



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: UG

Branch: Environmental Engineering

Subject Code: BE05013081

Subject Name: Green Building and Smart Cities

w. e. f. Academic Year:	2024-25
Semester:	5
Category of the Course:	Professional Elective Course - 2

Prerequisite:	Basic knowledge of Environmental Engineering, including concepts of water supply, waste management, and environmental pollution, along with fundamental understanding of energy and sustainability concepts.
Rationale:	Rapid urbanization and environmental challenges require sustainable approaches in building and city development. This course introduces the fundamentals of green buildings, resource efficiency, and environmental impacts of the built environment. It also provides an overview of smart city concepts, urban systems, and modern technologies for sustainable urban development. The course enables students to apply basic sustainable practices in buildings and cities for improved environmental performance and quality of life.

Course Outcomes:

Sr. No.	CO statement	Marks% weightage
CO-1	Interpret the environmental and energy impacts of buildings and concepts of green buildings.	12
CO-2	Apply principles of sustainable materials, passive design and resource conservation in buildings.	26
CO-3	Identify and classify green building rating systems and their performance parameters.	11
CO-4	Explain and interpret components and systems of smart cities including governance and infrastructure.	25
CO-5	Apply smart city planning and resilience concepts through case study analysis.	26

Teaching and Examination Scheme:

Teaching / Learning Scheme (in Hours per semester)					Total Credits	Assessment Pattern and Marks					Total Marks
L	T	P	PBL	Total no of hours per semester		Theory		Tutorial / Practical			
						ESE (E)	PA / CA (M)	PA/CA (I)	PBL (I)	ESE (V)	
45	30	00	15	90	03	70	30	20	30	00	150



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Content:

Sr. No.	Content	Total Hrs
1	Basics of Built Environment and Sustainability Impacts of buildings on environment; Concept of green buildings and basic terminology; Environmental and energy impacts of built environment; Urban warming effect and affecting factors with mitigation measures	05
2	Green Building Materials, Design and Energy Efficiency Basic idea of sustainable building materials; Alternative building materials; Concept of resource efficiency in construction; Water conservation in buildings; Indoor Environmental Quality; Passive design concepts; Basic waste management in construction; Smart Solid Waste Collection and Segregation Systems in High-Rise Buildings; Energy use and Energy conservation methods in buildings; Resource conservation methods in buildings	12
3	Green Building Rating Systems and Applications Introduction to green building rating systems; Basic concepts of rating systems and evaluation criteria; Overview of LEED and GRIHA rating systems Performance parameters in rating systems; Scheme of National Clean City Awards and Urban Sustainability Initiatives; Case studies of green buildings	05
4	Fundamentals of Smart Cities and Urban Systems Concept, evolution and components of smart cities; Smart City Mission (India): objectives and features; Smart governance: e-governance, Information and Communication Technology (ICT); Smart mobility: Intelligent Transportation Systems (ITS), public transport; Urban infrastructure systems: water supply, sewerage, solid waste, energy systems; Environmental systems: air quality monitoring, wastewater reuse, urban green spaces	11
5	Urban Planning, Resilience and Smart City Applications Urban planning: zoning, mixed land use, Transit-Oriented Development (TOD); Smart urban form: density, compact development, infrastructure integration; Resilient cities: concept, urban flooding, climate adaptation strategies; Disaster management: early warning systems, emergency response systems; Case studies: Indian and global smart cities; Best practices and challenges in smart city implementation; Future trends: AI, 5G in smart cities.	12
TOTAL		45



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Suggested Specification table with Marks (Theory): (For B.E. only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
40	40	20	00	00	00

R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

The syllabus of *Green Building and Smart Cities* directly contributes to

SDG 7	Affordable and Clean Energy Promotes energy-efficient buildings, passive design strategies, renewable energy integration, and smart energy systems for sustainable urban development.
SDG 9	Industry, Innovation and Infrastructure Supports climate resilience, sustainable urban development, and adaptation to climate-related risks
SDG 11	Sustainable Cities and Communities Core focus on green buildings, smart cities, sustainable urban planning, resilient infrastructure, mobility systems, and improved urban quality of life.
SDG 12	Responsible Consumption and Production Encourages sustainable material selection, resource efficiency, water conservation, waste reduction, recycling, and responsible construction practices.
SDG 13	Climate Action Addresses carbon footprint reduction, energy conservation, urban warming mitigation, climate resilience, and sustainable strategies for reducing environmental impacts.

Reference Books:

1. Sustainable Construction: Green Building Design and Delivery by Charles J. Kibert
2. Green Building: Guidebook for Sustainable Architecture by Michael Bauer
3. Green Building Design and Construction for a Sustainable Future
4. Introduction to Smart Cities by Anil Kumar
5. Smart Cities: Concepts, Practices, and Applications by Krishna Kumar

List of Tutorials:

1. Environmental and Energy Impacts of Built Environment
2. Urban Warming and Mitigation Measures
3. Sustainable Materials and Resource Efficiency in Buildings
4. Energy Conservation and Passive Design in Buildings
5. Green Building Rating Systems and Evaluation Criteria
6. Case Study of Green Buildings
7. Smart City Concepts and Urban Systems



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8. Smart Governance and Mobility Systems
9. Urban Planning and Resilience Strategies
10. Smart City Case Studies and Future Trends

List of Open-Source Software/learning website:

1. Sustainable Materials and Green Buildings by IIT Delhi, NPTEL, https://onlinecourses.nptel.ac.in/e-learning/preview/noc19_ce40
2. Sustainable Architecture, IIT Roorkee, NPTEL, https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ar12
3. Smart Cities, IIT Indore, NPTEL, <https://nptel.ac.in/courses/105106832>

List of suggested activities for Term Work / Self Learning:

Sr. No.	PBL Category	Name of the Activity	No. of Hours	Evaluation Criteria
1.	Mini Project	Prepare a mini project on sustainable building materials, passive design and energy conservation techniques in buildings	Study/Design = 3 hrs Report & PPT = 2 hrs Total = 5 hrs	Based on technical understanding, report quality, innovation and presentation skills
2.	Micro Project	Develop a micro project on urban planning, resilience strategies and smart city applications using case studies	Research = 2 hrs Report = 2 hrs PPT = 1 hr Total = 5 hrs	Based on problem analysis, applicability of concepts, report quality and presentation
3.	Seminar	Seminar on given technical topics beyond syllabus	Total = 10 hrs	Based on technical analysis, data interpretation, report quality and presentation skills
4.	Case Study Analysis	Analyze environmental and energy impacts of built environment and urban warming mitigation measures using local/regional examples	Study = 3 hrs PPT = 2 hrs Total = 5 hrs	Based on analytical understanding, interpretation of impacts, and presentation quality
5.	Technical Report Writing	Review LEED and GRIHA rating systems and prepare a comparative report on performance parameters and applications	Study = 2 hrs Report Writing = 2 hrs, PPT = 1 hr Total = 5 hrs	Based on a report highlighting rating criteria and applications
6.	Video Based Learning	Study NPTEL/MOOC video lectures on smart city governance, mobility and urban infrastructure systems	Video Learning = 4 hrs MCQ Test = 1 hr Total = 5 hrs	Based on performance in MCQ test and conceptual understanding
