LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF INSTRUCTIONS & EXAMINATIONS [LR-24]
(w.e.f. Academic Year 2026-27)

B.E. V-Semester (Tentative)

S. No	Course Code	Category	Course Title	Scheme of Instruction				Scheme of Examination			Credits
								Maximum Marks			
				L	T	P/D	Contact Hours/Week	CIE	SEE	Duration in Hours	
Theory Course											
1	U24CE501	PCC	Concrete Technology*	3	-	-	3	40	60	3	3
2	U24CE502	PCC	Environmental Engineering	3	-	-	3	40	60	3	3
3	U24CE503	PCC	Theory of structures-I	3	-	-	3	40	60	3	3
4	U24CE504	PCC	Hydrology and Water Management	2	-	-	2	40	60	3	2
5	U24CE505	PCC	Intelligent Transportation Systems	3	-	-	3	40	60	3	3
6	--	PEC	Professional Elective-I	3	-	-	3	40	60	3	3
Practical/ Laboratory Course											
7	U24CE5L1	PCC	Concrete Technology Lab	-	-	3	3	25	50	3	1.5
8	U24CE5L2	PCC	Environmental Engineering Lab	-	-	2	2	25	50	3	1
9	U24EN5L1	HSMC	Soft Skills and Employability skills Lab	-	-	3	3	25	50	3	1.5
Internship											
10	U24CE5P1	PROJ	Internship (During Vacations after IV Semester)				-	50	-	-	1
Total				**17**		**8**	**25**	**365**	**510**	**27**	**22**

TW: *Term Work (includes assignments, Seminars, micro-Projects, industrial visits, any other student activities etc.)

L: Lecture (Hrs /Wk /Sem) **T**: Tutorial (Hrs/Wk/Sem) **P**: Practical
D: Drawing (Hrs/Wk/Sem)

CIE: Continuous Internal Evaluation
ESC: Engineering Science Course
OEC: Open Elective Course
ME: Mechanical Engineering
CS: Computer Science.

SEE: Semester End Examination
PCC: Professional Core Courses
PEC: Professional Elective Courses
PROJ: Project

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 Institution)
DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF INSTRUCTIONS & EXAMINATIONS [LR-24]
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	
Theory Course											
1	U24CE506	PEC 1	Solid and Hazardous Waste Management	3	-	-	3	40	60	3	3
	U24CE507		Advanced Surveying	3	-	-	3	40	60	3	3
	U24CE508		Construction Project and Planning	3	-	-	3	40	60	3	3
2	U24CE604	PEC 2	Design of Hydraulic Structures	3	-	-	3	40	60	3	3
	U24CE605		Sustainable Construction Methods	3	-	-	3	40	60	3	3
	U24CE606		Urban Transportation planning	3	-	-	3	40	60	3	3
3	U24CE607	PEC 3	Environmental Impact Assessment	3	-	-	3	40	60	3	3
	U24CE608		Contract Management	3	-	-	3	40	60	3	3
	U24CE609		Robotics and Automation in Civil Engineering	3	-	-	3	40	60	3	3
4	U24CE704	PEC 4	Advanced Concrete Technology	3	-	-	3	40	60	3	3
	U24CE705		Advanced RCC Design	3	-	-	3	40	60	3	3
	U24CE706		Foundation Engineering	3	-	-	3	40	60	3	3
5	U24CE707	PEC 5	GIS and Remote Sensing	3	-	-	3	40	60	3	3
	U24CE708		Repair and Rehabilitation of Structures	3	-	-	3	40	60	3	3
	U24CE709		Groundwater Engineering	3	-	-	3	40	60	3	3
6	U24CE801	PEC 6	Ground improvement techniques	3	-	-	3	40	60	3	3
	U24CE802		Principles of Climate change	3	-	-	3	40	60	3	3
	U24CE803		Finite Elements Methods	3	-	-	3	40	60	3	3

Professional Electives with 6 Threads

S. No.	PE 1	PE 2	PE 3	PE 4	PE 5	PE6
1.	Solid and Hazardous Waste Management	Design of Hydraulic Structures	Environmental Impact Assessment	Advanced Concrete Technology	GIS and Remote Sensing	Ground improvement techniques
2.	Advanced Surveying	Sustainable Construction Methods	Contract Management	Advanced RCC Design	Repair and Rehabilitation of Structures	Principles of Climate change
3.	Construction Project and Planning	Urban Transportation planning	Robotics and Automation in Civil Engineering	Foundation Engineering	Groundwater Engineering	Finite Elements Methods

Course Code	Course Title						Core / Elective
U24CE501	Concrete Technology						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Building Materials	3	-			40	60	3

Course Objectives

The objectives of this course are to impart knowledge of and problem-solving skills in

1. Understanding the composition, hydration, and fresh properties of cement and concrete.
2. Applying principles of hardened concrete behavior and testing methods to evaluate performance.
3. Analyzing concrete mix design parameters and statistical quality control as per IS 10262:2019, including an introductory role of AI in optimization.
4. Evaluating the effectiveness of chemical and mineral admixtures in improving concrete properties.
5. Creating and assessing suitable applications of special concretes, including emerging technologies like 3D printed concrete.

Course Outcomes

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

1. Analyse the manufacturing process of Ordinary Portland Cement and its hydration principles.
2. Identify the properties and tests on Hardened Concrete.
3. Perform concrete mix design using the IS method and evaluate quality control importance.
4. Classify types of chemical and mineral admixtures and assess their influence on self-compacting and fiber-reinforced concrete
5. Differentiate various types of special concrete and evaluate their unique properties and applications in construction

UNIT-I

Cement: Portland cement – Constituents, types and grades of cement – Composition and functions of each compound – Manufacturing of Ordinary Portland Cement (dry and wet process) – Hydration of cement, chemical reactions and hydration products – Microstructure of hydrated cement – Heat of hydration and rate of hydration – Physical tests on cement as per IS codes (fineness, consistency, setting time, soundness, compressive strength, specific gravity).

Fresh Concrete: Workability – Definition and factors affecting workability – Tests for workability (slump test, compaction factor, Vee-Bee test, flow test) – Setting time of concrete – Effect of time and temperature on workability – Segregation and bleeding – Batching, mixing (manual and machine), transportation, placing and compaction of concrete – Vibration and revibration – Curing of concrete (methods and importance) – Self-curing agents and water curing.

UNIT-II

Properties of Hardened Concrete: Water–cement ratio – Abram's Law – Gel-space ratio – Effective water in mix – Microstructure and strength development – Short term and long term properties of concrete – Stress–strain behaviour of concrete.

Testing of Hardened Concrete: Destructive tests – Compression, tension (split and direct), and flexure tests – Nondestructive tests (Rebound hammer test, Ultrasonic pulse velocity test) – Significance and limitations of each method.

Elasticity, Creep and Shrinkage: Modulus of elasticity – Dynamic modulus of elasticity – Poisson's ratio – Creep: nature, types, factors influencing, relationship with time, and effects – Shrinkage: types (plastic, drying, autogenous, carbonation) – Control measures.

UNIT-III

Concrete Mix Design: Basic considerations – Target mean strength – Statistical quality control – Acceptance criteria – Factors affecting mix design – Proportioning of ingredients – Trial mixes – Adjustments for field conditions – Detailed procedure for IS method (IS 10262:2019) – Overview of British and ACI methods of mix design – Quality control at batching plant and construction site. Role of Artificial Intelligence (AI) in optimizing mix proportions and quality control.

UNIT-IV

Admixtures: Introduction – Classification – Chemical admixtures (plasticizers, super plasticizers, retarders, accelerators, air entraining agents) – Mineral admixtures (fly ash, silica fume, GGBS, rice husk ash, metakaolin) – Influence on workability, strength, durability – Compatibility issues – Dosage and standards.

Special Applications: Self-Compacting Concrete (SCC) – Concrete for fiber reinforced applications (FRC) – Concept, characteristics, and applications – Use of admixtures in SCC and FRC – Ready Mix Concrete (RMC) – Concept, production process, benefits and site handling

UNIT-V

Special Concretes: High Strength Concrete – High Performance Concrete – Fiber Reinforced Concrete – Ferrocement – Mass Concrete – Lightweight Concrete – High Density Concrete – Polymer Concrete – Recycled Aggregate Concrete – Geopolymer Concrete – Nano Concrete – Shotcrete – Reactive Powder Concrete – Concept, need, properties, mix composition and applications. Introduction to 3D Printed Concrete – concept, mix requirements, advantages and limitations.

Text Books:

1. Concrete Technology, M.L. Gambir, Tata, Mc. Graw Hill Publishers, New Delhi, 5th Edition, 2017
2. Concrete Technology, M.S. Shetty, S.Chand &Co., Revised Edition, 2006
3. Design of Concrete Mixes – N.K. Krishna Raju, CBS Publishers and Distributors
4. Special Concrete and Concrete Construction – Dr. B.C. Punmia, Laxmi Publications

References Books:

1. Properties of Concrete Pearson, A.M. Naville, Education India, 5th edition, 2012
2. Concrete Technology, A.R. Santha Kumar, Oxford university Press, NewDelhi
3. Concrete: Micro structure, Properties and Materials, P.K. Metha and J.M. Monteiro, Tata Mc-GrawHill Education
4. Concrete Admixtures Hand Book Properties, V S Rama Chandran, Noyes Publications, U.S.A
5. Concrete Admixtures Handbook: Properties, Science and Technology– V.S. Ramachandran, William Andrew/Noyes Publications, 2nd Edition

Course Code	Course Title						Core / Elective
U24CE502	ENVIRONMENTAL ENGINEERING						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Fluid Mechanics	3				40	60	3

Course Objectives

The objectives of this course are to impart knowledge of and problem-solving skills in

1. Understand the principles of environmental engineering and its role in sustainable development.
2. knowledge of water and air pollution control systems.
3. Design and operate water and wastewater treatment systems.
4. Analyze and mitigate environmental impacts of engineering projects.
5. Develop solutions for solid waste management and air pollution control.

Course Outcomes

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

1. Assess characteristics of water and wastewater and their impacts
2. Estimate quantities of water and waste water and plan conveyance components
3. Design for the safe disposal of waste water and its reuse.
4. Design components of water and waste water treatment Plant
5. Understand the Global effects with issues of air pollution and control

UNIT-I

Introduction: Waterborne diseases – protected water supply – Population forecasts, design period – types of water demand – factors affecting – fluctuations – fire demand – water quality and testing – drinking water standards: sources of water - Comparison from quality and quantity and other considerations – intakes – infiltration galleries.

