

## B. Tech. Civil Engineering

Course code: Course Title	Course Structure			Pre-Requisite
CE429: Urban Water Resource Management	L	T	P	Nil
	3	1	0	

**Course Objective:** The objective of this course is to provide an in-depth understanding of various aspects of urban water resource management. It includes: Collection of water from different sources of fresh water to meet the requirement, and Distribution of quality water to end users. Water conservation, groundwater recharge, and managing the drainage network for safe disposal of excess rainwater and sewerage.

S. No	Course Outcomes (CO)
CO1	Understanding of water availability and its quality with respect to BIS specifications.
CO2	Ability to analyse water distribution network and drainage network.
CO3	Understanding of concepts and theoretical perspectives related to Integrated Water Resource Management and application of tools for practicing it.
CO4	Ability to make groundwater and surface water resources as renewable sources.
CO5	Understanding of flood management through an efficient drainage network.

S. No.	Contents	Contact Hours
UNIT 1	Water requirement, water availability, water budget, water balance, Zero liquid discharge concept, and implementation. Urban lakes and reservoirs: quality and quantity assessment, treatment of rough water to meet BIS standards.	8
UNIT 2	Analysis of water distribution network and stormwater network, floodplain delineation, integrated flood management practice, Impact Development, rehabilitation, and restoration of urban water bodies	8
UNIT 3	Integrated Water Resource Management: History of water management, Integrated water resource management: concepts and theoretical perspectives, Principles and tools for practicing IWRM, Issues and challenges in IWRM, Corporate social responsibility in water resource management.	8

<b>UNIT 4</b>	Concept and framework of watershed approach, Soil and water conservation, Water harvesting-importance and techniques. A case study of water harvesting.	8
<b>UNIT 5</b>	Freshwater Ecosystem Management: Artificial recharges of groundwater, River basin management, Management of lakes, Management of wetlands, Case study: Dal Lake, Ganga Action Plan	10
	<b>Total</b>	<b>42</b>

<b>REFERENCES</b>		
<b>S. No.</b>	<b>Name of Books/Authors/Publishers</b>	<b>Year of Publication / Reprint</b>
1	Rossmiller, R.L., “Storm water design for sustainable development”, Mc.Graw-Hill Education, 2013(First Edition)	2013
2	D. Borchardt, J.J. Bogardi and R.B. Iibish (Editors). 2016. Integrated Water Resources Management: Concept, Research and Implementation. Springer.	2016
3	R. Avis and M. Avis. 2019. Rainwater harvesting: A guide to human-scale system design. New Society Publishers.	2019

<b>B. Tech. Civil Engineering</b>				
<b>Course code: Course Title</b>		<b>Course Structure</b>		<b>Pre-Requisite</b>
<b>CE431: Traffic Engineering</b>		<b>L</b>	<b>T</b>	<b>CE 305: Transportation Engineering</b>
		3	0	2

**Course Objective:** This course aims to expose the students to traffic surveys, traffic characteristics, and traffic flow theory, concept of capacity, level of service, traffic control devices, highway lighting and parking studies.

<b>S. No.</b>	<b>Course Outcomes (CO)</b>
<b>CO1</b>	To expose students to carry out various traffic studies for traffic flow parameters
<b>CO2</b>	To expose students to the concept of traffic capacity and level of service
<b>CO3</b>	To expose students to types of signals and design methods
<b>CO4</b>	To equip students with the knowledge of pavement marking and signs for traffic control
<b>CO5</b>	To expose students to aspects of highway lighting and parking facilities

<b>S. No</b>	<b>Contents</b>	<b>Contact Hours</b>
<b>UNIT 1</b>	Traffic engineering studies and analysis: Objectives of traffic engineering study, Components of road traffic and their effect on road traffic, Spot speeds, speed and delay study, traffic volume survey, O-D survey.	12
<b>UNIT 2</b>	Theory of Traffic Flow: Basic diagram of traffic flow, Vehicular stream equations and diagrams, shock waves in traffic, freeway capacity and level of service, probabilistic aspects of traffic flow.	10
<b>UNIT 3</b>	Traffic Control: Traffic control through time sharing and space sharing concepts, traffic signs, traffic signals, warrants for traffic signal, road markings, islands, types of traffic signal systems, signal coordination, application of ITS.	10
<b>UNIT 4</b>	Highway lighting: need, principle of visibility, Design factors, Design of highway lighting system; Parking studies: need, types of parking, parking surveys.	10
	<b>Total</b>	<b>42</b>

