SUSTAINABLE CONSTRUCTION METHODS
(CIVL 3222)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) What is the primary goal of sustainable development?
(a) Economic growth (b) Environmental protection
(c) Social equality (d) All of the above

(ii) The renewable energy source is commonly integrated into green building systems for power generation
(a) coal (b) solar (c) natural gas (d) diesel

(iii) Where is India's first green building located?
(a) ITC Green Centre, Gurgaon
(b) Suzlon Earth, Pune
(c) Wipro Technologies, Gurgaon
(d) CII – Sohrabji Green Business Centre, Hyderabad

(iv) LEED is acronym for
(a) Leadership in Energy and Efficiency Design
(b) Leadership in Energy and Efficiency Document
(c) Leadership in Energy and Environmental Design
(d) Leadership in Energy and Environmental Document

(v) LEED certification was developed by what organization?
(a) TERI (b) WORLD GBC (c) IGBC (d) USGBC

(vi) Which of the following is a sustainable construction material commonly used in green building?
(a) Conventional Concrete (b) Vinyl flooring
(c) Bamboo flooring (d) Single panel window

(vii) Which of the following materials is 100% recyclable?
(a) Plastic (b) Aluminium (c) Wood (d) Glass

(viii) What are recyclable materials?
(a) Materials that decompose naturally in the environment
(b) Materials that can be processed and reused in new products
(c) Materials that cannot be broken down by natural processes
(d) Materials that are only used once and discarded

(ix) What is the compressive strength of good quality ashlar masonry?
(a) 1 to 5 MPa (b) 5 to 10 MPa
(c) 10 to 20 MPa (d) 20 to 30 MPa

(x) What is rubble masonry primarily composed of?
(a) Regular shaped stones (b) Irregular shaped stones
(c) Bricks (d) Concrete blocks

Fill in the blanks with the correct word

(xi) Manufactured sand (M-sand) shows _____ flowablity characteristics than river bed sand in cement mortars.

(xii) GRIHA means _____.

(xiii) The green roof is primarily composed of _____.

(xiv) The main benefit of energy-efficient appliances in buildings is _____.

(xv) For high performance and energy efficiency, _____ can be used as infill walls.

Group - B

2. (a) In details, describe the concept of **embodied energy** and **operational energy** of buildings. *[(CO2,CO3)(Remember/LOCQ)]*
(b) Mention various types of materials that can be used as sustainable construction materials. Explain them. *[(CO2,CO3)(Remember/LOCQ)]*
6 + 6 = 12

3. Calculate the total embodied energy required for the preparation of cement. Consider the following data:
- Coal consumption= 90 kg/ton of cement
- Assume imported coal of 30 MJ energy
- Consider transmission loss= 15%
- Consider coal consumption= 1kg/kWh

[(CO2,CO3,CO4)(Analyze/HOCQ)]
12

Group - C

4. Discuss the various categories of the LEED rating system. Explain how each category contributes to sustainability in a building project and provide examples of measures that can help achieve the credits in these categories. *[(CO5)(Understand/LOCQ)]*
(6 + 6) = 12

5. (a) What are the key advantages and disadvantages of fly ash bricks compared to traditional clay bricks in terms of strength, durability, cost-effectiveness, and environmental impact? *[(CO3)(Analyse/HOCQ)]*

   (b) How does the composition and manufacturing process of fly ash bricks influence their performance in different climatic conditions? *[(CO4)(Remember/LOCQ)]*

6 + 6 = 12

Group - D

6. (a) Explain why it is necessary to use alternatives to traditional cement in construction industry? *[(CO3,CO4)(Remember/LOCQ)]*

   (b) Write short notes on limestone and rice husk ash used as alternative to traditional cement. *[(CO3,CO4)(Remember/LOCQ)]*

   (c) Vividly explain the use of pozzolanic materials as an alternative to traditional cement. *[(CO2)(Apply/IOCQ)]*

3 + (3 + 3) + 3 = 12

7. A real estate developer is planning to construct a **50-story commercial tower** in a metropolitan city. The company wants to incorporate **sustainable construction methods** to minimize environmental impact and achieve a **LEED Platinum certification**. The project is located in an area with limited water resources, high energy demands, and increasing air pollution.

   The stakeholders are considering the following sustainable strategies:

   - Use of Recycled and Locally Sourced Materials
   - Net-Zero Energy Design with Solar Panels and Wind Turbines
   - Rainwater Harvesting and Greywater Recycling
   - High-Performance Insulated Glass and Passive Ventilation
   - Smart Building Management System for Energy Efficiency

   (i) How can using recycled and locally sourced materials reduce the carbon footprint of the project? What challenges might arise in material procurement?

   (ii) Energy Efficiency: Explain how the combination of solar panels, wind turbines, and passive ventilation can help the building achieve net-zero energy consumption.

   (iii) Water Management: In a region with water scarcity, how can rainwater harvesting and greywater recycling contribute to sustainability? What additional measures can enhance water efficiency?

   (iv) Cost vs. Benefit Analysis: Sustainable construction often involves higher initial costs. How can the long-term benefits (e.g., operational savings, increased property value, regulatory incentives) justify the investment? *[(CO3,CO4,CO5,CO6)(Analyse/HOCQ)]*

(3 + 3 + 3 + 3) = 12

Group - E

8. (a) What are the most effective low-cost construction techniques for earthquake-resistant housing, and how do they improve structural performance? *[(CO3)(Analyse/HOCQ)]*

(b) How can traditional building methods be adapted for low-cost earthquake-resistant construction in rural areas? *[(CO4)(Remember/LOCQ)]*

6 + 6 = 12

9. (a) What are the key advantages and construction methods of cast-in-situ roofs, and how do they compare to precast roofing systems? *[(CO3)(Analyse/HOCQ)]*

(b) What are the common challenges in the construction of cast-in-situ roofs, and how can they be addressed to ensure quality and durability? *[(CO4)(Remember/LOCQ)]*

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	53.13	3.13	43.75