2013

BASIC ENVIRONMENTAL ENGINEERING & ELEMENTARY BIOLOGY

Time Allotted : 3 Hours | Full Marks : 70

The figures in the margin indicate full marks.

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

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

   i) Road traffic noise is measurred by

      a) L_{10} (18 hour) index

      b) $L_e P_n$

      c) L_{eq}

      d) none of these.

ii) Atmospheric radioactive window permits thermal radiation of which wavelength to leave the earth ?

a) 4·3 to 9·3 μm

b) 9·5 to 10·6 μm

c) 7 to 12 μm

d) 7·3 to 10·3 μm.

iii) In logistic growth equation, zero population growth (ZPG) means

a) $dN / dt = 0$

b) $dN / dt > 0$

c) $dN / dt < 0$

d) None of these.

iv) Which one of the following is true for a waste water sample ?

a) BOD > COD

b) COD > BOD

c) BOD = COD

d) BOD = 1 / COD.

v) Living organisms are good example of

a) closed system

b) open system

c) isolated system

d) none of these.

vi) Kyoto protocol is related on which of the following ?

a) Depletion of ozone layer

b) World's first forest conservation programme

c) Emission of atmospheric CO_2

d) Photochemical smog.

vii) More scientific method than BOD to determine water quality parameter is

a) COD b) DO

c) Both of these d) none of these.

viii) Which one is primary pollutant ?

a) Acrolein b) PAN

c) O_3 d) CO.

ix) An example of a producer is

a) Fungus b) Caterpillar

c) Bird d) Moss.

x) The value of earth's albedo is

a) 0·7 b) 0·8

c) 0·4 d) 0·3

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What is acid rain ? Give the chemical reactions leading to the formation of acids. How does acid rain affect an aquatic ecosystem ? 1 + 2 + 2

3. a) What do you understand by the term 'Maximum Sustainable yield' ?

   b) Prove that $N = k/2$ for maximum sustainable yield. 2 + 3

4. Define biodiversity. Classify different types of biodiversity. 1 + 4

5. What are endemic species. Differentiate between *in situ* and *ex situ* conservation principles. 2 + 3

6. What is trickling filter ? Explain its use with a diagram. 1 + (1 + 3)

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) What is meant by hardness of water ?

   b) State Darcy's law.

   c) What are the methods of water softening ?

   d) What are biochemical effects of arsenic and cadmium ?

   e) Establish the relation $BOD_t = L_0 \left(1 - e^{-kt} \right)$ where, BOD_t = amount of oxygen consumed by the waste in first t days, L_0 = ultimate carbonaceous oxygen demand, k = the BOD reaction rate constant in day^{-1}. 1 + 1 + 4 + 5 + 4

8. a) Show that the temperature of the atmosphere falls by a rate

   $r = -g/C_p$ where,

   r = rate of change of temperature with altitude

   g = gravitational constant

   C_p = specific heat at constant pressure.

   b) In 1970, the world's population was 4 billion and growth rate was 2% per year. Steady-state population is 12 billion. When would the population reach 6 billion ? What would be the projected population in 2025 using logistic model ?

   c) In a work area the noise levels are recorded as follows :

   100 dB (*A*) for 30 min/day, 95 dB (*A*) for 2 hr/day, 90 dB (*A*) for 4 hr/day, 80 dB (*A*) for 2 hr/day. Determine whether the combined noise level is within limit. Given : Noise Threshold Limit values of 100 dB (*A*) is 1 hr, 95 dB (*A*) is 2 hr, 90 dB (*A*) is 4 hr and 80 dB (*A*) is 16 hr. 5 + 5 + 5

9. a) What do you mean by temperature inversion ?

b) What are the important classes of inversion ?

c) The BOD_5 of a sample of waste water is found to be 150 mg/L. The initial DO of diluted waste water is 10 mg/L and the test requires a decrease in DO of the least 3 mg/L, with at least 2 mg/L of DO remaining at the end of five days. Now find out the range dilution factor (P), required to produce acceptable results.

d) "Through the ecosystem, inorganic nutrients are recycled but flow of energy is unidirectional." Justify the above statement. 2 + 3 + 5 + 5

10. a) What is solid waste ? Write a note on land filling as a method of disposal of solid waste.

b) Define hazardous waste.

c) Write the effects of hazardous wastes on the environment and on the human health.

d) Calculate the temperature of earth by simple global temperature model. 4 + 2 + 4 + 5

11. Write short notes of any *three* of the following : 3 × 5

a) 5 days BOD test

b) Biomedical waste disposal method

c) Conservation of Biodiversity

d) Comparison of Montreal protocol and Kyoto protocol

e) Material balance for steady state system with non-conservative pollutants

f) Ventury scrubber.