UNIT-II

water treatment units – sedimentation – principles – design factors – coagulation- flocculation clarifier design – coagulants - feeding arrangements. Filtration – theory – working of slow and rapid gravity filters – multimedia filters – design of filters – troubles in operation - comparison of filters – disinfection – theory of chlorination, chlorine demand - other disinfection practices–Design of distribution systems–pipe appurtenances.

UNIT-III

Characteristics of sewage –waste water collection–Estimation of waste water and storm water – decomposition of sewage, examination of sewage – B.O.D. Equation – C.O.D. Design of sewers – shapes and materials – sewer appurtenances, manholes – inverted siphon – catch basins – flushing tanks – ejectors, pumps and pump houses – house drainage – plumbing requirements – sanitary fittings-traps – one pipe and two pipe systems of plumbing **–** ultimate disposal of sewage – sewage farming –self-purification of rivers.

UNIT-IV

Waste water treatment plant – Flow diagram - primary treatment Design of screens – grit chambers – skimming tanks – sedimentation tanks – principles of design – Biological treatment – trickling filters – ASP– Construction and design of oxidation ponds. Sludge digestion – factors effecting – design of Digestion tank – Sludge disposal by drying – septic tanks working principles and design – soak pits.

UNIT-V

Air pollution–classification of air pollution– Effects air pollution–Global effects–Meteorological parameters affecting air pollution–Atmospheric stability–Plume behavior –Control of particulates – Gravity settlers, cyclone filters, ESPs–Control of gaseous pollutants–automobile pollution and control.

TEXT BOOKS:

1. Environmental Engineering by H. S Peavy, D. R. Rowe, G. Tchobanoglous, McGraw Hill Education (India) Pvt Ltd, 2014
2. Environmental Engineering by D. P. Sincero and G.A Sincero, Pearson 2015.
3. Environmental Engineering, I and II by BC Punmia, Std. Publications.
4. Environmental Engineering, I and II by SK Garg, Khanna Publications.
5. Environmental Pollution and Control Engineering CS Rao,Wiley Publications

REFERENCE BOOKS:

1. Water and Waste Water Technology by Steel, Wiley
2. Waste water engineering by Metcalf and Eddy, McGraw Hill, 2015.
3. Water and Waste Water Engineering by Fair Geyer and Okun, Wiley, 2011
4. Water and Waste Water Technology by Mark J Hammar and Mark J. Hammar Jr.Wiley, 2007.
5. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
6. Introduction to Environmental Engineering by P. Aarne Vesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition 2008.
7. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication

Course Code	Course Title						Core/Elective
U24CE503	Theory of Structures-I						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Strength of Materials	3	-	-	-	40	60	3

Course Objectives

1. Understand the advantage of statically indeterminate structure over the statically determinate structure
2. Understand basic methods for the analysis of statically indeterminate beams and frames and know the difference between different methods
3. Analyse the statically indeterminate members such as continuous beams for various types of loading.
4. Identify the various straining action in arches
5. Analyze arches with varying degrees of indeterminacy

Course Outcomes

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

1. Solve statically indeterminate beams and portal frames using classical methods
2. Sketch the SFD and BMD diagrams for different loading condition for in determinate structures.
3. Find the degree of static and kinematic indeterminacies of the structures.
4. Analyze the three hinged and two hinged arches.
5. To analyze multi storied frames using approximate methods

UNIT–I

Slope Deflection Method: Application of the method to continuous beams with and without sinking of supports, single bay - portal frames (Degree of freedom not exceeding three), loading on each span may be point load(s) or uniformly distributed load on whole span, shear force and bending moment diagrams.

UNIT-II

Moment Distribution Method: Application of the method to continuous beams with and without sinking of supports, portal frames (static indeterminacy not exceeding three), loading on each span may be point load(s) or uniformly distributed load on whole span, shear force and bending moment diagrams.

UNIT-III

Kani's Method: Application of the method to continuous beams with and without support sinking, portal frames (static indeterminacy not exceeding three), and loading on each span may be point load(s) or uniformly distributed load on whole span, shear force and bending moment diagrams.

UNIT–IV

Elastic Theory of Arches: Introduction – Types of Arches – Comparison between Three hinged and Two hinged Arches Eddy's theorem - Analysis of Three hinged parabolic arches - determination of horizontal thrust, bending moment, normal thrust and radial shear for static loading, draw BMD

Two hinged arches: Introduction –Analysis of two hinged parabolic arches, determination of horizontal thrust, bending moment, normal thrust and radial shear for static loading and Secondary stresses in two hinged arches due to temperature and elastic shortening of rib.

UNIT–V

Cables and Suspension bridges: Stresses in suspended loaded cables, length of cable, simple suspension bridge with 3- hinged stiffening girders for static load.

Text Books

1. Structural Analysis- A Unified Approach, D.S. Prakash Rao, University Press, 1996
2. Theory of structures, B.C. Punmia and A.K. Jain, Laxmi Publications, New Delhi, 2004.
3. Basic Structural Analysis, C.S.Reddy, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
4. *Fundamentals of Structural Analysis* by K. M. Leet, C. M. Uang , – 3rd Edition,2006.
5. *Structural Analysis: A Unified Classical & Matrix Approach* by A. Ghali, A. Neville – 6th Edition.

References

1. Analysis of Structures ***by*** V. N. Vazirani & M. M. Ratwani., 10th Edition, New Delhi, 2014.
2. *Structural Analysis* **by R. C. Hibbeler** – 10th Edition (SI Units), Pearson Education
3. Theory of Structures,G.S,Pandit,S.P.Gupta and R.GuptaVol.I&II,TataMcGrawHill,NewDelhi,1999.
4. Theory of Structures, Pandit, G .S., S. P. Gupta and R. Gupta,Vol.l, Tata McGraw Hill, New Delhi, 1999
5. Mechanics of Structures (Vol. 1 &2), S.B. Junarkar, Charotar Publishing House Anand, 1992.

Course Code	Course Title						Core / Elective
U24CE504	Hydrology and Water Management						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Fluid Mechanics - I	2	-	-	-	40	60	2

Course Objectives

The objectives of this course are to impart knowledge of and problem-solving skills in

1. Understanding the importance of Hydrology and its applications
2. Introduction to Hydrological processes and estimation of Design flood
3. Basic concepts and assessment of groundwater flows
4. Applications of statistical models in Hydrology
5. Importance of Hydrology and its applications

Course Outcomes

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

1. Compute mean Rainfall, Develop Intensity-Duration-Duration curves
2. Estimate Design flood for Water Resources structures
3. Compute drawdown and yield in aquifers
4. Apply Principles of probability to hydrological problems and develop Rainfall – Runoff relationship
5. Describe irrigation methods, soil-water-plant relationships, and crop water requirements.

UNIT-I

General: Definition, relation to engineering design, hydrological cycle, importance of hydrology and its application in engineering. Rainfall: Definition, types of rainfall, measurement of rain fall, types of rain gauges, network design, presentation of precipitation data, mean aerial rainfall; thiessen polygon, isohyetal methods., depth- area- duration curve, dependable rainfall. Infiltration: Evaporation, transpiration-definitions and processes.

UNIT-II

Runoff: Definition, runoff process, factors affecting runoff, determination of runoff, importance of stream gauging, runoff formulae and runoff tables, dependable yield of a basin. Floods: Definition, causes, importance of flood studies, flood peak and flood hydrograph, methods of computing flood peak, empirical methods, rational formula, unit hydrograph method, flood frequency studies, Weibul‟s and Gumble‟s extreme value methods.

UNIT-III

Groundwater: Types of aquifers, aquifer parameters, specific yield, storage coefficient, coefficients of permeability and transmissivity, Darcy‟s law, types of well, steady radial flow to wells in confined and unconfined aquifers, yield of open wells, safe yield, constant level pumping test and recuperation test

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

Irrigation: Definition, necessity of irrigation, types of irrigation, advantages and ill- effects of irrigation.

Soil-water-plant relationship: Vertical distribution of soil moisture, soil moisture tension, soil moisture stress, soil moisture constants, plant water relationship, moisture stress and plant response, consumptive use, crop factor, duty, factors affecting duty, types of crops and their water requirements, crop rotation.

Text Books:

1. Engineering Hydrology, K.Subramanya, Tata McGraw Hill Publishing Co.Ltd. 1996 Water Supply Engineering, Dr.B.C.Punmia & AK Jain, Laxmi Publications (P)Ltd..
2. Irrigation Engineering and Hydraulic Structures, S K Garg, Khanna Publisher

3. P. N. Modi, "Irrigation Water Resources & Water Power Engineering", Standard Publishers, 2014
4. Ch. S. N. Murthy, "Water Resources Engineering: Principles and Practice", New Age International Publishers, Delhi, 2002.
5. K Subramanya, "Engineering Hydrology",4 th Edition, Mc-GrawHill, 2013

References Books:

1. G. L. Asawa, "Irrigation and water Resources engineering", New Age International Publishers, Delhi, 2005.
2. Larry W Mays, Water Resources Engineering, John Wiley & Sons, 2000.
3. Kedar Mutreja, "Applied Hydrology", Tata Mc-GrawHill, 1996
4. Hydrology for Engineers, Ray K.Linsley, Jr, Max A.Kohler, Joseph L.H.Paulhus, McGraw-Hill Book Company, 1980
5. Hydrology for Engineers, Ray K. Linsley, Jr, Max A. Kohler, Joseph L.H .Paulhus, McGraw-Hill Book Company, 1980

Course Code	Course Title						Core / Elective
U24CE505	**Intelligent Transportation Systems**						**Core**
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
U24CE506	SOLID AND HAZARDOUS WASTE MANAGEMENT						PEC-1
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives

The objectives of this course are

1. Understand the problems of municipal, biomedical, hazardous and industrial wastes.
2. Acquire knowledge about legal, institutional and financial aspects of solid waste management.
3. Recognize environmental and health impacts due to improper waste management.
4. Understand engineering, financial and technical options for waste management.
5. Gain knowledge about biomedical, nuclear and chemical waste management techniques.