<b>REFERENCES</b>		
<b>S. No</b>	<b>Name of Books/ Authors/ Publishers</b>	<b>Year of Publication/ Reprint</b>

1.	Khanna, S. K., Justo, C.E.G. and Veeraragavan A. “Highway Engineering”, Nem Chand & Bros., Roorkee, U.K	2014
2.	Kadiyali, L. R., “Traffic Engineering and Transportation Planning”, Khanna Publishers, New Delhi	2018
3.	Pignataryo L., “Traffic Engineering-Theory and Practice”, John Wiley	2011
4.	McShane W.R. and Roess R.P., “Traffic Engineering” Prentice Hall	1987

B. Tech Civil Engineering					
Course code: Course Title		Course Structure			Pre-Requisite
CE433: Advanced Surveying and Geoinformatics	L	T	P	CE207: Surveying and Geoinformatics	
	3	0	2		

**Course Objective:** It introduces the advanced concepts of Surveying and Geoinformatics

<b>S. No</b>	<b>Course Outcomes (CO)</b>
CO1	Understand and apply the advanced concepts of Surveying
CO2	Understand and apply advanced concepts of GNSS and GPS in Surveying and navigation
CO3	Understand and apply advanced concepts of Remote sensing in Surveying and Mapping
CO4	Understand and apply advanced concepts of Remote sensing in Surveying and Mapping
CO5	Develop an understanding of emerging technologies and applications in Geoinformatics

<b>S. No</b>	<b>Contents</b>	<b>Contact Hours</b>
<b>UNIT 1</b>	<b>Advanced Surveying Techniques</b> -Principles and Methods of Precise Surveying, Electronic Distance Measurement (EDM) and Total Station, Digital Theodolites and Auto Levels, Laser Scanning and LiDAR Surveying, Hydrographic and Underground Surveying, Error Analysis and Adjustment Techniques	8
<b>UNIT 2</b>	<b>Global Navigation Satellite Systems (GNSS) and GPS</b> - Fundamentals of GNSS: GPS, GLONASS, Galileo, BeiDou, GPS Signal Structure and Positioning Methods, Differential GPS (DGPS) and Real-Time Kinematic (RTK) Techniques, GPS Data Processing and Accuracy Assessment, Applications of GNSS in Engineering and Mapping, Case Studies: GNSS in Land and Urban Planning	8
<b>UNIT 3</b>	<b>Remote Sensing for Surveying and Mapping</b> - Fundamentals of Remote Sensing and Electromagnetic Spectrum, Types of Remote Sensors: Optical, Microwave, Thermal, Satellite Image Interpretation and Classification Techniques, DEM and DSM Generation from Remote Sensing Data, Applications in Topographic Mapping and Land Use Analysis, UAV (Drone) Surveying: Data Acquisition and Processing	8
<b>UNIT 4</b>	<b>Geographic Information System (GIS) and Spatial Analysis</b> -GIS Data Models: Raster and Vector, Coordinate Systems and Map Projections, Spatial Data Analysis: Overlay, Buffering, Interpolation, GIS-based 3D Modelling and Terrain Analysis, Web GIS and Cloud-based GIS Applications, Case Study: GIS in Disaster Management and Urban Planning	8
<b>UNIT 5</b>	<b>Emerging Technologies and Applications in Geoinformatics</b> - Artificial Intelligence and Machine Learning in Geospatial Analysis, Internet of Things (IoT) and Smart Cities Mapping, 3D Laser Scanning and BIM (Building Information Modelling), Geospatial Big Data and Cloud Computing, Blockchain for Land Records and Cadastral Mapping, Future Trends in Surveying and Geoinformatics	10
	<b>Total</b>	<b>42</b>

