors and Telecommunications.

UNIT- II:

Public & private sector role in infrastructure development: A Historical Overview of Infrastructure Privatization, The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Challenges in Privatization Water Supply, Power, Infrastructure, Road Transportation Infrastructure in India, BOOT, BOT, PPP, HAM, Case studies preferable.

UNIT- III:

Infrastructure planning and management: Typical infrastructure planning steps, Planning and appraisal of major infrastructure projects, screening of project ideas, Life cycle analysis, Multicriteria analysis for comparison of infrastructure alternatives, Procurement strategies, Scheduling and management of planning activities, Infrastructure Project Budgeting and Funding, Regulatory Framework, Sources of Funding, Economics and Demand Risks, Political Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Case studies preferable.

UNIT- IV:

Environment and social impact assessment aspects: Categories attribute and parameters, identification of environmental & social impacts over project area and over project cycle, special considerations involving land and water interrelation ships – environmental laws and regulations.

UNIT- V:

Strategies for successful infrastructure project implementation: Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure, Projects. Governments Role in Infrastructure Implementation, An Integrated Framework for Successful, Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.

TEXT BOOKS

1. J. Parkin and D. Sharma, "Infrastructure planning", Thomas Telford, London, 1999.
2. P. Chandra, "Projects: Planning, analysis, selection, financing, implementation, and review", Tata McGraw-Hill, New Delhi, 2009.
3. J. D. Finnerty, "Project financing - Asset-based financial engineering", John Wiley &Sons, New York, 1996.
4. T. Hegazy, "Computer-based construction project management", Prentice Hall, New Jersey,2002.

REFERENCE BOOKS

1. Vasant Desai, "Project Management", Himalaya Publishing , 1st Edition, 2010
2. Anjaneyulu, Y &Manickam, V, "Environmental Impact Assessment Methodology", B.S. Publications, Hyderabad, (2012).
3. Grigg, Neil, "Infrastructure Engineering and Management", Wiley, (1988).
4. NPTEL – Course Material prepared by IIT Madras.
5. S. Goodman and M. Hastak, "Infrastructure planning handbook: Planning, engineering, and economics", McGraw-Hill, New York, 2006.

Course Code	Course Title						Core / Elective
U21CE8P1	**Major Project**						**Core**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	16	50	150	8

Course Objectives:

The objective of the course is to:

1. Develop further skills and knowledge gained during the programme by applying them
2. Analysis of a specific problem or issue, via a substantial piece of work carried out over an extended period.
3. Demonstrate proficiency in the design of a research project, application of appropriate research methods, collection and analysis of data and presentation of results.

Course Outcomes:

After completing the course, the student will be able to:

1. Do literature survey/industrial visit and identify the problem
2. Apply basic engineering fundamental in the domain of practical applications
3. Cultivate the habit of working in a team
4. Attempt a problem solution in a right approach
5. Correlate the theoretical and experimental/simulations results and draw the proper inferences
6. Prepare report as per the standard guidelines.

The aim of Major Project is to implement and evaluate the proposal made as part of Project. Students can also be encouraged to do full time as part of project work based on the common guidelines for all the departments. The students placed in project need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction. The department will appoint a project coordinator who will coordinate the following:

1. Re-grouping of students - deletion of project candidates from groups made as part of project Work
2. Re-Allotment of project students to supervisor
3. Project monitoring at regular intervals

All re-grouping/re-allotment has to be completed by the 1st week of VIII semester so that students get sufficient time for completion of the project. All projects will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for 50 marks can be conducted after completion of five weeks. The final viva voce of 150 marks can be conducted after 12 weeks of instruction. Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.

Note: Three periods of contact load will be assigned to each project guide

Course Code	Course Title						Core / Elective
U21CE8P2	**Comprehensive viva-voce**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
Internship	**-**	**-**	**-**	**4**	**100**	**-**	**2**

Course Objectives:

The objective of the course is to:

1. To use variables for formulating complex mathematical models in management science, industrial engineering and transportation models.

Course Outcomes:

After completing the course, the student will be able to:

1. Face interview both in the academic and the industrial sector.

Guidelines

1. The course should be mapped with a faculty and classes shall be arranged for practicing questions based on the core courses listed in the curriculum.
2. The viva voce will be conducted by the same three-member committee assigned for final project phase II evaluation. It comprises of Project coordinator, expert from Industry/research Institute and a senior faculty from a sister department.
3. The pass minimum for this course is 25.
4. The mark will be treated as internal and should be uploaded along with internal marks of other courses.
5. Comprehensive Viva should be conducted along with final project evaluation by the three-member committee.

Mark Distribution

Total marks: 50, only CIE, minimum required to pass: 25 Marks

Course Code	Course Title						Core / Elective
U21CE806	Green Building Technology						OEC-4
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
---	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. To impart knowledge of the principles and practices of the green buildings.
2. 2) To know the importance of sustainable use of natural resources and energy.
3. 3) To understand the principles of effective energy and resources management in buildings.
4. 4) To bring awareness of the basic criteria in the green building rating systems.
5. 5) To understand the methodologies to reduce, recycle and reuse towards sustainability.

Course Outcomes

After Completion of this course, the student will be able to

1. Define sustainability and a green building, along with its features and benefits.
2. Describe the criteria used for site selection and water efficiency methods.
3. Explain the energy efficiency terms and methods used in green building practices.
4. Select materials for sustainable built environment & adopt waste management methods.
5. Describe the methods used to maintain indoor environmental quality.