Course Outcomes

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

1. Apply sampling techniques and characterization methods of solid waste.
2. Understand health and environmental impacts of improper waste management.
3. Categorize municipal, e-waste, biomedical, nuclear and hazardous wastes.
4. Apply solid waste management practices including waste reduction at source, collection, transportation, treatment and disposal techniques.
5. Develop hazardous waste management plans including waste minimization and safe disposal practices.

UNIT-I

Introduction to Solid and Hazardous Waste Management

Ecosystem – Meaning, Types, Components, Structure and Functions. Levels of organization in nature. Food chain and trophic structure. Bio geo chemical cycles. Need for hazardous waste management – Sources of hazardous wastes – Effects on community – Terminology and classification – Storage and collection – Problems in developing countries – Protection of public health and environment.

UNIT-II

Municipal Solid Waste Management

Definition – Sources and types of solid waste – Composition and its determinants – Factors influencing waste generation – Quantity assessment of solid waste – Sampling and characterization methods – Collection and transportation – Processing and disposal methods.

.

UNIT-III

Nuclear Waste and E-Waste Management

Characteristics and types of nuclear waste – Uranium mining and processing – Power reactors – Refinery and fuel fabrication wastes – Spent fuel – Management of nuclear wastes – Decommissioning of nuclear power plants – Health and environmental effects .E-waste – Sources – Characteristics – Environmental impacts – Recycling and disposal techniques

UNIT-IV

Biomedical and Chemical Waste Management

Biomedical wastes – Types – Sources (Domestic and Industrial) – Management and handling – Control of biomedical waste – Inorganic pollutants – Environmental effects – Need for control.

Treatment and disposal techniques – Physical, Chemical and Biological processes – Health and environmental impacts.

UNIT-V

Management of Hazardous Wastes

Identifying hazardous waste – Methods – Quantities generated – Components of hazardous waste management plan – Waste minimization techniques – Treatment and disposal practices in Indian industries Future challenges in hazardous waste management.

Text Books:

1. George Tchobanoglous et al., *Integrated Solid Waste Management*, McGraw Hill, 1993.
2. Tchobanoglous, Theisen & Vigil, *Solid Waste Engineering Principles and Management Issues*, McGraw Hill, 1997.

References Books:

1. R.E. Land & P.A. Rebers, *Municipal Solid Wastes – Problems & Solutions*, Lewis Publishers.
2. J. Glynn Henry & Gary W. Heinke, *Environmental Science and Engineering*, Prentice Hall of India, 2004.
3. WHO, *Safe Management of Wastes from Health-Care Activities*, Geneva, 1999.
4. USEPA, *Test Methods for Evaluating Solid Waste (SW-846)*.
5. A.D. Bhide & B.B. Sundaresan, *Solid Waste Management – Collection, Processing and Disposal*, Nagpur..

Course Code	Course Title						Core / Elective
U24CE507	Advance Surveying						PEC-1
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Surveying & Geomatics	3			3	40	60	3

Course Objectives

The objectives of this course are to impart knowledge of and problem-solving skills in

1. To introduce the purpose, principles, and instruments used in tacheometric surveying.
2. To impart knowledge on geodetic surveying and triangulation methods.
3. To explain photogrammetric surveying techniques and aerial photo interpretation.
4. To provide understanding of field astronomy and celestial observations in surveying.
5. To introduce special and modern surveying instruments and their applications.

Course Outcomes

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

1. Apply tacheometric techniques to determine distances and elevations with accuracy.
2. Design and analyze geodetic triangulation networks and select survey stations.
3. Perform photogrammetric computations using aerial photos and ground controls.
4. Determine geographic coordinates using astronomical observations and time conversions.
5. Operate advanced surveying instruments like Total Station and EDM effectively.

UNIT-I

Tacheometric Surveying: Introduction, purpose, principle & use of tacheometry, Instrument used & stadia hairs & Fixed hair methods of tacheometry, Tacheometry constant & Problems Anallatic lens theory, subtense bar, Field work in tacheometry. Reduction of readings, errors and precisions. Difference between Theodolite & Tacheometer.

UNIT-II

Geodetic Surveying: Introduction & object of Geodetic Surveying, Principal & classification of triangulation system, Selection of base line and stations, Orders of triangulation-triangulation figures, Station marks and signals-marking signals.

UNIT-III

Photogrammetric Surveying: Introduction, principle, uses Aerial camera, aerial photographs Definitions, scale of vertical and tilted photograph Ground coordinates, ground control, examples on scale, Displacements and errors, Examples on Displacement and errors, Procedure of aerial survey, Examples on flight planning, Photomaps and mosaics. Difference between Mosaic & Map, Stereoscopes, Parallax bar

UNIT-IV

Field Astronomy: Introduction & Instruments & purpose, Astronomical terms, Time & conversion of time, Abbreviations, Determination of azimuth, Latitude and longitude.

UNIT-V

Special Survey Instruments: Introduction, Electromagnetic Distance Measurement, Electronics Theodolite, Total station, Site square, Pentagraph, Autoset Level, Transit level, Special Compasses, Brunton Universal Pocket Transit, Mountain Compass Transit.

Text Books:

1. Duggal, S. K., Surveying Vol. I & II, Tata Mcgraw Hill, New Delhi.
2. Subramanian, R., Surveying & Levelling, Oxford University Press, New Delhi
3. Punamia, B.C., Surveying Vol. I, II & III, Laxmi Publications
4. Kanetkar, T.P. and Kulkarni, S.V., Surveying and Levelling Vol. I & II, Pune Vidhyarthi Gruh

References:

1. Arora, K.R., Surveying Vol. I, II & III, Standard Book House. New Delhi
2. Basak, N.N., Surveying and Levelling, Tata Mcgraw Hill, New Delhi
3. Agor, R., Surveying and Levelling, Khanna Publishers, New Delhi
4. Remote Sensing and GIS by B Bhatia, Oxford University Press, New Delhi.
5. Anji Reddy, M., Remote Sensing and Geographical Information Systems, B.S. Publications, Hyderabad, 2001.

Course Code	Course Title						Core / Elective
U24CE508	CONSTRUCTION PROJECT AND PLANNING						PEC-1
Pre-requisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
--------	3	-	-	-	40	60	3

Course Objectives

The objectives of this course are to impart knowledge of and problem-solving skills in

1. Provide fundamental knowledge of construction project planning, organizational structures, and project management systems in infrastructure development.
2. Introduce network-based scheduling techniques (CPM, PERT, AOA, AON) for effective planning, scheduling, and monitoring of construction projects.
3. Develop competency in cost analysis, resource optimization, and project control using modern management tools and software.
4. Familiarize students with construction contracts, tendering procedures, and various project delivery systems used in industry.
5. Impart knowledge of safety management practices and emerging Artificial Intelligence applications in construction management

Course Outcomes

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

1. Explain construction project planning principles, organizational structures, and project management systems used in construction projects.
2. Develop and analyze construction schedules using CPM, PERT, AOA, AON, and linear scheduling techniques
3. Perform cost-time trade-off analysis and apply resource allocation, smoothing, and leveling techniques for project optimization using appropriate tools and software.
4. Evaluate construction contracts, tendering procedures, and project delivery methods such as BOT, BOOT, and PPP.
5. Apply safety management principles and identify Artificial Intelligence and Machine Learning applications in construction management for efficient project monitoring and control.

UNIT-I

Introduction: Introduction to construction project planning - Significance, objectives and functions, organization, principles of organization and its types, Construction team and its roles and responsibility existing construction practices and project management systems, Project scale, Economy of scale application in construction cost estimates.

UNIT-II

Construction Management through Network Theory: Definitions and different types of Event, activity, dummy, Network rules, Network event numbering (Fulkerson Rule), Hierarchies of complex network, work break down structure, Liner Scheduling methods - bar charts, milestone charts, their limitations, difference between PERT and CPM, network-based scheduling techniques - PERT, CPM and AOA in construction management. Numerical Problems.

UNIT-III

Cost & Resource Optimization Techniques: Cost Model - Direct and Indirect Cost component of Project, Cost Slope, Project Cost-Time analysis and optimization. Resource usage profile, Histograms,

Resource allocation, smoothing & leveling techniques. Project Updating. Introduction of Project management software - Building Information Modeling (BIM) ,Ms Primavera(P6) etc

UNIT-IV

Contracts: Introduction, types of construction contracts and their advantages and disadvantages, condition of contracts,
workmen compensation act, contract labor act.

Tender: Tender form, tender documents, notice inviting tenders, Work order.

Project Delivery Methods: BOT, SBOO. BOOT, Public Private Partnership (PPP), Detailed project report (DPR)

UNIT-V

Safety Management: Importance of safety in construction industry, Safety, Health and Environment on project sites, Safety management function, Safety responsibility and accountability in construction industry, Safety organizations, Safety administration. accidents their causes, effects and preventive measures, costs of accidents.

Artificial Intelligence in Construction Management: Introduction to Artificial Intelligence in Civil Engineering, Machine Learning applications in construction projects,

Text Books:

1. S.C. Sharma, *Construction Engineering and Management*, Khanna Publishers, New Delhi, 2008.
2. L.S. Srinath, *PERT and CPM: Principles and Applications*, East-West Press, 2001.
3. S. Seetharaman, *Construction Engineering and Management*, Umesh Publications, 2012.
4. Jimmie Hinze, *Construction Planning and Scheduling*, McGraw-Hill, 2001.
5. N.V. Krishnan, *Construction Engineering and Management*, Jaico Publishing House, Bombay, 1997.

References Books:

1. P. S. Gahlot and B. M. Dhir, *Construction Planning and Management*, New Delhi, India: Wiley Eastern Ltd., 2018
2. B. C. Punmia and K. K. Khandelwal, *Project Planning and Control with PERT and CPM*, New Delhi, India: Laxmi Publications, 2006.
3. K. K. Chitkara, *Construction Project Management: Planning, Scheduling and Controlling*, New Delhi, India: Tata McGraw-Hill Education, 2004.
4. P. S. Gahlot and B. M. Dhir, *Construction Planning and Management*, New Delhi, India: Wiley Eastern Ltd., 2018.
5. B. C. Punmia and K. K. Khandelwal, *Project Planning and Control with PERT and CPM*, New Delhi, India: Laxmi Publications, 2006.