REFERENCES		
S. No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Advanced Surveying Techniques - Title: <i>Advanced Surveying: Total Station, GIS and Remote Sensing</i> Authors: Satheesh Gopi Publisher: Pearson Education India Edition: Reprint Edition Year of Publication: 2007 ISBN: 9788131700679	2007
2	Global Navigation Satellite Systems (GNSS) and GPS -Title: <i>GPS and GNSS for Land Surveyors</i> , Author: Jan Van Sickle , Publisher: CRC Press, Edition: 5th Edition , ISBN: 9781032521022	2023
3	Remote Sensing for Surveying and Mapping -Title: <i>Remote Sensing and Image Interpretation</i> , Authors: Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman, Publisher: Wiley, Edition: 7th Edition, ISBN: 9781118343289	2015
4	Geographic Information System (GIS) and Spatial Analysis -Title: <i>GIS, Spatial Analysis, and Modeling</i> , Editors: David J. Maguire, Michael F. Goodchild, Michael Batty, Publisher: Esri Press, Edition: 1st Edition, ISBN: 9781589481305	2005
5	Emerging Technologies and Applications in Geoinformatics -Title: <i>Emerging Trends in Open Source Geographic Information Systems</i> , Editor: G. Mustafa Mohiuddin, Publisher: Engineering Science Reference, Edition: 1st Edition, ISBN: 9781522550396	2018

<b>B.Tech. Civil Engineering</b>				
<b>Course code: Course Title</b>		<b>Course Structure</b>		<b>Pre-Requisite</b>
<b>CE435: Construction Project Management</b>	L	T	P	Nil
	3	1	0	

<b>Course Objective:</b> Understand the concepts and principles of modern-day Construction.
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<b>S. No</b>	<b>Course Outcomes (CO)</b>
<b>CO1</b>	Understand the Network Techniques, Construction Planning, and Management.
<b>CO2</b>	Find the time cost optimization of the projects.
<b>CO3</b>	Understand the site layout, inspection, supervision, and quality control.
<b>CO4</b>	Implement safety in construction.
<b>CO5</b>	Implement the labour laws and Acts

<b>S. No</b>	<b>Contents</b>	<b>Contact hours</b>
<b>UNIT 1</b>	Construction Planning and Network Techniques: Pre-tender planning; contract planning; planning and scheduling construction jobs by bar charts; Planning and scheduling construction jobs by critical path network techniques; allocation of resources; techniques of development and analysis of PERT/CPM networks for building project, bridge project and industrial shed constructions; updating of network; examples and case studies; Computer software for network analysis.	8
<b>UNIT 2</b>	Time-cost Optimization: Direct cost, indirect cost, total cost; purpose, stages, and methods of cost control techniques of time cost optimization; examples and case studies.	8
<b>UNIT 3</b>	Labour Laws and Acts, Project Management: Feasibility study; project reports; progress reports; monitoring and controlling project activities.	8
<b>UNIT 4</b>	Site Layout: Principles governing site layout; factors affecting site layout; preparation of site layout. Supervision, Inspection and Quality Control: Supervisor's responsibilities; keeping records; control of field activities, handling disputes and work stoppages; storage and protection of construction materials and equipment; testing and quality control. Purpose of inspection: Inspection of various components of construction, reports and records; and statistical quality control	9
<b>UNIT 5</b>	Safety in Construction: Safety: importance of safety, accident-prone situations at a construction site, i.e, safety measures for excavation, drilling/blasting, scaffolding/formwork, hoisting & erection, demolition, and hot bituminous work. Fire Safety: Safety record of the construction industry, safety campaign	9

	<b>Total</b>	<b>42</b>
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<b>REFERENCES</b>		
<b>S. No</b>	<b>Name of Books/ Authors/ Publishers</b>	<b>Year of Publication/ Reprint</b>
<b>1</b>	Chitkara, K.K. Construction Project Management – Planning, Scheduling and Controlling, Tata McGraw-Hill.	<b>2015</b>
<b>2</b>	Seetharaman, S. Construction Engineering and Management, Umesh Publications.	2006
<b>3</b>	Choudhary, S. Project Management. Tata McGraw-Hill	<b>2004</b>
<b>4</b>	Srivastava, V.K. Construction Planning and Management, Galgotia Publications.	<b>2014</b>
<b>5</b>	Punmia, B.C.; Khandelwal, K.K. (2002). Project Planning & Control with PERT& amp; CPM, Laxmi Publications.	<b>2002</b>
<b>6</b>	Kumar, Neeraj Jha. Construction Project Management – Theory and Practice –Pearson.	<b>2015</b>
<b>7</b>	Gahlot, P.S. & Dhir B.M. Construction Planning and Management, New Age International.	<b>2007</b>



B. Tech Civil Engineering					
Course code: Course Title		Course Structure			Pre-Requisite
CE437: Construction and Design Aspects in Transportation Engineering	L	T	P	CE 305: Transportation Engineering	
	3	1	0		
Course Objective: The course aims to equip students with the knowledge and skills necessary for designing, analysing, and managing transportation infrastructure.					

