

SUSTAINABLE BUILT ENVIRONMENT

(Open Elective – II)

Course Code:
20CE11P5

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Unit -1: Sustainable Architecture & Sites

(10 hours)

Integrated approach for green building design: factors for site selection, understanding site ecology & site analysis. Soil erosion & pollution control measures: types of soil erosion, strategies to mitigate land degradation, design techniques & challenges. Microclimate: factors affecting microclimate & heat islands, strategies to address heat island effect in built environment. Designing green spaces and enhancing biodiversity in built environment.

Unit-2: Water Management

(10 hours)

Water balance and approach for water efficiency: 3R approach for water efficiency –Reduce, Reuse/ Recycle and Recharge. Water-efficient plumbing fixtures, standards & codes. Efficient irrigation practices – hydrozoning, control devices for water supply, irrigation systems – drip & sprinklers. Wastewater treatment & reuse, wastewater treatment technologies: physical, biological and natural. Rainwater harvesting and utilisation, groundwater recharge techniques: design considerations.

Unit-3: Energy Management

(10 hours)

Introduction, performance evaluation and approach for energy efficiency in buildings. Energy efficiency standards & codes: BEE ECBC 2017 & Energy Performance Index (EPI), ASHRAE 90.1, star labelling for appliances. Efficient building envelope: heating loads in buildings, building orientation and form, envelope heat transfer & material specifications – wall, roof & fenestration. Air conditioning: types of air conditioning systems, design considerations and control systems. Lighting in building: daylighting & artificial lighting, methods to determine ECBC compliance for interior lighting and lighting controls. Renewable energy systems and technologies. Introduction to Net Zero Energy buildings.

Unit-4: Sustainable Building Materials

(10 hours)

Attributes of Sustainable Building Materials: Recycled content, Regional material, Renewable material, Embodied energy, Embodied carbon, Material performance, Recyclability, Elimination of hazardous materials. Ecolabeling of Products: Types of Ecolabels – Type I, II & III. Sustainable Materials for Green Buildings: Ready mix concrete, Construction Blocks, Glass, Steel TMT Bars, Construction Chemicals, Insulation Materials, Cement, Paints. Waste management during construction & post-occupancy: Segregation strategies, Types of waste management – organic, inorganic, e-waste, hazardous waste

Unit-5: Indoor Environmental Quality and Rating systems

(10 hours)

Indoor air quality: codes and standards, fresh air requirements, design considerations. Approach for improving indoor air quality: measures to reduce sick building syndrome, demand control ventilation, CO₂ monitoring in buildings, air quality monitoring. Enhancing occupants' comfort, health and wellbeing: thermal comfort, visual comfort, acoustics, ergonomics, olfactory comfort. Important provisions of ASHRAE 62.1, ASHRAE 62.2, ASHRAE 55, ASHRAE 170, ISHRAE 1001 regarding IEQ.

Introduction to IGBC rating system, Green Rating for Integrated Habitat Assessment (GRIHA) rating

system, Leadership in Energy and Environmental Design (LEED) rating system, Green & Ecofriendly Movement (GEM) Green Building Certification.

TEXT BOOKS:

1. Kubba, S., LEED Practices, Certification, and Accreditation Handbook, 1st Edition, Elsevier, 2010.
2. Indian Buildings Congress, Practical Handbook on Energy Conservation in Buildings, 1st Edition, Nabhi Publications, 2008.
3. Ministry of Power, Energy Conservation Building Code 2017, Revised Version, Bureau of Energy Efficiency, 2017.
4. Guide on Green BuiltEnvironment, IGBC, 2021
5. IGBC Green New Buildings rating system, IGBC, 2016
6. IGBC Green Homes rating system, IGBC, 2019

REFERENCES:

1. National Building Code, Bureau of Indian Standards, 2016
2. ANSI/ASHRAE/ASHE Standard 170-2017, Ventilation of Health CareFacilities
3. Indoor Environmental Quality Standard ISHRAE Standard- 10001 : 2019
4. IGBC Net Zero Energy Buildings Rating System, 2018
5. American Society of Heating, Refrigerating and Air-Conditioning Engineers(ASHRAE) Standards
 - a. Standard 90.1-2022—Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings
 - b. Standard 62.1-2022 : Ventilation and Acceptable Indoor Air Quality in Residential Buildings
 - c. Standard 62.2 (2007) : Ventilation and Acceptable Indoor Air Quality in Low Rise Residential Buildings
 - d. Standard 55 (2017) : Thermal Environmental Conditions for Human Occupancy