Course Code	Course Title						Core / Elective
U24CE5L1	CONCRETE TECHNOLOGY LABORATORY						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Material Testing	-	-	-	3	25	50	1.5

Course Objectives

The objectives of this course are to impart knowledge of and problem-solving skills in

1. **Understanding** standard testing procedures for cement, aggregates, and concrete as per relevant IS codes.
2. **Applying** laboratory techniques to determine material properties.
3. **Analyzing** the behavior of fresh and hardened concrete through experimental test results.
4. **Evaluating** the quality of concrete materials based on IS specifications.
5. **Preparing and testing** concrete mixes for strength assessment.

Course Outcomes

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

1. **Explain** the significance and procedures of standard tests on cement and aggregates.
2. **Perform** laboratory tests to determine fineness, consistency, setting time, specific gravity, sieve analysis, and related material properties.
3. **Analyze** the results of fresh and hardened concrete tests such as slump, compaction factor, compressive strength, split tensile strength, and flexural strength
4. **Evaluate** the quality of concrete materials and compare results with IS code requirements.
5. **Prepare and test** concrete specimens to assess strength characteristics and suitability for structural use.

I. Test on Cement

1. Fineness test
2. Specific gravity test
3. Normal Consistency test
4. Initial setting time and final setting time.
5. Soundness test.
6. Compressive strength of cement.

II. Test on Aggregate (Fine and Coarse Aggregates)

1. Specific gravity and Bulk Density
2. Surface moisture and water absorption test
3. Sieve Analysis.
4. Bulking of sand (Lab & Field method).

III. Test on Fresh& Hardened Concrete

1. Slump Cone Test
2. Compaction Factor Test
3. Compressive strength of concrete
4. Split tensile strength of concrete
5. Flexural strength of concrete

References

1. Concrete Technology, A.R. Shantha Kumar, Oxford Publishers (Second edition)
2. Concrete Technology M.S. Shetty and A.K. Jain, S.Chand &Co, 2018.
3. Concrete Manual, M.L. Gambhir, Dhanpat Rai& Sons
4. IS10262:2019, Concrete Mix Proportioning Guidelines (Second Revision)
5. IS456(2000), Plain and Reinforced Concrete-Code of Practice

Course Code	Course Title						Core/Elective
U24CE5L2	ENVIRONMENTAL ENGINEERING LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	25	50	1

Course Objectives

1. Understanding water and wastewater treatment processes
2. Analyzing water quality parameters (pH, BOD, COD, etc.)
3. Studying air pollution control techniques
4. Learning solid waste management practices
5. Conducting experiments on environmental sampling and monitoring

Course Outcomes

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

1. Apply knowledge of environmental engineering principles to analyze and design water and wastewater treatment systems
2. Conduct experiments and analyze data to determine water and air quality parameters
3. Understand and apply solid waste management practices
4. Develop skills to operate and maintain environmental engineering equipment
5. Interpret and report experimental results, and recommend solutions for environmental problems.

LIST OF EXPERIMENTS

1. a) Determination of total dissolved solids
   b) Determination of total suspended solids
   c) Determination of fluorides
2. Determination of Ph by Ph meter
3. Determination of Hardness (EDTA Method)
4. Determination of alkalinity of water
5. Determination of chlorides
6. Determination of residual chlorine
7. Determination of optimum alum dosage
8. Determination of BOD
9. Determination of COD
10. Determination of Dissolved Oxygen

Text Books:

1. Hammer, M.J.and Hammer, M.J.Jr.,Water and Wastewater Technology, Prentice-Hall of India Pvt.Ltd.
2. G.S.Birdie &J.S.Birdie,Water Supply and Sanitary Engineering, Dhanpat Rai Publishing Company (P)Ltd.
3. Dr.P.N.Modi,"WaterSupplyEngineering",StandardBookHouse,RajsonsPublicationsPvt.Ltd
4. Environmental Engineering by H. S Peavy, D. R. Rowe, G. Tchobanoglous, McGraw Hill Education (India) Pvt Ltd, 2014

.

Course Code	Course Title						Core / Elective
U24CE5P1	INTERNSHIP						core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	50	--	1

Course Objectives

The objectives of this course are.

1. Produce an accurate record of work performed during the Internship/Co-op
2. Apply engineering knowledge to a problem in industry
3. Produce a technical report
4. Discuss work in a team environment, if relevant to the project
5. Conduct herself/himself responsibly, safely, and ethically in a professional environment

Course Outcomes

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

1. Design a small and simple production hardware.
2. Develop a small and simple product in software
3. Understand the turbidity in water sample. Complete the task or realize a pre-specified target, with limited scope, rather than taking up a complex task and leave it.
4. Learn to find alternate viable solutions for a given problem and evaluate the seal ternatives with reference to pre-specified criteria
5. Implement the selected solution and document the same.

Guidelines of Internship

Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important as employers are looking for employees who are properly skilled and have awareness about industry environment, practices and culture. Internship is structured, short-term, supervised training often focused around particular tasks or projects with defined time scales.
Duration: Internship to be completed after II, IV semester of 4 weeks.
Internship Work Identification: Student may choose to undergo Internship at
Industry/Govt./NGO/MSME/Rural Internship/Innovation/IPR/Entrepreneurship.
Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/Medium enterprises.
Student can take internship work in the form of online/onsite work including but not limited to:

1. Working for consultancy/research project
2. Participation at events (technical/business) in innovation related competitions like Hackathon
3. Contribution in incubation/innovation/entrepreneurship cell/institutional innovation council/startup cells of institute
4. Learning at departmental lab/tinkering lab/institutional workshop
5. Development of new product/business plan/registration of start-up
6. Participation in IPR workshop/leadership talks/idea design/innovation/business competition/technical expos
7. Industry/government organization internship
8. In-house product development, intercollegiate/inter department research internship under research lab/group/MSME/online internship
9. Carrying out surveys related to society-related engineering problems such as solid waste management, water supply network, air quality etc.

Internship Diary

Students must maintain Internship Diary/Internship Workbook. The purpose is to cultivate the habit of documenting day-to-day observations, impressions, information gathered and suggestions given. The diary/workbook should be signed daily by the supervisor. Internship diary/workbook and internship report must be submitted along with attendance record and evaluation sheet duly signed and stamped by the industry.

- Proper and timely documented entries
- Adequacy and quality of information recorded
- Data recorded
- Thought process and recording techniques used
- Organization of the information

Recommended Evaluation Parameters

1. Post internship internal evaluation: 25 Marks
   Internship diary/workbook and internship report: 25 Marks
   Evaluation through Seminar Presentation/Viva-Voce at the Institute.
2. Evaluation will be based on depth of knowledge, communication skills, presentation skills, team work, creativity, planning & organizational skills, adaptability, analytical skills, attitude and behavior at work, societal understanding, ethics, regularity and punctuality, attendance record, log book and student feedback from external internship supervisor.

Internship Report Format

1. Title/Cover Page
2. Internship completion certificate
3. Internship place details: Company background, organization activities, scope and objectives of the study/personal observations
4. Index/Table of contents
5. Introduction
6. Title/Problem statement/Objectives
7. Motivation/Scope and rationale of the study
8. Methodological details
9. Results/Analysis/Inferences and conclusion
10. Suggestions/Recommendations for improvement to industry, if any
11. Attendance record
12. Acknowledgement
13. List of references (books, magazines and other sources)

Note: Students have to undergo summer internship of 4weeks at the end of semester IV and credits will be awarded after evaluation in V semester

.

LORDS INSTITUTE OF ENGINEERINGAND TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF INSTRUCTIONS & EXAMINATIONS [LR-24]
(w.e.f. Academic Year 2026-27)
B.E. VI-Semester (Tentative)

S. No	Course Code	Category	Course Title	Scheme of Instruction				Scheme of Examination			Credits
				L	T	P/D	Contact Hours/Week	Maximun Marks CIE	Maximun Marks SEE	Duration in Hours	
Theory Course											
1	U24CE601	PCC	Theory of Structures-II	3	-	-	3	40	60	3	3
2	U24CE602	PCC	Geotechnical Engineering*	3	-	-	3	40	60	3	3
3	U24CE603	PCC	Design of Reinforced Concrete Structures	3	-	-	3	40	60	3	3
4	-	PEC	Professional Elective-II	3	-	-	3	40	60	3	3
5	-	PEC	Professional Elective-III	3	-	-	3	40	60	3	3
6	-	OEC	Open Elective–I	3	-	-	3	40	60	3	3
Practical/ Laboratory Course											
7	U24CE6L1	PCC	Computer Aided Civil Engineering Drafting Lab	-	-	2	2	25	50	3	1
8	U24CE6L2	PCC	Geotechnical Engineering Lab	-	-	2	2	25	50	3	1
Skill Development Course											
9	U24MA6L1	BSC	Aptitude and Reasoning Skills Lab	-	-	2	2	25	50	3	1
Seminar											
10	U24CE6P2	PROJ	Technical Seminar			2	2	50	-		1
Total				**18**		**8**	**26**	**365**	**510**	**24**	**22**

TW: *Term Work (includes assignments, Seminars, micro-Projects, industrial visits, any other student activities etc.)