<b>S. No.</b>	<b>Course Outcomes (CO)</b>
<b>CO1</b>	To expose students to carry out traffic and transportation studies at a traffic intersection
<b>CO2</b>	To expose students to the concept of traffic capacity and level of service at intersections
<b>CO3</b>	To expose students to the design aspects of at-grade traffic intersections with and without pedestrian flow
<b>CO4</b>	To expose students to the knowledge of planning and design aspects of grade-separated intersections with pedestrian facilities
<b>CO5</b>	To expose students to the planning and design of various terminal facilities

<b>S. No</b>	<b>Contents</b>	<b>Contact Hours</b>
<b>UNIT 1</b>	Types of intersections, Principles of intersection design: basic considerations, maneuver elements, separation of conflict points, design elements, design speed, intersection curves, super elevation of curves at intersection, intersection sight distance.	12
<b>UNIT 2</b>	At grade intersections: types, design considerations, capacity and LOS, design of rotary and signalized intersections, vehicle actuated signals, signal co-ordination, area traffic control system (ATCS), Pedestrian facility planning at grade intersections.	10
<b>UNIT 3</b>	Grade separated inter sections: types, design principles, Planning and design considerations for foot over bridge and subway for pedestrian crossing at grade separated intersections.	10
<b>UNIT 4</b>	Terminal facilities: types, bus terminus, design principles, design elements, design and case studies of inter modal transfer facilities	10
	<b>Total</b>	<b>42</b>
<b>REFERENCES</b>		

<b>S. No</b>	<b>Name of Books/ Authors/ Publishers</b>	<b>Year of Publication/ Reprint</b>
1.	Khanna, S. K., Justo, C.E.G. and Veeraragavan A. “Highway Engineering”, Nem Chand & Bros., Roorkee, U.K	2014
2.	Kadiyali, L. R., “Traffic Engineering and Transportation Planning”, Khanna Publishers, New Delhi	2018
3.	Kumar, R.S., “Introduction to Traffic Engineering” United Press Hyderabad	2018
4.	Sharma, S.K., “Principles, Practice and Design of Highway Engineering including Airport Pavements” S. Chand and Company, New Delhi	2012

B. Tech Civil Engineering				
Course code: Course Title	Course Structure			Pre-Requisite
CE 439: Traffic and Transportation Planning	L	T	P	NIL
	3	1	0	
<b>Course Objective:</b> This course aims to expose the students to advance topics of transportation engineering: transportation planning surveys, urban transport modes and travel demand forecasting process.				

<b>S. No.</b>	<b>Course Outcomes (CO)</b>
<b>CO1</b>	To expose students to carry out origin destination surveys for travel demand estimation
<b>CO2</b>	To expose students to the features of different modes of urban transportation and urban infrastructure
<b>CO3</b>	To expose students to various issues of transportation planning
<b>CO4</b>	To equip students with the knowledge of various methods of analysing traffic data for trip generation, trip distribution, modal split, and assignment

<b>S. No</b>	<b>Contents</b>	<b>Contact Hours</b>
<b>UNIT 1</b>	Introduction: Urban travel characteristics, transportation planning process, demarcation of traffic zones, and collection of data.	10
<b>UNIT 2</b>	Trip generation analysis: Identification of study area, types and sources of data, roadside interview, home interview surveys, expansion factors, trip generation models, zonal models, category analysis, household models, trip attractions of work centers.	10
<b>UNIT 3</b>	Trip Distribution analysis: Trip distribution models, Growth factor models, Gravity models, opportunity models.	10
<b>UNIT 4</b>	Mode Split analysis: Mode choice behaviour, mode split curves, probabilistic models	6
<b>UNIT 5</b>	Traffic Assignment: Elements of transportation network, minimum path trees, all-or-nothing assignment. Appropriate experiments would be taken up.	6
	<b>Total</b>	<b>42</b>

