

| CODE   | SUSTAINABLE ENGINEERING | CATEGORY | L | T | P | CREDIT |
|--------|-------------------------|----------|---|---|---|--------|
| MCN201 |                         |          | 2 | 0 | 0 | NIL    |

**Preamble:** Objective of this course is to inculcate in students an awareness of environmental issues and the global initiatives towards attaining sustainability. The student should realize the potential of technology in bringing in sustainable practices.

**Prerequisite:** NIL

**Course Outcomes:** After the completion of the course the student will be able to

|      |  |
|------|--|
| CO 1 | Understand the relevance and the concept of sustainability and the global initiatives in this direction      |
| CO 2 | Explain the different types of environmental pollution problems and their sustainable solutions              |
| CO 3 | Discuss the environmental regulations and standards  |
| CO 4 | Outline the concepts related to conventional and non-conventional energy                                     |
| CO 5 | Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles |

#### Mapping of course outcomes with program outcomes

|      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 |
|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|
| CO 1 |      |      |      |      |      | 2    | 3    |      |      |       |       | 2     |
| CO 2 |      |      |      |      |      | 2    | 3    |      |      |       |       | 2     |
| CO 3 |      |      |      |      |      | 2    | 3    |      |      |       |       | 2     |
| CO 4 |      |      |      |      |      | 2    | 3    |      |      |       |       | 2     |
| CO 5 |      |      |      |      |      | 2    | 3    |      |      |       |       | 2     |

#### Assessment Pattern

#### Mark distribution

| Bloom's Category | Continuous Assessment Tests |    | End Semester Examination |
|------------------|-----------------------------|----|--------------------------|
|                  | 1                           | 2  |                          |
| Remember         | 20                          | 20 | 40                       |
| Understand       | 20                          | 20 | 40                       |
| Apply            | 10                          | 10 | 20                       |
| Analyse          |                             |    |                          |
| Evaluate         |                             |    |                          |
| Create           |                             |    |                          |

#### Continuous Internal Evaluation Pattern:

Attendance : 10 marks  
 Continuous Assessment Test (2 numbers) : 25 marks  
 Assignment/Quiz/Course project : 15 marks

**End Semester Examination Pattern:** There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

| Total Marks | CIE | ESE | ESE Duration |
|-------------|-----|-----|--------------|
| 150         | 50  | 100 | 3 hours      |

### Course Level Assessment Questions

**Course Outcome 1 (CO1):** Understand the relevance and the concept of sustainability and the global initiatives in this direction

1. Explain with an example a technology that has contributed positively to sustainable development.
2. Write a note on Millennium Development Goals.

**Course Outcome 2 (CO2):** Explain the different types of environmental pollution problems and their sustainable solutions

1. Explain the 3R concept in solid waste management?
2. Write a note on any one environmental pollution problem and suggest a sustainable solution.
3. In the absence of green house effect the surface temperature of earth would not have been suitable for survival of life on earth. Comment on this statement.

**Course Outcome 3(CO3):** Discuss the environmental regulations and standards

1. Illustrate Life Cycle Analysis with an example of your choice.
2. “Nature is the most successful designer and the most brilliant engineer that has ever evolved”. Discuss.

**Course Outcome 4 (CO4):** Outline the concepts related to conventional and non-conventional energy

1. Suggest a sustainable system to generate hot water in a residential building in tropical climate.
2. Enumerate the impacts of biomass energy on the environment.

**Course Outcome 5 (CO5):** Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles

1. Suggest suitable measures to make the conveyance facilities used by your institution sustainable.

### Model Question paper

#### Part A

(Answer all questions. Each question carries 3 marks each)

1. Define sustainable development.
2. Write a short note on Millennium Development Goals.
3. Describe carbon credit.
4. Give an account of climate change and its effect on environment.
5. Describe biomimicry? Give two examples.
6. Explain the basic concept of Life Cycle Assessment.
7. Name three renewable energy sources.

8. Mention some of the disadvantages of wind energy.
9. Enlist some of the features of sustainable habitat.
10. Explain green engineering.

### Part B

**(Answer one question from each module. Each question carries 14 marks)**

11. Discuss the evolution of the concept of sustainability. Comment on its relevance in the modern world.

OR

12. Explain Clean Development Mechanism.

13. Explain the common sources of water pollution and its harmful effects.

OR

14. Give an account of solid waste management in cities.

15. Explain the different steps involved in the conduct of Environmental Impact Assessment.

OR

16. Suggest some methods to create public awareness on environmental issues.

17. Comment on the statement, "Almost all energy that man uses comes from the Sun".

OR

18. Write notes on:

- a. Land degradation due to water logging.
- b. Over exploitation of water.