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
PCC: Professional Core Courses **OEC**: Open Elective Courses
EN: English **ME**: Mechanical Engineering
HSMC: Humanities & Social Sciences Including Management Courses
PROJ: Project

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 Institution)
DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF INSTRUCTIONS & EXAMINATIONS [LR-24]
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	U24CE506	PEC 1	Solid and Hazardous Waste Management	3	-	-	3	40	60	3	3
	U24CE507		Advanced Surveying	3	-	-	3	40	60	3	3
	U24CE508		Construction Project and Planning	3	-	-	3	40	60	3	3
2	U24CE604	PEC 2	Design of Hydraulic Structures	3	-	-	3	40	60	3	3
	U24CE605		Sustainable Construction Methods	3	-	-	3	40	60	3	3
	U24CE606		Urban Transportation planning	3	-	-	3	40	60	3	3
3	U24CE607	PEC 3	Environmental Impact Assessment	3	-	-	3	40	60	3	3
	U24CE608		Contract Management	3	-	-	3	40	60	3	3
	U24CE609		Robotics and Automation in Civil Engineering	3	-	-	3	40	60	3	3
4	U24CE704	PEC 4	Advanced Concrete Technology	3	-	-	3	40	60	3	3
	U24CE705		Advanced RCC Design	3	-	-	3	40	60	3	3
	U24CE706		Foundation Engineering	3	-	-	3	40	60	3	3
5	U24CE707	PEC 5	GIS and Remote Sensing	3	-	-	3	40	60	3	3
	U24CE708		Repair and Rehabilitation of Structures	3	-	-	3	40	60	3	3
	U24CE709		Groundwater Engineering	3	-	-	3	40	60	3	3
6	U24CE801	PEC 6	Ground improvement techniques	3	-	-	3	40	60	3	3
	U24CE802		Principles of Climate change	3	-	-	3	40	60	3	3
	U24CE803		Finite Elements Methods	3	-	-	3	40	60	3	3

Professional Electives with 6 Threads

S. No.	PE 1	PE 2	PE 3	PE 4	PE 5	PE6
1.	Solid and Hazardous Waste Management	Design of Hydraulic Structures	Environmental Impact Assessment	Advanced Concrete Technology	GIS and Remote Sensing	Ground improvement techniques
2.	Advanced Surveying	Sustainable Construction Methods	Contract Management	Advanced RCC Design	Repair and Rehabilitation of Structures	Principles of Climate change
3.	Construction Project and Planning	Urban Transportation planning	Robotics and Automation in Civil Engineering	Foundation Engineering	Groundwater Engineering	Finite Elements Methods

LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF INSTRUCTIONS & EXAMINATIONS [LR-24]
OPEN ELECTIVE COURSES

S. No.	Course Code	Category	Course Title
1.	U24EE608	OEC 1	Fundamental of Power Electronics
	U24EE609		Electrical Installation and Safety
	U24CS607		Java Programming
	U24IT606		Operating Systems
	U24ME610		Basics Of 3-DPrinting
	U24ME611		Modern Manufacturing Processes
	U24CE610		**Disaster Management****
	U24CE611		**Basics of civil Engineering ****
	U24EC607		Principles of Data Communication and Network
	U24EC608		Embedded Systems
	U24MB602		Total Quality Management
	U24MB603		Innovation Management
	U24CD607		Data Ethics
	U24CM607		Fundamentals of Machine Learning

Course Code	Course Title						Core / Elective
U24CE601	THEORY OF STRUCTURES - II						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Theory of Structures -I	3	-	-	-	40	60	3

Course Objectives

1. The concept of influence lines, moving loads, and moving lines is explained to assess the maximal S.F. and B.M. for the same section
2. Analysis of indeterminate structures by stiffness matrix method.
3. Analysis of indeterminate structures by flexibility matrix method.
4. Analysis of indeterminate structures by direct element method.
5. To determine the shape factor and define the theorems of plastic analysis

Course Outcomes

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

1. Use various classical methods for analysis of indeterminate structures
2. Analyse the structure using flexibility matrix method to calculate the Redundant forces and sketch the BMD and SFD
3. Analyse the structure using Stiffness matrix method to calculate the Redundant forces and sketch the BMD and SFD
4. Develop Stiffness matrix using Direct Element method for indeterminate structures
5. Determine the collapse load/ultimate load for continuous beams

UNIT– I

Moving loads and Influence Line diagrams: Influence lines for reaction, bending moment and shear force. Determination of maximum bending moment and shear force for moving load systems on simply supported girders by ((i) single point load, (ii) uniformly distributed load longer than the span, (iii) uniformly distributed load shorter than the span and (iv) series of point loads.

UNIT-II

Matrix methods of structural analysis - Introduction, Static and Kinematic Indeterminacy, Compatibility and Equilibrium equations.

Stiffness Matrix Method: Introduction, Analysis of continuous beams including settlement of supports, pin jointed plane trusses, single bay single storey Frames including Side Sway with static indeterminacy not exceeding three

UNIT-III

Flexibility Matrix Method- Introduction, Analysis of continuous beams including settlement of supports, pin jointed plane trusses, single bay single storey Frames including Side Sway with static indeterminacy not exceeding three

UNIT-IV

Direct Stiffness Method: Introduction, Analysis of continuous beams including settlement of supports, pin jointed plane trusses, single bay single storey Frames including Side Sway with static indeterminacy not exceeding three

UNIT– V

Plastic Analysis: Introduction – Plastic Moment/Fully Plastic Moment – Plastic section modulus , calculation of shape factor for rectangular ,T-section and symmetrical & unsymmetrical I-Section collapse load/ultimate load and plastic moment, load factor, plastic hinge, plastic analysis of continuous beams.

Text Books

1. Structural Analysis- A Unified Approach, D.S. Prakash Rao, University Press, 1996
2. Theory of structures, B.C. Punmia and A.K. Jain, Laxmi Publications, New Delhi, 2004.
3. Basic Structural Analysis, C.S.Reddy, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
4. Fundamentals of Structural Analysis by K. M. Leet, C. M. Uang , – 3rd Edition,2006.
5. Structural Analysis: A Unified Classical & Matrix Approach by A. Ghali, A. Neville – 6th Edition

References

1. Analysis of Structures ***by*** V. N. Vazirani & M. M. Ratwani., 10th Edition, New Delhi, 2014.
2. *Structural Analysis* **by R. C. Hibbeler** – 10th Edition (SI Units), Pearson Education
3. Theory of Structures, G.S,Pandit,S.P.Gupta and R.GuptaVol.I&II,TataMcGrawHill,NewDelhi,1999.
4. Theory of Structures, Pandit, G .S., S. P. Gupta and R. Gupta,Vol.l, Tata McGraw Hill, New Delhi, 1999
5. Mechanics of Structures (Vol. 1 &2), S.B. Junarkar, Charotar Publishing House Anand, 1992.

Course Code	Course Title						Core / Elective
U24CE602	Geotechnical Engineering*						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives

The objectives of this course are to impart knowledge of and problem-solving skills in

1. Understand soil origin, classification, and index properties.
2. Determine engineering properties of soils.
3. Analyze stress distribution and seepage in soils.
4. Understand the concept of compaction and consolidation in soils
5. Understand Seepage, Strength and Compressibility characteristics of soils

Course Outcomes

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

1. Identify and classify the soil and their index properties
2. Calculate the capillarity and permeability parameters of soils.
3. Analyze stress distribution, and seepage in soils.
4. Evaluate compaction, consolidation, and settlement behavior of soils.
5. Determine shear strength of soils and assess stability of soil masses.

UNIT-I

Origin & Classification of Soils: Soil as a pseudo-elastic three phase particulate medium Physical Properties of soil: Weight ratios (Water content, Density, Unit weights, Specific Gravity); Volume ratios (void ratio, porosity, degree of saturation, relative density); Clay mineralogy, Interrelationships, Laboratory tests for determination of Index properties. Classification and Identification of soils for general and engineering purposes as per IS: 1498-1970.

UNIT-II

Capillarity in Soils: Surface tension and capillary rise in soil, Capillary tension, Capillary pressure.

Permeability of Soils: Darcy's law for flow through soils - validity of Darcy's Law - Factors affecting permeability - Laboratory tests for determination of co-efficient of permeability (constant head, variable head permeability tests) - Field tests (Pumping in and pumping out tests) - Equivalent permeability of stratified soils.

UNIT-III

Stress in Soils: Total, effective and neutral stress distribution in different ground conditions

Seepage in Soils: Seepage flow, seepage pressure - Flow nets - Locating phreatic line in a homogeneous earthen dam using Kozeny's parabola - Computation of seepage quantity**.**

Quick Sand phenomena: Critical Hydraulic gradient, Remedial measures**.**

UNIT-IV

Compaction: Compaction Mechanism; factors affecting compaction. Laboratory determination of compaction characteristics - standard and modified Proctor tests - IS Light and Heavy compaction tests; Field surface, compaction equipment, procedure, quality control.

Consolidation: Spring analogy - Void ratio and effective stress (e Vs log p) relationship - Terzaghi's theory of one dimensional consolidation - Assumptions and derivation of GDE- Computation of magnitude of settlement (using Cc, mv) and rate of settlement (cv , Tv, d) classification based on OCR.

UNIT-V

Shear Strength: Significance of Shear strength in soils - Mohr - Coulomb equation – shear parameters - Laboratory tests for determination of shear strength - Direct shear test, Tri-axial compression test, Un-confined compression test, Vane shear test, Factors affecting shear strength of cohesion-less and cohesive soils.

Text Books:

1. 1. Soil Mechanics and Foundations, Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain, Lakshmi Publication, 17th Edition, 2005.
2. Geotechnical Engineering, Venkataramaiah, C., New Age Publishers,2006

References Books:

1. 1. Soil Mechanics and Foundation Engineering, Arora, K.R., Standard Publishers Distributors, revised and enlarged sixth edition,2007.
2. Soil Mechanics and Foundation Engineering, Murthy, V.N.S., Dhanpat Rai & Sons,2006
3. IS 2720 (Relevant Parts), "LaboratoryTests on Soils", Bureau of Indian Standards.
4. IS 1498-1970 "Classification and Identification of Soils for General and Engineering purposes", Bureau of Indian Standards

Course Code	Course Title						Core / Elective
U24CE603	Design of Reinforced Concrete Structures						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
---	3	-	-	-	40	60	03

Course Objectives

The objectives of this course are to

1. To understand various design philosophies and limit state of deflection
2. Design of singly reinforced, doubly reinforced and flanged beams for flexure, shear and bond.
3. Analyze and design of one-way and two-way slabs.
4. To understand design of short and long columns
5. To design footings and staircase

Course Outcomes

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

1. Understand the design philosophy and principles.
2. Solve engineering problems of RC elements subjected to flexure, shear and bond
3. Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns, footings and staircase.

UNIT-I

Introduction to Limit State Design and Serviceability: Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety. Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section.

Limiting deflection, short-term deflection, long-term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam.

UNIT-II

Limit State Design of Beams: Design of singly and doubly reinforced rectangular beams for flexure, shear and bond. Design of flanged beams for flexure, shear and bond.

UNIT-III

Limit State Design of Slabs and Stairs: Introduction to one way and two-way slabs, Design of cantilever, simply supported and one-way continuous slab. Design of two-way slabs.