<b>REFERENCES</b>		
<b>S. No</b>	<b>Name of Books/ Authors/ Publishers</b>	<b>Year of Publication/ Reprint</b>
1.	Khanna, S. K., Justo, C.E.G. and Veeraragavan A. "Highway Engineering", Nem Chand & Bros., Roorkee, U.K.	2014
2.	Kadiyali, L. R., "Traffic Engineering and Transportation Planning", Khanna Publishers, New Delhi.	2018

3.	Pignataryo L., "Traffic Engineering-Theory and Practice", John Wiley.	2011
4.	McShane W.R. and Roess R.P., "Traffic Engineering". Prentice Hall.	1987

**B.TECH. CIVIL ENGINEERING**

Course Code: Course Title	COURSE STRUCTURE			PRE-REQUISITE
<b>CE 441: Finite Element Method</b>	L	T	P	Nil
	3	0	2	

**Course Objective:** This course covers continuum mechanics, stress-strain relations, FEM formulations for beams, plates, and plane stress/strain problems, along with variational methods, numerical integration, and convergence criteria. Students will analyse structural components and apply commercial FEM software to real-world problems.

S. No.	Course Outcomes (COs)
<b>CO 1</b>	Understand the fundamental concepts of continuum mechanics, strain-displacement relations, and structural theories.
<b>CO 2</b>	Develop finite element formulations for beams, plane stress/strain problems, and plate bending using variational principles.
<b>CO 3</b>	Apply numerical techniques, including shape functions and integration methods, to improve FEM accuracy and convergence.
<b>CO 4</b>	Analyse structural components such as trusses, plates, and shells using FEM and evaluate eigenvalue problems.
<b>CO 5</b>	Utilize commercial FEM software to model and solve structural mechanics problems, validating results through simulations.

S. No.	Contents	Contact Hours
<b>Unit 1</b>	Introduction to continuum mechanics, stress and strain state variables, strain-displacement relations for different structural problems, Euler-Bernoulli and Timoshenko beam theories, plane stress and plane strain problems, Kirchhoff's and Mindlin's plate theories, formulation of 3D elasticity, shell problems, and the principle of total minimum potential energy.	<b>8</b>
<b>Unit 2</b>	Rayleigh-Ritz method, variational formulation of continuous systems, discretization approach for analysing continuous systems, mesh generation techniques, Galerkin and other weighted residual methods, generalized and natural coordinate models of displacement field, convergence criteria, numerical errors, and finite element model refinements.	<b>8</b>
<b>Unit 3</b>	Finite element formulation of Euler-Bernoulli beam problems, plane stress and plane strain using generalized coordinate displacement models, shape functions for Lagrangian, serendipity, and iso-parametric elements, r-s-t and area coordinates, tetrahedron and hexahedron elements, Cartesian mapping, Jacobian, numerical integration methods,	<b>8</b>
<b>Unit 4</b>	Stiffness matrix for truss elements using natural coordinates, finite element formulation of Timoshenko beam problems, plane stress and plane strain analysis using quadrilateral and triangular elements, load vector determination, plate bending analysis with rectangular and triangular elements, and introduction to eigenvalue problems.	<b>8</b>
<b>Unit 5</b>	Axisymmetric elasticity problems, shear locking, under-integration, singularity elements, patch tests, and FEM software applications using	<b>10</b>

	ANSYS and other tools. Introduction to FEM for dynamic analysis, formulation of mass and damping matrices, mode shapes and natural frequencies, time integration methods for dynamic problems, and response spectrum analysis.	
<b>Unit: Lab</b>	Introduction to FEM software (ANSYS, ADINA, ABAQUS, MATLAB), meshing, boundary conditions, solver settings, and analysis of beam, plane stress/strain, plate bending, and axisymmetric problems. Validation through numerical integration and model refinements.	
	<b>Total</b>	<b>42</b>

