

**ECOLOGY AND ENVIRONMENTAL ENGINEERING
(MECH 4130)**

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) Lithosphere deals with
(a) air (b) land (c) water (d) none of (a), (b) & (c).
- (ii) Which of the following is biotic component of an ecosystem?
(a) Fungi (b) Ethesis (c) Temperature (d) pH.
- (iii) What is the primary source of air pollution in urban areas?
(a) Deforestation (b) Industrial emissions
(c) Agricultural activities (d) Volcanic eruptions.
- (iv) Which gas is responsible for the depletion of the ozone layer in the stratosphere?
(a) Carbon dioxide (CO₂) (b) Methane (CH₄)
(c) Nitrous oxide (N₂O) (d) Chlorofluorocarbons (CFCs).
- (v) What is the main cause of water pollution in bodies of water like lakes and rivers?
(a) Agricultural runoff (b) Residential sewage
(c) Industrial discharges (d) Natural weathering of rocks.
- (vi) Acid rain is due to
(a) CO₂ (b) SO₂ (c) CFC (d) NH₃.
- (vii) What is the term used to describe the increase in the concentration of greenhouse gases in the Earth's atmosphere, leading to global warming?
(a) Greenhouse effect (b) Ozone depletion
(c) Acid rain (d) Desertification.
- (viii) The international protocol to protect the ozone layer is the
(a) Montreal Protocol (b) Vienna Protocol
(c) Kyoto Protocol (d) Cartagena Protocol.

- (ix) What does the term "biodegradable" mean?
 (a) Capable of being recycled
 (b) Able to decompose naturally by biological processes
 (c) Non-toxic and harmless to the environment
 (d) Inert and stable in the environment.
- (x) Which of the following is a secondary air pollutant?
 (a) Carbon monoxide (b) Sulphur dioxide
 (c) Ozone (d) Carbon dioxide.

Fill in the blanks with the correct word

- (xi) The process by which green plants convert carbon dioxide and water into glucose and oxygen is called _____.
- (xii) The layer of the atmosphere that protects life on Earth from harmful ultraviolet (UV) radiation is the _____.
- (xiii) The largest reservoir of nitrogen on our planet is _____.
- (xiv) The permissible range of pH for drinking water as per Indian standard is _____.
- (xv) The primary component responsible for the greenhouse effect is _____.

Group - B

2. (a) Human population follows a logistic curve until it stabilizes at 15.0 billion. In 2006, the world's population was 6.6 billion, and its growth rate was 1.2 percent. When would the population reach 7.5 billion — one half of its assumed carrying capacity? [[CO3](Analyse/IOCQ)]
- (b) Write the differential equation of logistic growth curve for a bacterial population in a host. Explain the different phases of bacterial growth with the help of a curve. Define "carrying capacity" and "environmental resistance" of an environment. [[CO3](Analyse/IOCQ)]
6 + 6 = 12
3. (a) What is Environment Impact Assessment (EIA)? What is the purpose of to study EIA? What is the outcome of an EIA? [[CO3](Understand/LOCQ)]
- (b) Suppose A lake has a carrying capacity of 10,000 fish. At the current level of fishing, 2,000 fish per year are taken with the catch uniformly distributed throughout the year. It is seen that the fish population holds fairly constant at about 4,000. If you wanted to maximize the sus-tainable yield, what would be the population size and yield? [[CO3](Evaluate/HOCQ)]
6 + 6 = 12

Group - C

4. (a) Define air pollution. What is Type I and Type II classification of air pollution sources? [[CO3](Analyse/HOCQ)]

- (b) What are criteria pollutants? How is the concentration of air pollutants expressed? Establish the relationship between ppm and mg/m³.

[[CO3](Remember/LOCQ)]

6 + 6 = 12

5. (a) Draw a cyclone separator and explain how particulate matters are separated in it, especially in coal based thermal power plant?

[[CO5](Understand/LOCQ)]

- (b) Explain the process of ozone depletion. What are the control measures for ozone depletion?

[[CO5](Remember/LOCQ)]

6 + 6 = 12

Group - D

6. (a) Name few VOCs and Emerging pollutants which pollute water. What is five day BOD test and how is it carried out in Lab?

[[CO3](Remember/LOCQ)]

- (b) A coal-fired power plant converts one-third of the coal's energy into electrical energy. The electrical power output of the plant is 1,200 MW. The other two-thirds of the energy content of the fuel is rejected to the environment as waste heat. About 20 percent of the waste heat goes up the smokestack, and the other 80 percent is taken away by cooling water that is drawn from a nearby river. The river has an upstream flow of 90.0 m³/s and a temperature of 22.0°C.

If the cooling water is only allowed to rise in temperature by 15°C, (i) what flow rate from the stream would be required? (ii) What would be the river temperature just after it receives the heated cooling water?

[[CO4](Evaluate/HOCQ)]

6 + 6 = 12

7. (a) Explain what hearing threshold level (HTL) is. Distinguish between temporary threshold shift (TTS), permanent threshold shift (PTS), and acoustic trauma with respect to cause of hearing loss, duration of exposure, and potential for recovery.

[[CO1](Understand/IOCQ)]

- (b) A home with 140 m² of poorly insulated ceiling is located in an area with an 8-month heating season during which time the outdoor temperature averages 4° C while inside temperature is kept at 21° C. It has been proposed to the owner that Rs 10000 be spent to add more insulation to the ceiling, raising its total R-value from 2 to 7 (m² - °C/W). The house is heated with electricity that cost Rs 8/ kWhr. How much money would the owner expected to save each year?

[[CO4](Evaluate/HOCQ)]

6 + 6 = 12

Group - E

8. (a) Discuss very briefly the steps involved in risk assessment that a group of people exposed to a combination of chemicals will contract cancer.

[[CO5](Remember/LOCQ)]

- (b) Find the concentration of chloroform in drinking water that would result in a 10⁻⁶ risk for a 70-kg person who drink 2L /day throughout his or her entire lifetime.

[[CO2](Evaluate/HOCQ)]

6 + 6 = 12

9. (a) What are hazardous substances? Name a few hazardous substances which are responsible for climatic change across the world. [[CO2](Remember/LOCQ)]
- (b) What is ISO 14001? What is environment policy? Briefly explain the steps involved in implementing EMS in an organisation. [[CO1](Remember/LOCQ)]

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	50	18.75	31.25

Course Outcome (CO):

After the completion of the course students will be able to

CO 1 Identify the current and emerging environmental engineering issues

CO 2 Learn ethical and societal responsibilities and to act accordingly

CO 3 Assess the impact of human activities on the environment

CO 4 Interpret the various types of pollutants and its probable remedies

CO 5 Formulate and construct solutions to minimize and mitigate environmental impacts

CO 6 Analyze and practice the profession of environmental engineering in the public and /or private sector

**LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*