UNIT-IV

Limit State Design of Columns: Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design procedure of slender columns

UNIT-V

Limit State Design of Footings: Introduction to foundations, safe bearing capacity of soils, design of isolated square, rectangular and square footings.

Staircase: Definition, types of staircase, design of dog legged staircase.

Text Books:

1. Unnikrishnan Pillai and Devdas Menon, “Reinforced Concrete Design”, McGraw Hill, New Delhi
2. Subramanian, “Design of Concrete structures”, Oxford university Press
3. H J Shah, “Reinforced Concrete Vol 1 (Elementary Reinforced Concrete)”, Charotar Publishing House Pvt. Ltd.
4. A.K Jain “ Limit State Design” Nem Chand & Bro’s.

Reference Books:

1. P C Varghese, “Limit State design of reinforced concrete” , PHI, New Delhi
2. W H Mosley, R Husle, J H Bungey, “Reinforced Concrete Design”, MacMillan Education, Palgrave publishers
3. Kong and Evans, “Reinforced and Pre-Stressed Concrete”, Springer Publications
4. A W Beeby and Narayan R S, “Introduction to Design for Civil Engineers”, CRC Press
5. 5. Robert Park and Thomas Paulay, “Reinforced Concrete Structures”, John Wiley & Sons, Inc.

Course Code	Course Title						Core / Elective
U24CE604	DESIGN OF HYDRAULIC STRUCTURES						PEC-II
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Hydrology & Water Resources Management	3	-	-	-	40	60	3

Course Objectives

The objectives of this course are to impart knowledge of and problem-solving skills in

1. Understand the types, alignment, and design principles of canal distribution systems.
2. Explain the theories related to canal flow and regulation works such as Kennedy's and Lacey's theories.
3. Analyze the design considerations and structural stability of gravity and earth dams.
4. Evaluate various reservoir storage methods, sedimentation issues, and site selection parameters.
5. Describe different types of spillways and energy dissipation techniques in hydraulic structures

Course Outcomes

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

1. Apply Kennedy's and Lacey's theories to design irrigation canals.
2. Explain reservoir and dam types, site selection, storage, yield, and sedimentation.
3. Assess the forces acting on gravity dams and perform basic stability analysis.
4. Design earth dams with proper seepage control and drainage systems.
5. Comprehend various components of Hydro power stations.

UNIT-I

Distribution systems –Types of canals, alignment, balancing depth, design of canals, Kennedy's and Lacey's theory, canal losses, lining of canals. Introduction to canal regulation works, cross drainage works. Canal outlets: non-modular, semi-modular and modular outlets. Introduction to diversion head works and its components.

UNIT-II

Storage Works-Reservoirs - Types of reservoirs, selection of site for reservoir, zones of storage of a reservoir, reservoir yield, estimation of capacity of reservoir using mass curve- Reservoir Sedimentation – Life of Reservoir. Types of dams, factors affecting selection of type of dam, factors governing selection of site for a dam.

UNIT-III

Gravity dam -advantages & disadvantages, selection criteria, economical height of the dam, forces acting on dam, stability analysis, elementary profile and practical profile, low and high gravity dams.

Spillways: Different types of spillways, energy dissipation below spillways, different types of spillway crest gates, stilling basin appurtenances (descriptive details only)

UNIT-IV

Earth dams: Types, Methods of construction, Seepage analysis for homogenous and zoned embankment dams, Drainage in embankment dams, various types of filters, Failure of Earth dams & Design criteria. Design to suit available materials and foundation conditions, seepage control measures.

UNIT-V

Hydro-power: Comparison of hydro power with thermal power, classification of hydro power plants, definition of various terms, principal components of hydro-electric power plants (Forebay, intake structure, penstock & surge tank), economical diameter of penstock.

Power house: Substructure and super structure of a power house, merits and demerits of an underground power house, fixation of dimensions of a power house.

Text Books:

1. Modi, Irrigation & Water Resources and Water Power, Standard Publishers, New Delhi..
2. S.K.Garg, Irrigation Engineering & Hydraulic Structures, Khanna Publishers
3. B.C.Punmiya&B.B.Lal,Irrigation&WaterPowerEngineering,LaxmiPublishers.
4. Ralph W.Warbs and W.P.James, Water Resources Engineering, Prentice Hall, New Delhi.
5. K.R. Arora, "Irrigation, Water Power and Water Resources Engineering", 3rd Edition, Standard Publishers distributors, 2010

References Books:

1. Ch. S. N. Murthy, "Water Resources Engineering: Principles and Practice", New Age International Publishers, Delhi, 2002.
2. G. L. Asawa, "Irrigation and water Resources engineering", New Age International Publishers, Delhi, 2005. 3. VenTe Chow, "Hand book of Applied Hydrology", McGraw-Hill Book Company, New York, 1964

Course Code	Course Title						Core / Elective
U24CE605	SUSTAINABLE CONSTRUCTION METHODS						PEC-II
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3

Course Objectives

The objectives of this course are to impart knowledge of and problem-solving skills in

1. Understand the importance of modular construction methods.
2. Gain knowledge of the practical applications and fundamental concepts of basic construction methods.
3. Learn about the characteristics of sustainable, energy-efficient building materials.
4. Study the core concepts of innovative construction methods.
5. Understand rating systems in detail, including their evolution, objectives, criteria, certification levels, benefits, and limitations.

Course Outcomes

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

1. Apply the modular construction techniques in practice.
2. Understand the fundamental construction methods used in construction projects.
3. Appropriately apply innovative and advanced construction methods.
4. Comprehend and utilize cutting-edge sustainable, energy-efficient building materials and methods.
5. Demonstrate the ability to evaluate and design sustainable building rating systems.

UNIT-I

Modular Construction Practices - Introduction to formwork - requirements of formwork, loads carried by formwork, types of formwork-timber, steel, slip forms, scaffolding. Modular construction - modular coordination, modular standardization, modular system building, modular shuttering, limitation and advantages of modular construction

UNIT-II

Basic Construction Methods – Construction of foundation and super structure - buildings - precast concrete structures, bridges - steel bridges, arch bridges, cantilever bridges segmental construction, box girders. Construction of special type of bridges such as cable stayed bridge, suspension and pre-stressed bridge.

UNIT-III

Sustainable Construction Materials – Overview of cutting-edge sustainable energy - efficient building materials, alternative cements and cementitious materials, sustainable issues for concrete, minimization of natural resource utilization, reduction in water consumption in concrete, recycled aggregate, evaluation of their potential to reduce the negative environmental impacts of construction activity.

UNIT-IV

Innovative Methods of Construction – Slip form technology, jump from technology, aluminum form technology, tunnel form technology, dry wall technology, plastering machines.

UNIT-V

Sustainable Building Rating Systems - Rating systems for the design, construction, operation, and maintenance of green buildings through Leadership in Energy and Environmental Design (LEED), Case Study of recent green construction projects in India – Certification of LEED Green Associate professional licensing. , Sustainable construction methods as per Indian Green Building Council (IGBC) , TERIs – Green rating for integrated habitat assessment (GRIHA), ECBC 2017 (Energy Conservation Building Code).

Text Books:

1. Construction Technology, Roy Chudley and Roger Greeno, Prentice Hall, New Delhi, 2005.
2. Construction Planning, Equipment and Methods, Peurifoy, Tata McGraw Hill Publication, NewDelhi, 2001.
3. "Sustainable Building Design Manual- Volume II", Published by TERI, New Delhi, 2009.
4. "The Engineering Guide to LEED-New Directions (Green Source): Sustainable construction", Liv Haselbach, McGraw-Hill Professional, 2008.

5. Indian Green Building Council, Green building rating system: New construction and major renovations (LEED India NC) reference guide version 1.0, Confederation of Indian Industry, CII- Sohrabaji Godrej Green Business Centre, Hyderabad, 2007.

References Books:

1. Principles and Practices of Commercial Construction, Cameron K. Andres, Ronald C. Smith,Prentice Hall, New Delhi, 2009
2. Formwork for Concrete Structures, Kumar Niraj Jha, McGraw Hill Publication, New Delhi, 2004.
3. Fundamentals of Building Construction Material and Method, Allen E, Iano, J, John Wiley andSons, 2011
4. Rebecca L. Henn; Andrew J. Hoffman (2013), Constructing Green the Social Structures of Sustainability (Urban and Industrial Environments), MIT Press.
5. Steve Goodhew Sustainable Construction Processes: A Resource Text ISBN: 978-1-40518759-6 May 2016 Wiley- Blackwell.

Course Code	Course Title						Core / Elective
U24CE606	URBAN TRANSPORTATION PLANNING						PEC-II
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Transportation Engineering	3	-	-	3	40	60	3

Course Objectives

The objectives of this course are to impart knowledge of and problem-solving skills in

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 patternand 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"PHI Learning, 2017.
3) KhannaS.K., JustoC.E.G., VeeraraghavanA., "**HighwayEngineering**",10thEdition, NemChand&Bros,2015.
4) R. Srinivasa Kumar , **Transportation Engineering** (Railways, Airport,) Universities Press, 2014

Course Code	Course Title						Core/Elective
U24CE607	**Environmental Impact Assessment**						PEC-III
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives

1. The objectives of this course is to:
2. Understand the principles of Environmental Impact Assessment (EIA)
3. Identify and analyze environmental impacts of projects
4. Develop skills for environmental impact prediction and mitigation
5. Learn to prepare environmental impact statements/reports
6. Apply EIA concepts to real-world projects/scenarios

Course Outcomes

1. After Completion of this course the student will be able to
2. Understand EIA principles and regulatory frameworks
3. Identify and analyze environmental impacts of projects
4. Predict and mitigate environmental impacts
5. Prepare and evaluate EIA reports/statements
6. Apply EIA concepts to real-world projects/scenarios.

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.

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-Advantages 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, Greenhouse effect, Industrial effluents and their impact on natural cycle, Environmental impact of Highways.

UNIT–V

Digital Transformation: EIA regulations now mandate digital submission via the PARIVESH 2.0 portal, enhancing transparency and efficiency. EIA studies must assess projects' carbon emissions impact and climate resilience measures, aligning with India's net-zero commitments Public Consultation: Enhanced public participation mechanisms, including digital access to EIA reports and virtual stakeholder forums.