#### References:

Sr. No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Bathe, K. J., <i>Finite Element Procedures</i> , Prentice Hall, ISBN: 978-0979004902	1996
2	Reddy, J. N., <i>An Introduction to the Finite Element Method</i> , McGraw-Hill, ISBN: 978-0072466850	2005
3	Zienkiewicz, O. C., & Taylor, R. L., <i>The Finite Element Method: Volume 1, The Basis</i> , Butterworth-Heinemann, ISBN: 978-0750650557	2000
4	Cook, R. D., <i>Concepts and Applications of Finite Element Analysis</i> , Wiley, ISBN: 978-0471356059	2001
5	Hughes, T. J. R., <i>The Finite Element Method: Linear Static and Dynamic Finite Element Analysis</i> , Dover Publications, ISBN: 978-0486411811	2000
6	Logan, D. L., <i>A First Course in the Finite Element Method</i> , Cengage Learning, ISBN: 978-0495668251	2011
7	Chandrupatla, T. R., & Belegundu, A. D., <i>Introduction to Finite Elements in Engineering</i> , Pearson, ISBN: 978-0132162746	2011
8	Liu, G. R., & Quek, S. S., <i>The Finite Element Method: A Practical Course</i> , Butterworth-Heinemann, ISBN: 978-0080983561	2013

B. Tech. Civil Engineering					
Course code: Course Title		Course Structure			Pre-Requisite
CE443: Sustainable Building Technologies		L	T	P	Nil
		3	0	2	
Course Objective: It is to equip students with knowledge of sustainable building design, energy efficiency, and resource conservation. It covers eco-friendly materials, climate-responsive design, performance validation, and emerging green technologies, preparing them for advancements in sustainable construction.					

<b>S. No</b>	<b>Course Outcomes (CO)</b>
<b>CO1</b>	Understand sustainability principles, green building policies, climate-responsive design, and GIS applications in urban planning.
<b>CO2</b>	Evaluate eco-friendly materials, embodied energy, operational energy, and perform energy modeling for sustainable building design.
<b>CO3</b>	Design sustainable foundations, optimize building components, integrate MEP systems, and apply BIM for performance tracking.
<b>CO4</b>	Conduct energy audits, implement water and waste management strategies, develop carbon-neutral solutions, and understand certification frameworks.
<b>CO5</b>	Explore advanced sustainable technologies, including AI-driven automation, bio-based materials, climate-responsive design, and blockchain integration.

<b>S. No.</b>	<b>Contents</b>	<b>Contact Hours</b>
<b>Unit 1</b>	Principles of Sustainability & Urban Planning: Sustainability principles, carbon footprint, circular economy, ecological balance. Sustainable Development Goals (SDGs) & Green Building Policies – Global (HQE, LEED, BREEAM) & Indian (ECBC, IGBC, GRIHA) perspectives. Climate & Passive Design Principles – Solar orientation, thermal comfort, wind analysis. Urban Sustainability & Smart Cities – GIS applications in sustainable urban planning. <b>ISO Standards:</b> 15392, 14050, 37120, 21929. <b>Software:</b> Climate Consultant, ArcGIS, Autodesk Insight(Revit)	9
<b>Unit 2</b>	Sustainable Materials & Energy Analysis: Material selection strategies and energy analysis techniques. Eco-Friendly Materials – Timber, bamboo, rammed earth, fly ash bricks, cement, sand, aggregates, recycled materials. Material Selection Based on Embodied Energy & Carbon Footprint – Life cycle analysis (LCA). Operational vs. Embodied Energy Calculations – Energy payback period analysis. Energy Modelling & Simulation Techniques – Solar exposure, daylighting, HVAC efficiency. <b>ISO Standards:</b> 14040, 14044, 52016-1. <b>Software:</b> One Click LCA, Athena Impact Estimator, PVsyst, DesignBuilder.	9
<b>Unit 3</b>	Sustainable Structural Components, Foundation Design for Sustainable	8

	Sites – Geothermal heat exchange, soil sustainability, rainwater harvesting. Walls, Roofs & Floors – Insulation, green roofs, modular construction, thermal mass considerations. MEP (Mechanical, Electrical, Plumbing) Integration in Sustainable Buildings – Smart grids, water-efficient plumbing, HVAC system optimization. Building Information Modelling (BIM) for Sustainability – Digital twins, performance tracking, efficiency enhancement. <b>ISO Standards:</b> 29481, 15686-5, 52010-1. <b>Software:</b> Revit, Tekla, ETABS, ANSYS, Digital Twin Software.	
<b>Unit 4</b>	Performance Validation & Certification: Energy Audits & Performance Benchmarking – Energy rating standards and efficiency checks. Water Management & Waste Reduction – Stormwater modelling, greywater recycling. Carbon Neutral Strategies & LCA in Buildings – Net-zero energy buildings, carbon sequestration techniques. Certification Frameworks & Documentation – LEED, BREEAM, HQE, EDGE, IGBC, ECBC. <b>ISO Standards:</b> 50001, 46001, 21930. <b>Software:</b> Tally (BIM LCA Plugin), LEED Online, EDGE App, HOMER Pro.	8
<b>Unit 5</b>	Future Trends in Sustainable Building: Smart & Adaptive Buildings – IoT-based energy optimization, AI-driven building automation. Bio-Based & 3D-Printed Materials – Sustainable innovations (e.g., mycelium, algae bricks). Climate-Responsive & Net Positive Energy Buildings – AI-driven predictive performance. Future of Sustainable Construction – Robotics, blockchain for material traceability, carbon capture. <b>ISO Standards:</b> 16739, 23386, 17772-1. <b>Software:</b> AI-Driven BIM Tools, Siemens <i>Mindsphere</i> , <i>EnergyPlus</i> .	8
	<b>Total</b>	<b>42</b>