UNIT – I

Introduction to Green Buildings: Definition of green buildings, definition of sustainability typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating system

UNIT – II

Site selection and planning: Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, and so on. Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems.

UNIT – III

Energy Efficiency: Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy. Methods to reduce operational energy: Energy efficient building envelopes, Solar Heat Gain Coefficient, U-Values for facade materials, efficient lighting technologies, energy efficient and BEE rated appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of NET ZERO buildings.

UNIT – IV

Building materials: Methods to reduce embodied energy in building materials: (a) Local building materials.(b) Natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks. (c) Materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. (d) Reuse of waste and salvaged materials. Waste Management: Handling of construction & demolition waste materials, separation of household waste, handling e-waste, on-site and off-site organic waste management.

UNIT – V

Indoor Environmental Quality: Day lighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics. Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc.

Text Books:

1. .IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, Indian
2. Green Building Council Publishers.
3. GRIHA version , GRIHA rating system, Green Rating for Integrated Habitat Assessment.
4. K.S. Jagadish, B.V. Venkatarama Reddyand K.S. Nanjunda Rao, Alternative building
5. Introduction to Green Buildings & Built Environment by IGBC

References:

1. Materials and technologies, New Age International Private Limited, 2017
2. G. D. Rai, Non-Conventional Energy Resource, Khanna Publishers, .

3. Energy and Resource Institute, Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi, 2009.
4. Mike Montoya, Green Building Fundamentals, Pearson, USA, 2019.
5. Charles J. Kibert, Sustainable Construction - Green Building Design and Delivery, 4th Edition,
6. Handbook Of Green Building Design And Construction Leed Breeam And Green Globes by Sam Kubba, ELSEVIER
7. Green Building : Principles & Practices. Dr. Adv. Harshul Savla

Course Code	Course Title						Core / Elective
U21CE807	Environmental Impact Assessment						OEC-4
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives

The objectives of this course is to:

1. Describe the ideas behind environmental impact assessments and how to use them in projects.
2. Enumerate and describe a variety of indicators, including socioeconomic, aquatic, terrestrial, and indicators of subsystems, and be able to choose indicators for environmental impact assessments.
3. Describe the effects on the environment of components related to transportation.
4. Capable of providing examples of environmental impact assessment approaches

Course Outcomes

After Completion of this course, the student will be able to

1. Give an explanation of environmental imbalances, indicators, and the EIA concept.
2. Determine and characterize the natural and man-made environments that will be impacted by the planned developments and/or are likely to have a negative influence on the project.
3. Determine the adverse effects and suggest mitigating or providing infrastructure.
4. Analyze the environmental effects of different advancements.
5. Provide an overview of the methods used to conduct environmental impact assessments.

UNIT – I

Introduction: Environment and its interaction with human activities - Environmental imbalances - Attributes, Impacts, Indicators and Measurements - Concept of Environmental Impact Assessment (EIA), Environmental Impact Statement, Objectives of EIA, Advantages and Limitations of EIA The Environmental Protection Act, Pollution Act, Motor Act.

UNIT – II

Environmental Indicators: Indicators for climate - Indicators for terrestrial subsystems - Indicators for aquatic subsystems - Selection of indicators - Socio-economic indicators - Basic information - Indicators for economy - Social indicators - Indicators for health and nutrition - Cultural indicators - Selection of indicators.

UNIT – III

Environmental Impact Assessment for Transportation Projects: Basic Concepts, Objectives, Transportation Related Environmental Impacts – Vehicular Impacts – Safety & Capacity Impacts – Roadway Impacts – Construction Impacts, Environmental Impact Assessment – Environmental Impact Statement and Environment Audit.

UNIT – IV

Environmental Issues in Industrial Development: On-site and Off-site impacts during various stages of industrial development, Long term climatic changes, Green house effect, Industrial effluents and their impact on natural cycle, Environmental impact of Highways, Mining.

UNIT – V

Environmental Audit & Environmental legislation: objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities.

Text Books:

1. *Jain, R.K., Urban, L.V., Stracy, G.S., (1991), "Environmental Impact Analysis", Van Nostrand Reinhold Co., New York*
2. *Rau, J.G. and Wooten, D.C., (1996), "Environmental Impact Assessment", McGraw Hill Pub. Co., New York*
3. *Canter, L.W., (1997), "Environmental Impact Assessment", McGraw Hill Pub. Co., New York*
4. *Environmental Impact Assessment Methodologies, Anjaneyulu. Y., and Manickam. V., B.S. Publications, Hyderabad, 2007.*

References:

1. *. Grand Jean, E. Gilgen A., "Environmental Fact ors in Urban Planning", Taylor and Francis Limited, London, 1976.*
2. *UNESCO, (1987), "Methodological Guidelines for the Integrated Environmental Evaluation of Water Resources Development", UNESCO/UNEP, Paris.*
3. *Environmental Impact Assessment, Barthwal, R. R.,New Age International Publishers, 2002*
4. *Environmental Impact Assessment- Theory and Practice, Wathern.P., Routledge Publishers, London, 2004.*
5. *Environmental Impact Assessment & Management, Hosetti, B. B., Kumar A, Eds, Daya Publishing House, 1998.*
6. *UNESCO, Methodological Guidelines for the Integrated Environmental Evaluation of Water Resources Development, UNESCO/UNEP, Paris, 1987*