Text Books:

1. Rau,J.G.andWooten,D.C.,(1996),"EnvironmentalImpactAssessment",McGrawHillPub.Co., New York
2. Canter,L.W.,(1997),"EnvironmentalImpactAssessment",McGrawHillPub.Co.,NewYork
3. Environmental Impact Assessment Methodologies, Anjaneyulu. Y.,n and Manickam. V.,B.S. Publications, Hyderabad, 2007.
4. Environmental Impact Assessment by R.R. Barthwal V.,B.S. Publications, Hyderabad, 2007.

References:

1. Grand Jean, E.Gilgen A.,"Environmental Factorsin 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.,KumarA,Eds,D ayaPublishing House, 1998.
6. -Environmental Engineering: Fundamentals and Applications by Subhash Verma, Varinder S Kanwar, and Siby John (2022)

Course Code	Course Title						Core / Elective
U26CE608	Contracts Management						PEC-III
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
---	3	-	-	-	40	60	3

Course Objectives

This course imparts knowledge and problem-solving skills to enable students to:

1. Understand various contracts, their suitability, and procurement processes in construction projects.
2. Acquire knowledge of different types of contracts used in construction.
3. Grasp the tendering process comprehensively.
4. Review contract provisions for effective project management.
5. Master contract management processes in construction projects.

Course Outcomes

Upon completion, students will be able to:

1. Understand fundamentals of legal systems in construction contracts.
2. Develop comprehensive contract management plans, including selection, stakeholders, and risk strategies.
3. Analyze project requirements to select optimal contract forms and parameters.
4. Administer contracts and resolve disputes via negotiation and mediation.
5. Apply contract law principles for effective management and dispute minimization.

UNIT I: Introduction to Construction Contracts

Definitions and types: Lump sum, fixed price, percentage rate, cost plus, target, design-build contracts.; Conditions of contract, parties involved, contract formation.; Advantages and disadvantages of construction contracts.

UNIT II: Tendering and Procurement

Key terms: Tendering, tender form/documents, notice inviting tenders, work order.; EOI, RFQ, RFP; prequalification process.; Project delivery methods: BOT, BOO, BOOT.; Tender submission/evaluation, PPP, DPR, tender rejection, contract agreement/documents.

UNIT III: Contract Clauses and Provisions

Definitions: General/special conditions, contract documents.; Payments, time delays, scope changes, extra claims.; Dispute resolution, termination, insurance/indemnity, performance bonds/guarantees.; Review, conclusion, subcontracting.

UNIT IV: Contract Administration

Elements of contract management; major stakeholders.; Duties/responsibilities of parties, stakeholder agreements.; Contract risk management, management reporting.; Dispute mechanisms: Negotiation, mediation.

UNIT V: Legal Framework in Contracts

Legal issues and definitions.; Essential requirements per Indian Contract Act 1872.; Characteristics of good contracts; enforceability.; Breach/termination; major stakeholders.; Overview of contract management activities.

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., “Law relating to Building and Engineering Contracts in India” Butterworths

5. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000

Reference Books

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.Jose M.Guevara, P.E., Fundamentals of Construction Management and Organisation 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
U26CE609	Robotics and Automation in Civil Engineering						PEC-III
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
---	3	-	-	-	40	60	3

Course Objectives

This course equips Civil Engineering students with foundational knowledge to:

1. Understand robotics fundamentals and their adaptation for civil construction applications.
2. Analyze automation systems for site operations, material handling, and infrastructure tasks.
3. Apply robot kinematics, sensors, and control for civil engineering challenges.
4. Evaluate integration of AI/ML with robotics for smart construction and monitoring.
5. Design basic robotic solutions for sustainable civil projects.

Course Outcomes

Upon completion, students will be able to:

1. Identify suitable robots and automation tools for civil engineering tasks like surveying, demolition, and 3D printing.
2. Perform kinematic analysis and simulation for construction robot manipulators.
3. Implement sensor-based control systems for autonomous civil operations.
4. Develop simple robot programs for tasks like bricklaying or inspection.
5. Assess economic, safety, and ethical aspects of robotics in civil infrastructure.

UNIT I: Fundamentals of Robotics in Civil Engineering

Introduction: Robot anatomy, degrees of freedom, coordinate systems; Civil applications (drones for surveying, robotic arms for rebar tying). Classifications: Industrial vs. construction robots; Mobile robots (AGVs for material transport). Civil-specific: Robotics in hazardous environments (demolition, tunnel boring); Case studies of successful human-robot collaboration.

UNIT II: Kinematics and Workspace Analysis

Forward/inverse kinematics for manipulators; Denavit- Hartenberg parameters. Workspace analysis: Reachable vs. dexterous workspace; Singularity avoidance for construction tasks (painting, welding). Trajectory planning: Straight-line, circular paths for bricklaying/masonry robots; Collision avoidance in construction sites.

UNIT III: Sensors, Actuators, and Drives for Construction

Sensors: Vision (cameras for crack detection), LiDAR (site mapping), IMUs, proximity sensors, force/torque sensors; Civil case studies. Actuators: Hydraulic/pneumatic for heavy lifting (excavation), electric for precision (inspection drones). Drive systems: Design basics for construction robots (payload, endurance, environmental protection).

UNIT IV: Control Systems and Programming

Control architectures: PID, fuzzy logic for stability in uneven terrain; Adaptive control. Programming: Lead-through, VAL/ROS basics; Simulation in Robot Studio/Gazebo. Civil applications: Pick-and-place (material handling), path following (pavement marking); Human-robot interface design.

UNIT V: Advanced Applications and Integration

AI/ML in civil robotics: Path optimization, computer vision for quality control, predictive maintenance for bridges/infrastructure. Construction 4.0: Digital twins, 3D printing, swarm robotics, BIM integration, IoT and smart sites. Disaster response: Search and rescue robots, damage assessment. Economics, safety standards (ISO 10218, ISO/TS 15066), ethics; Future trends (soft robotics, bio-inspired systems).

Text Books

1. John J. Craig, *Introduction to Robotics: Mechanics and Control*, Pearson.
2. Mikell P. Groover et al., *Industrial Robotics: Technology, Programming, Applications*, McGraw-Hill.
3. S.R. Deb, *Robotics Technology and Flexible Automation*, Tata McGraw-Hill.

Reference Books

4. M. J. Skibniewski, *Robotics in Civil Engineering*, publisher: Van Nostrand Reinhold, ISBN-13: 978- 0442319250
5. Luc Jaulin, Automation for Robotics (Control, Systems and Industrial Engineering), publisher: Wiley- ISTE, ISBN13-978-1848217980
6. Tanjina Nur, Robotics in Civil Engineering, Publisher: Arcler Education Inc, ISBN13-978- 1680943764

Course Code	Course Title						Core / Elective
U24CE610	DISASTER MANAGEMENT						OEC-1
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Environmental Engineering	3	-	-	-	40	60	03

Course Objectives

The objectives of this course are to impart knowledge of and problem-solving skills in

1. Provide fundamental knowledge on disaster concepts, types, causes, risk, vulnerability, and capacity.
2. Develop understanding of disaster management cycle, risk assessment, and mitigation strategies.
3. Introduce institutional framework and policies related to disaster management in India including Disaster Management Act 2005.
4. Enhance awareness on preparedness, response, rehabilitation, and reconstruction strategies.
5. Familiarize students with modern tools and technologies such as GIS, Remote Sensing, GPS, and Early Warning Systems used in disaster management.

Course Outcomes

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

1. Explain disaster concepts, types, causes, vulnerability, and risk assessment principles.
2. Classify various natural, technological, and man-made disasters and analyze their impacts.
3. Apply disaster management cycle principles including prevention, mitigation, preparedness, response, and recovery strategies.
4. Evaluate institutional mechanisms, policies, and legal frameworks for disaster management in India.
5. Evaluate institutional mechanisms, policies, and legal frameworks for disaster management in India.

UNIT-I

Introduction

Understanding the concepts and definitions of disaster, types of disasters, causes, hazard, vulnerability, risk and capacity—disaster and development, and disaster management.

UNIT-II

Hazardous Methods : Geological disasters (earthquakes, landslides, tsunami, mining); hydro-meteorological disasters (floods, cyclones, lightning, thunderstorms, hail storms, avalanches, droughts, cold and heat waves); biological disasters (epidemics, pest attacks, forest fire); technological disasters (chemical, industrial, radiological, nuclear) and manmade disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters). Global disaster trends— emerging risks of disasters—climate change and urban disasters.

UNIT-III

Disaster Management Cycle and Framework: Disaster management cycle—paradigm shift in disaster management—pre-disaster risk assessment and analysis, risk mapping, zonation and micro-zonation, prevention and mitigation of disasters, early warning system.

UNIT-IV

Preparedness Capacity Development: Awareness—during disaster evacuation—disaster communication—search and rescue—emergency operation centre—incident command system— relief and rehabilitation. Post-disaster—damage and needs assessment, restoration of critical infrastructure—early recovery—reconstruction and redevelopment; IDNDR**.**

UNIT-V

Disaster Management in India: Disaster profile of India—mega disasters of India and lessons learnt—Disaster Management Act 2005—institutional and financial mechanism—National Policy on Disaster Management—national guidelines and plans on disaster management; role of government (local, state and national), non-government and inter-governmental agencies.

Applications of science and technology for disaster management—geo-informatics in disaster management (RS, GIS and GPS)—disaster communication system (early warning and its dissemination)—land use planning and development regulations—disaster safe designs and constructions—structural and non-structural mitigation of disasters—S&T institutions for disaster management in India**.**

Text Books:

1. A Text Book of Disaster Management – Shashwat Publication
2. Fundamentals of Disaster Management – Astral International
3. Disaster Management – S.C. Sharma
4. Managing Natural Disasters in the 21st Century – C. N. R. Rao

References Books:

1. Disaster Management in India: Policies, Institutions and Practices – Rajib Shaw (Routledge)
2. Disaster Management Act & Policies: With Case Studies – National Institute of Disaster Management *Study Material*
3. NIDM (National Institute of Disaster Management) Training Modules – Govt. of India
4. UNDRR (United Nations Office for Disaster Risk Reduction) Reports & Manuals – Global frameworks & case examples
5. . NDMA (National Disaster Management Authority) Guidelines Collection – Govt. publication

Course Code	Course Title						Core / Elective
U24CE611	Basics of Civil Engineering						OEC-1
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Surveying & Geomatics	3			3	40	60	3

Course Objectives

The objectives of this course is to impart knowledge of and problem solving skills in

1. Scope and significance of civil engineering in infrastructural development.
2. Surveying and levelling techniques and their importance in construction and land measurements.
3. construction materials, their properties, and their selection based on strength, durability, economy, and environmental considerations.
4. Highlight advancements in civil engineering, focusing on sustainable practices, smart city planning, and innovative systems for urban development.