#### References:

S. No.	Author, Title, Publisher, ISBN No.	Year of Publication & Reprint
1	Kibert, C. J., Sustainable Construction: Green Building Design and Delivery, John Wiley & Sons, ISBN: 9781119055310	2016 (Reprint: 2019)
2	Gorse, C., Johnston, D., & Pritchard, M., A Dictionary of Construction, Surveying and Civil Engineering, Oxford University Press, ISBN: 9780199534463	2017
3	Mendler, S. F., Odell, W., & Lazarus, M., The HOK Guidebook to Sustainable Design, John Wiley & Sons, ISBN: 9780471696131	2006
4	DeKay, M., & Brown, G. Z., Sun, Wind, and Light: Architectural Design Strategies, John Wiley & Sons, ISBN: 9781118332887	2013
5	Rosenlund, H., Climatic Design: Solutions for Buildings That Can Do More With Less Technology, Arvinus + Orfeus Publishing, ISBN: 9789187543311	2010
6	K.S. Jagdish, Sustainable Building Technologies, Published by BMTPC MHUA Govt. of India, I.K. International Publishing House, Pvt. Ltd, New Delhi, ISBN:9789386768209	2019
7	ISO 15392:2019, Sustainability in Buildings and Civil Engineering Works – General Principles	2019
8	ISO 14050:2020, Environmental Management – Vocabulary	2020



9	ISO 37120:2018, Sustainable Cities and Communities – Indicators for City Services and Quality of Life	2018
10	ISO 14040:2006, Life Cycle Assessment – Principles and Framework	2006
11	ISO 52016-1:2017, Energy Performance of Buildings – Calculation of Energy Needs for Heating and Cooling	2017
12	ISO 29481:2016, Building Information Modeling (BIM) – Framework for Information Delivery Manual	2016
13	ISO 15686-5:2017, Service Life Planning for Buildings – Performance Evaluation	2017
14	ISO 52010-1:2017, Energy Performance of Buildings – Climatic Data for Calculations	2017
15	ISO 50001:2018, Energy Management System (EMS) – Requirements with Guidance for Use	2018
16	ISO 46001:2019, Water Efficiency Management Systems – Requirements with Guidance for Use	2019
17	ISO 21930:2017, Sustainability in Building Construction – Environmental Declaration of Building Products	2017
18	ISO 16739:2018, Industry Foundation Classes (IFC) for BIM & Digital Twin Integration	2018
19	ISO 23386:2020, Digital Building Information – Terminology & Classification	2020
20	ISO 17772-1:2017, Energy Performance of Buildings – Indoor Environmental Quality	2017
21	LEED v4.1, Building Design and Construction Reference Guide, U.S. Green Building Council	2018
22	ECBC 2017, Energy Conservation Building Code, Bureau of Energy Efficiency, Government of India	2017
23	ISO 21929-1 Sustainability in Building Construction – Sustainability Indicators — Part 1: Framework for the development of indicators and a core set of indicators for buildings	2022

B. Tech. Civil Engineering					
Course code: Course Title		Course Structure.			Pre-Requisite
CE445: Integrated Intelligent Transportation System		L	T	P	Nil
		3	1	0	
Course Objective: To introduce the principles, architecture, and technologies of Intelligent Transportation Systems (ITS) and their role in enhancing traffic efficiency, safety, and sustainability. The course emphasizes real-time data, communication systems, and AI/ML applications for smart mobility solutions.					

