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.				

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

S. No.	Contents	Contact Hours
Unit 1	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. **ISO Standards:** 15392, 14050, 37120 , 21929. **Software:** Climate Consultant, ArcGIS, Autodesk Insight(Revit)	9
Unit 2	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. **ISO Standards:** 14040, 14044, 52016-1. **Software:** One Click LCA, Athena Impact Estimator, PVsyst, DesignBuilder.	9
Unit 3	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. **ISO Standards:** 29481, 15686-5, 52010-1. **Software:** Revit, Tekla, ETABS, ANSYS, Digital Twin Software.	
Unit 4	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. **ISO Standards:** 50001, 46001, 21930. **Software:** Tally (BIM LCA Plugin), LEED Online, EDGE App, HOMER Pro.	8
Unit 5	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. **ISO Standards:** 16739, 23386, 17772-1. **Software:** AI-Driven BIM Tools, Siemens *Mindsphere, EnergyPlus*.	8
	Total	**42**

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, Arvinius + 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