To **Essential Course Outcomes**

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

1. Understand the scope and applications of Civil Engineering.
2. Describe the methods of levelling and demonstrate its applications in real-world scenarios.
3. Evaluate materials based on strength, durability, eco-friendliness, and economic considerations for different civil engineering structures.
4. Identify the various building components, methods of construction, and services.
5. Describe the Concept of Smart Cities and promote sustainable civil engineering practices.

UNIT-I

Introduction to types of buildings as per NBC, Selection of site for buildings, Components of a residential building and their functions, Introduction to Industrial buildings and types.

Building Planning – Basic requirements, elements, introduction to various building area terms, computation of plinth area, carpet area.

UNIT-II

Surveying and Levelling: Definition of Surveying, Aims and applications, Fundamental principles of surveying, Classification of surveying, Plans and maps, Scales, and Units of measurement, Introduction to liner and angular measurements, Types of compass. Introduction to levelling, Aims and application of levelling, Methods of levelling.

UNIT-III

Overview of Construction Material: Scope of construction materials in Building Construction, Selection of materials for different civil engineering structures based on strength, durability, Eco friendly and economy.

UNIT-IV

Building Construction: Introduction, Classification of buildings (types of buildings), Types of loads acting on buildings, Building Components and their functions and nominal dimensions, Bonds in brickwork.

Building Services: Introduction, Water supply system in a building, drainage, House drainage system, Electrification, Building finishes.

UNIT-V

Advancements in Civil Engineering: Smart city and its features, Solid waste management systems, Mass transport systems, Bus Rapid Transit System (BRTS), Metro, Green Building, Features of earthquake resistance structures.

Text Books:

1. Duggal, S. K., Surveying Vol. I & II, Tata Mcgraw Hill, New Delhi.
2. Basic Civil engineering, Gopi, S., Pearson Publication
3. Punamia, B.C., Surveying Vol. I, II & III, Laxmi Publications
4. Kanetkar, T.P. and Kulkarni, S.V., Surveying and Levelling Vol. I & II, Pune Vidhyarthi Gruh

References:

1. Construction Technology, Chudley, R., Longman Group, England
2. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application
3. Agor, R., Surveying and Levelling, Khanna Publishers, New Delhi
4. Remote Sensing and GIS by B Bhatia, Oxford University Press, New Delhi.

Note:

Access free engineering textbooks in your mother tongue through the AICTE e-KUMBH portal.
Visit: https://ekumbh.aicte-india.org

Course Code	Course Title						Core / Elective
U24CE6L1	Computer Aided Civil Engineering Drafting Lab						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Engineering Graphics & Design Practice	-	-	-	2	25	50	1

Course Objectives

The objectives of this course are to impart knowledge of and problem-solving skills in

1. Use of **AutoCAD software** for preparation of civil engineering drawings.
2. Preparation of **building drawings** including plan, section and elevation.
3. Preparation of **detailed construction drawings** such as masonry bonds, staircases and footings.
4. Preparation of **RCC detailing drawings** including beams, footings and slab reinforcement.
5. Development of **isometric and 3D drawings** of residential buildings.

Course Outcomes

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

1. Apply AutoCAD commands to prepare basic civil engineering drawings.
2. Develop detailed construction drawings such as masonry bonds, staircases and footings.
3. Prepare building drawings including plan, section and elevation of residential buildings
4. Create structural detailing drawings such as RCC beams, footings and slab reinforcement layouts.
5. Develop isometric and 3D models of residential buildings using AutoCAD.

List of Experiments

S No	Topic / Exercises
1.	Detailed drawing (section and elevation) of English Bond and Flemish Bond in odd and even courses- One brick wall and one and half brick wall.
2.	Developing plan and section of dog-legged staircase.
3.	Developing plan and section of Open Well staircase.
4.	Detailed drawing (Plan and section) of different types of footings
5.	Developing plan of single storied residential building.
6.	Developing section and elevation of single storied residential building.
7.	Detailing of RCC beams and footing.
8.	Detailing of Reinforcement Layout of Slab
9.	Isometric view of building Single store residential building
10.	Isometric view of building Double store residential building.
11.	3D Modeling of Simple Building using CAD Software

Note:

1. **At least 10 Sheets must be covered.**
2. All drawings must be through commercially available software like AutoCAD, etc.

Text Books:

1. Gurucharan Singh and Jagdish Singh, building planning, designing and scheduling, Standard Publishers-Delhi, 2005.
2. **Nighat Yasmin**, *Introduction to AutoCAD for Civil Engineering Applications*, SDC Publications.

References Books:

1. **M. Chakraborti**, *Civil Engineering Drawing (Including Architectural Aspects)*, Standard Publishers.
2. **B. P. Verma**, *Engineering Drawing and Graphics Using AutoCAD*, Khanna Publishers, New Delhi.
3. **R. Gopalakrishna**, *Engineering Drawing (Vol. I & II)*, Subhas Stores, Bangalore.
4. **S. Trymbaka Murthy**, *Computer Aided Engineering Drawing*, I.K. International Publishing House, New Delhi.
5. **N. D. Bhatt**, *Engineering Drawing*, Charotar Publishing House, Anand.

Course Code	Course Title						Core / Elective
U24CE6L2	GEOTECHNICAL ENGINEERING LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Soil Mechanics	-	-	-	2	25	50	1

Course Objectives

The objectives of this course are to impart knowledge of and problem-solving skills in

1. To understand index properties of soils through standard laboratory tests.
2. Understand the formation of soil and classification of the soils in Laboratory
3. Determine the Engineering Properties of Soils in Laboratory
4. To evaluate shear strength parameters using laboratory testing methods.
5. To apply laboratory results in geotechnical design and field problems.

Course Outcomes

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

1. Understand the broad principles of Soil Mechanics in Laboratory.
2. Characterize and classify the soils in Laboratory
3. Assess compressibility and consolidation characteristics of soils.
4. Evaluate shear strength parameters of soils using appropriate test methods.
5. Analyze laboratory test data for geotechnical design applications.

LIST OF EXPERIMENTS

1. Determination of Moisture Content
2. Determination of Specific Gravity
3. Atterberg Limits (Liquid Limit, Plastic Limit, and shrinkage limit)
4. Field Density
   a) Field density by core cutter method and
   b) Field density by sand replacement method
5. Determination of Specific gravity of soil Grain size distribution by sieve analysis
6. Permeability of soil by constant and variable head test methods
7. Standard Proctor's Compaction Test
8. Determination of Coefficient of consolidation (square root time fitting method)
9. Unconfined compression test
10. Direct shear test
11. Vane shear test
12. Triaxial Test (Demonstration only)

Text Books:

1. Soil Mechanics and Foundation Engg., K.R. Arora, Standard Publishers and Distributors, Delhi.
2. Principals of Geotechnical Engineering, Braja M. Das, Cengage Learning Publishers.

Suggested Readings:

1. Geotechnical Engineering by C. Venkataramiah, New age International Pvt. Ltd, (2002).
2. Geotechnical Engineering Principles and Practices Cuduto, PHI International.
3. Geotechnical Engineering by Manoj Dutta & Gulati S.K – Tata McGraw-Hill Publishers New Delhi.
4. Soil Mechanics and Foundation, B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi
5. Measurement of Engineering Properties of Soils, E. Saibaba Reddy & K. Rama Sastri, New Age

Course Code	Course Title						Core / Elective
U24CE6P2	Technical Seminar						PROJ
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	50	-	1

Course Objectives

The objectives of this course are to impart knowledge of and problem-solving skills in

1. Analyze a current topic of professional interest by conducting a detailed literature survey.
2. Summarize and present the selected topic effectively before an audience.
3. Acquire skills in technical report writing.
4. Improve analytical and problem-solving skills.
5. Develop communication and soft skills required in professional practice.
6. Integrate Sustainable Development Goals (SDGs) and innovative approaches into technical discussions.

Course Outcomes

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

1. Understand current industrial and societal needs.
2. Analyze modern techniques, processes, and tools used in industry.
3. Prepare a structured technical report on an industrial or research-based topic.
4. Present technical knowledge effectively through seminar delivery.
5. Demonstrate confidence, communication skills, and professional ethics.
6. Correlate technical knowledge with SDGs and innovative engineering practices

Integration of Sustainable Development Goals (SDGs):

Students are encouraged to align seminar topics with relevant SDGs such as:

SDG 6: Clean Water and Sanitation

SDG 9: Industry, Innovation and Infrastructure

SDG 11: Sustainable Cities and Communities

SDG 12: Responsible Consumption and Production

SDG 13: Climate Action

Innovation Component

1. Emerging technologies related to the topic.
2. Use of modern tools (AI, GIS, IoT, BIM, Machine Learning, Smart Materials, etc.).
3. Case studies of innovative engineering solutions.
4. Patents / Startups / Research advancements.
5. Feasibility and scalability of innovative ideas.

Course Plan – Seminar

Each student shall identify a topic of current relevance in Civil Engineering, obtain faculty approval, conduct literature survey, prepare a detailed report, and present it in class.

- Presentation Structure:
- Presentation Duration: 20 minutes (PPT)
- Question & Answer Session: 10 minutes
- Total Duration: 30 minutes

Mandatory Seminar Report Format

6. Abstract
7. Introduction
8. Literature Review
9. Technical Discussion
10. Innovation & Emerging Trends
11. SDG Relevance
12. Case Study (if applicable)
13. Conclusions
14. References (IEEE/APA format)

Guidelines for Awarding Marks (CIE – 50 Marks)

S. No	Description	Max. Marks
1	Contents and Relevance (Including SDG alignment)	10
2	Presentation Skills	10
3	Preparation of PPT Slides (Clarity & Innovation)	05
4	Questions and Answers	05
5	Report in Prescribed Format (Including SDG & Innovation Section)	20