19. Discuss the elements related to sustainable urbanisation.

OR

20. Discuss any three methods by which you can increase energy efficiency in buildings.

## Syllabus

Sustainability- need and concept, technology and sustainable development-Natural resources and their pollution, Carbon credits, Zero waste concept. Life Cycle Analysis, Environmental Impact Assessment studies, Sustainable habitat, Green buildings, green materials, Energy, Conventional and renewable sources, Sustainable urbanization, Industrial Ecology.

### Module 1

Sustainability: Introduction, concept, evolution of the concept; Social, environmental and economic sustainability concepts; Sustainable development, Nexus between Technology and Sustainable development; Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), Clean Development Mechanism (CDM).

### Module 2

Environmental Pollution: Air Pollution and its effects, Water pollution and its sources, Zero waste concept and 3 R concepts in solid waste management; Greenhouse effect, Global warming, Climate change, Ozone layer depletion, Carbon credits, carbon trading and carbon foot print, legal provisions for environmental protection.

### Module 3

Environmental management standards: ISO 14001:2015 frame work and benefits, Scope and goal of Life Cycle Analysis (LCA), Circular economy, Bio-mimicking, Environment Impact Assessment (EIA), Industrial ecology and industrial symbiosis.

### Module 4

Resources and its utilisation: Basic concepts of Conventional and non-conventional energy, General idea about solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans and Geothermal energy.

### Module 5

Sustainability practices: Basic concept of sustainable habitat, Methods for increasing energy efficiency in buildings, Green Engineering, Sustainable Urbanisation, Sustainable cities, Sustainable transport.

## Reference Books

1. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
2. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning
3. Environment Impact Assessment Guidelines, Notification of Government of India, 2006
4. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998
5. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
6. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
7. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).
8. Purohit, S. S., Green Technology - An approach for sustainable environment, Agrobios Publication

## Course Contents and Lecture Schedule

| No  | Topic   | No. of Lectures |
|-----|---|-----------------|
| 1   | Sustainability  |                 |
| 1.1 | Introduction, concept, evolution of the concept                               | 1               |
| 1.2 | Social, environmental and economic sustainability concepts                    | 1               |
| 1.3 | Sustainable development, Nexus between Technology and Sustainable development | 1               |
| 1.4 | Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs)  | 1               |
| 1.5 | Clean Development Mechanism (CDM)   | 1               |
| 2   | Environmental Pollution   |                 |
| 2.1 | Air Pollution and its effects   | 1               |
| 2.2 | Water pollution and its sources   | 1               |
| 2.3 | Zero waste concept and 3 R concepts in solid waste management                 | 1               |
| 2.4 | Greenhouse effect, Global warming, Climate change, Ozone layer depletion      | 1               |
| 2.5 | Carbon credits, carbon trading and carbon foot print.                         | 1               |
| 2.6 | Legal provisions for environmental protection.                                | 1               |
| 3   | Environmental management standards  |                 |
| 3.1 | Environmental management standards  | 1               |
| 3.2 | ISO 14001:2015 frame work and benefits  | 1               |
| 3.3 | Scope and Goal of Life Cycle Analysis (LCA)                                   | 1               |
| 3.4 | Circular economy, Bio-mimicking   | 1               |
| 3.5 | Environment Impact Assessment (EIA)   | 1               |
| 3.6 | Industrial Ecology, Industrial Symbiosis                                      | 1               |
| 4   | Resources and its utilisation   |                 |
| 4.1 | Basic concepts of Conventional and non-conventional energy                    | 1               |
| 4.2 | General idea about solar energy, Fuel cells                                   | 1               |
| 4.3 | Wind energy, Small hydro plants, bio-fuels                                    | 1               |
| 4.4 | Energy derived from oceans and Geothermal energy                              | 1               |
| 5   | Sustainability Practices  |                 |
| 5.1 | Basic concept of sustainable habitat  | 1               |
| 5.2 | Methods for increasing energy efficiency of buildings                         | 1               |
| 5.3 | Green Engineering   | 1               |
| 5.4 | Sustainable Urbanisation, Sustainable cities, Sustainable transport           | 1               |