<b>S. No</b>	<b>Course Outcomes (CO)</b>	
<b>CO1</b>	To understand the fundamentals and need for Intelligent Transportation System.	
<b>CO2</b>	To explore technologies and applications in modern traffic and transportation systems.	
<b>CO3</b>	To learn system architecture, data acquisition techniques, and communication protocols.	
<b>CO4</b>	To understand transport demand management and public transport in ITS.	
<b>CO5</b>	To understand the role of AI, ML, and IoT in Intelligent Transportation Systems and evaluate the effectiveness of ITS solutions in solving real-world transportation problems.	
<b>S. No</b>	<b>Contents</b>	<b>Contact hours</b>
<b>UNIT 1</b>	Introduction to ITS: Definition, Scope, and need for ITS, Taxonomy, Historical Background, Urbanization and Motorization Trends, Characteristics of the Transport System, Transport Problems and Key Issues, Component and architecture, Global Implementation, Challenges in Deployment, Need for ITS in Urban Traffic Regulation, Technologies for Vulnerable Road Users	8
<b>UNIT 2</b>	Various Detection, Identification and Collection Method for ITS: Introduction, Sensing and Detection Technologies (Roadway, Environmental, Probe-based, magnetic, ultrasonic and infrared sensors), Bluetooth, Inductive loop detectors, Radar, LiDAR, Cameras, RFID Communication Technologies: Dedicated Short-Range Communication (DSRC), 5G, V2V, V2I, and VANETs, Data acquisition and traffic Monitoring: Mobile Reports, Real-time Using Cellular Network and GPS Probe, Smart Card- Based Data Collection	8
<b>UNIT 3</b>	Traffic Management System Component and ITS Applications: Introduction, Objective of Traffic Management, Traffic Management Measures, ITS for Traffic Management, Development of Traffic Management System, Traffic Management Centre Advanced Traffic Management Systems (ATMS), Advanced Traveller Information Systems (ATIS), Advanced Vehicle Control Systems (AVCS), Commercial Vehicle Operations (CVO), Advance Public Transportation Systems, Emergency Management Systems, Incident Management, Urban Road Safety, ITS for Intermodal Freight Transport	8

<b>UNIT 4</b>	Transport Demand Management and ITS for Public Transport: Introduction, Application of TDM, Use of GPS system, Automatic Passenger Count (APC), Automatic vehicle location (AVL) and Automatic Vehicle Identification (AVI) system, Traffic signal Priority, Real Time Passenger Information (RTPI), Fare Collection, Lane Control Technologies, Surveillance/CCTV/Security System, ITS operation Public Transport, Transport Integrated Management System, Electronic Toll Collection System	8
<b>UNIT 5</b>	Real world Problems; Use of ML and AI in ITS: Real-world case studies: India and global perspectives, Smart cities and ITS integration, Internet of Things (IoT) in ITS, Privacy and Security Concerns, Future Trends: Cooperative ITS (C-ITS), Edge Computing, Digital Twins, Role of AI and ML in Traffic Prediction, Vehicle classification and Detection, and Route Optimization, Deep learning Models for Traffic Video analytics, Intelligent Traffic Signal Control, Autonomous and Connected Vehicles, Use of big data and cloud computing in Transportation	10
<b>TOTAL</b>		<b>42</b>

<b>REFERENCES</b>		
<b>S. No.</b>	<b>Names of Books/Authors/Publishers</b>	<b>Year of Publication / Reprint</b>
1.	Intelligent Transport Systems: Technologies and Applications. Authors: Asier Perallos, Unai Hernandez-Jayo, Enrique Onieva, Ignacio Julio García Zuazola. Publisher: <i>Wiley</i> .	2015
2.	IRC SP:110-2017, Application of Intelligent Transport Systems for Urban Roads.	2017
3.	<i>Intelligent Transportation system: Editors:</i> Sarkar, P. K., & Jain, A. K. Publisher PHI Learning Pvt. Ltd.	2018
4.	Intelligent Transportation Systems: Concepts and Cases. Sundaravalli Narayanaswami. McGraw Hill Education India.	2022
5.	Introduction to intelligent transportation system and advanced technology. (pp. 3-6). Editors: Upadhyay, R. K., Sharma, S. K., & Kumar, V. Publisher: Springer Nature Singapore	2024