

**M.E. (Water Resources & Hydraulic Engineering) Examination (Evening),
2025**

(2nd Semester)

**AQUATIC ECOLOGY AND ENVIRONMENT
(Paper -Supplementary)**

Time : Three Hours

Full Marks : 100

Answer any *four* questions.

1. (a) (a) What is the importance of Chemical Composition of solid waste, and what do you mean by Proximate analysis?
- (b) Explain the 'Surface impoundments' land disposal technique of hazardous waste.
- (c) What is the difference between Hauled container and Stationary container methods of municipal solid waste collection system?
- (d) Write down two classifications of materials comprising municipal solid waste and two general sources of municipal solid waste?
- (e) Determine the moisture content of a 225 kg solid waste sample. Composition given in Table 1 and 2.
- (f) Determine the density of a 175 kg solid waste sample. Composition given in Table 1 and 2.

(3+5+5+2+5+5=25)

Table 1

Component	Percent by mass
Food wastes	14
Paper	40
Cardboard	12
Plastics	12
Garden Trimming	10
Wood	8
Tin cans	4

Table 2.

Typical data on moisture content and density for solid waste component.

Component	Moisture percent		Density, Kg/m ³	
	Range	Typical	Range	Typical
Food wastes	50-80	70	120-480	290
Paper	4-10	6	30-130	85
Cardboard	4-8	5	30-80	50
Plastics	1-4	2	30-130	65
Garden Trimming	30-80	60	60-225	105
Wood	15-40	20	120-320	240
Tin cans	2-4	3	45-160	90
Etc...				

[Turn over

2. (a) Briefly highlight aims and objectives of “Environmental Impact Assessment”
 (b) What are the important steps in the EIA Process to be followed?
 (c) What the environmental components of EIA? (6+6+8)

3. (a) The rate of change of oxygen deficit in a river can be expressed using standard notation as

$$\frac{dD}{dt} = K_1 L - K_2 D$$

Deduce the mathematically to establish oxygen sag curve equation

- (b) A town discharges untreated sewage of 255 m³/hr in a flowing stream having flow of 2550 m³/hr. The BOD of raw sewage is 190 mg/L. Dissolved oxygen is absent in raw sewage. Average sewage temperature is 30° C. The stream water temperature is 20°C and it contains 8.5 mg/L at upstream side oxygen saturation at 20°C is 9.2 mg/L and it decreases by 0.1 mg/L for one degree increase in temperature. If de-oxygenation and re-aeration rates are 0.1/day and 0.2/day (Base 10)

Find out the following:-

- i) Critical time
 ii) Critical Oxygen deficit

(10+15)

4. (a) If the per capita contribution of SS and BOD is 85 gm and 60 gm, find the population equivalents of
 (i) A combined system serving 1500 persons and having 80 gm per capita daily of BOD and
 (ii) 50,000 litres daily of industrial wastewater containing 1850 mg/L of SS.

- (b) Estimate the quantity of carbon (in giga-tonne) in the atmosphere corresponding to a concentration of CO₂ of 2.0 ppm_v. Assume the total mass of air equals to 5.69 x 10²¹ gm. Density of air at 29° C and 825 mm of Hg pressure is 2.62 kg/m³.

- (c) Explain briefly different types of waste products. What is self purification of stream? Classify different types of self-purification and describe them in brief.

- (d) Deduce an expression for BOD & oxygen- equivalent relationships (7+8+10+5)

5. Design waste stabilization ponds for treatment of 8 MLD wastewater generating from a town having population of 60000. Following informations are available for the design:

Characteristics of Waste Water:

pH = 7.6, SS = 140 mg/l, BOD = 120 mg/l, COD = 180 mg/l, FC = 5×10⁶/100 ml

Solar Radiation:

Winter: Maximum = 170 cal/cm².day

Minimum = 110 cal/cm².day

Sky clearance factor = 0.7

Wastewater temperature (winter) = 24°C

Average ambient temperature = 18°C

K_p for pond at 20°C = 0.12/day

Expected treated effluent characteristics:

pH = 7 to 8, BOD $\leq$ 10 mg/l, TC $\leq$ 10⁴/100 ml (25)

6. (a) Highlight discharge standard for treated sewage revised by Ministry of Environment & Forest and Climate Change, Govt. of India.

(b) State use based classification of surface water laid down by Central Pollution Control Board, Govt. of India.

(c) An aeration tank on the diffused air system is to treat 6.8 x10⁶ l/day of the settled sewage having BOD of 200 mg/l. Find the

- (i) Volume of the aeration tank, if the design criterion is 1 m³ for 535 gm of BOD, in the effluent sewage to the tank
- (ii) Volume of the aeration tank, if the suspended solids content of the mixed liquor is 2500 mg/l, and the BOD is to be 40 gm per 100 gm of suspended solids.

(6+8+5+6)