

|                               |                                                    |
|-------------------------------|----------------------------------------------------|
| <b>Branch Name:</b>           | Civil Engineering                                  |
| <b>Program Code:</b>          | ET106                                              |
| <b>Course Name:</b>           | Green Building                                     |
| <b>Course Code:</b>           | 2ET1060508T                                        |
| <b>Pre-requisite Subject:</b> | Study of Basic Civil and Environmental Engineering |

**Course Objective:**

- To introduce the concept and importance of green buildings in sustainable development.
- To familiarize students with green building materials, technologies, and energy-efficient design principles.
- To provide knowledge about national and international green building rating systems.
- To enable students to understand water and waste management techniques in green construction.

**Teaching and Examination Scheme:**

| Credit | Teaching Scheme<br>Hours per week |   |   |       | Evaluation Scheme (Marks) |      |      |      |                   |      |      |      |                  |
|--------|-----------------------------------|---|---|-------|---------------------------|------|------|------|-------------------|------|------|------|------------------|
|        |                                   |   |   |       | Theory (Marks)            |      |      |      | Practical (Marks) |      |      |      | Total<br>(Marks) |
|        | L                                 | T | P | Total | SEE                       |      | CCA  |      | SEE               |      | CCA  |      |                  |
|        |                                   |   |   |       | Min.                      | Max. | Min. | Max. | Min.              | Max. | Min. | Max. |                  |
| 4      | 3                                 | 1 | - | 4     | 24                        | 60   | 16   | 40   | -                 | -    | -    | -    | 100              |

| Subject Contents |                                                                                                                                                                                                                                                                        |             |               |  |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------|--|
| Sr. No           | Topic                                                                                                                                                                                                                                                                  | Total Hours | Weightage (%) |  |
| 1                | <b>Introduction to Green Building:</b> Definition, concepts, and importance of green buildings. Sustainable development goals (SDGs) and their relation to green building practices. Environmental impacts of conventional buildings and the need for green solutions. | 4           | 10            |  |
| 2                | <b>Green Building Materials and Technologies:</b> Characteristics of sustainable materials, low-carbon materials, recycled materials, and their applications. Renewable energy integration in buildings: Solar, wind, and geothermal technologies.                     | 6           | 15            |  |
| 3                | <b>Green Building Design Principles:</b> Passive design strategies, energy-efficient design, water-efficient systems, and indoor environmental quality. Integration of building orientation, daylighting, and natural ventilation.                                     | 8           | 15            |  |
| 4                | <b>Green Building Rating Systems:</b> Overview of national and international green building rating systems such as LEED, GRIHA, BREEAM, and WELL. Comparative assessment of rating systems and certification processes.                                                | 4           | 15            |  |
| 5                | <b>Energy Efficiency in Green Buildings:</b> Energy-efficient building envelopes, HVAC systems, lighting systems, and appliances. Net-zero energy buildings (NZEB) and case studies.                                                                                   | 8           | 20            |  |
| 6                | <b>Water Management in Green Buildings:</b> Strategies for water conservation, rainwater harvesting, wastewater recycling, and management. Use of greywater                                                                                                            | 4           | 10            |  |

|   |                                                                                                                                                                                                                          |   |    |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|
|   | systems in sustainable buildings.                                                                                                                                                                                        |   |    |
| 7 | <b>Waste Management in Green Buildings:</b> Construction and demolition waste management. Lifecycle assessment of building materials. Techniques for reducing waste generation and promoting circular economy practices. | 4 | 10 |
| 8 | <b>Green Building Case Studies and Future Trends:</b> Analysis of exemplary green building projects. Emerging technologies in green construction. Role of IoT and AI in sustainable building management.                 | 4 | 05 |

**List of Text Books:**

1. Kruger, A., & Seville, C., Green Building: Principles and Practices in Residential Construction, Cengage Learning, 2017.
2. Hall, K., The Green Building Handbook, Routledge, 2021.
3. Kibert, C. J., Sustainable Construction: Green Building Design and Delivery, Wiley, 4th Edition, 2022.

**List of Reference Books:**

1. Lechner, N., *Heating, Cooling, Lighting: Sustainable Design Methods for Architects*, Wiley, 4th Edition, 2021.
2. Yudelson, J., *Green Building A to Z: Understanding the Language of Green Building*, New Society Publishers, 2020.
3. UNEP, *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*, United Nations Environment Programme, 2011.
4. Ahuja, V., *Green Building and Sustainable Engineering*, Springer, 2018.
5. Langston, C., & Ding, G., *Sustainable Practices in the Built Environment*, Routledge, 2022.

**Course Outcomes**

Upon successful completion of this course, students will be able to:

1. Understand the principles and importance of green building and sustainable construction practices.
2. Identify and utilize eco-friendly building materials and technologies.
3. Apply green design principles to enhance energy and water efficiency.
4. Compare and assess green building rating systems and certification processes.
5. Develop strategies for effective waste management in building projects.
6. Analyze case studies to understand real-world applications and emerging trends in green building technologies.

**List of Tutorials:**

1. Analyze an existing building for its environmental impact and suggest sustainable modifications.
2. Prepare a list of green materials for a given project and evaluate their performance and costs.
3. Develop a mock certification application for a building under LEED or GRIHA standards.
4. Design a rainwater harvesting and greywater recycling system for a residential building.
5. Research and present the design features, technologies, and performance of a green building project.

**E-Resources:**

- <http://nptel.ac.in/>

### Course Learning Outcomes (CLO):

After successful completion of the course the students shall be able to:

| <b>CLO</b> | <b>Description</b>                                                                                             | <b>Bloom's Taxonomy Level</b> |
|------------|----------------------------------------------------------------------------------------------------------------|-------------------------------|
| CLO1       | Understand the principles and importance of green building and sustainable construction practices.             | L2                            |
| CLO2       | Identify and utilize eco-friendly building materials and technologies.                                         | L4                            |
| CLO3       | Apply green design principles to enhance energy and water efficiency.                                          | L3                            |
| CLO4       | Compare and assess green building rating systems and certification processes.                                  | L4                            |
| CLO5       | Develop strategies for effective waste management in building projects.                                        | L5                            |
| CLO6       | Analyze case studies to understand real-world applications and emerging trends in green building technologies. | L4                            |

L1- Remember, L2- Understand, L3- Apply, L4- Analyze, L5- Evaluate, L6- Create

### Mapping of CLOs with POs & PSOs

|                                 | <b>Program Outcomes (POs)</b> |            |            |            |            |            |            |            |            |             |             |             | <b>Program Specific Outcomes (PSOs)</b> |             |             |
|---------------------------------|-------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-----------------------------------------|-------------|-------------|
| <b>Course Learning Outcomes</b> | <b>PO1</b>                    | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b>                             | <b>PSO2</b> | <b>PSO3</b> |
| CLO1                            | M                             |            |            |            |            |            |            |            | M          |             | M           |             |                                         |             |             |
| CLO2                            | M                             |            |            |            |            |            | M          |            | M          |             | M           |             | M                                       |             |             |
| CLO3                            | M                             | M          |            | M          |            |            | M          |            |            |             | M           |             | M                                       |             |             |
| CLO4                            |                               | M          |            | M          |            |            |            |            |            |             | M           |             |                                         | M           |             |
| CLO5                            |                               |            |            |            |            |            | M          |            | M          |             | M           |             |                                         | M           |             |
| CLO6                            |                               |            | M          |            |            |            |            |            |            |             |             |             |                                         |             |             |

**H: High, M: Medium, L: Low**