

M.E. (Water Resources & Hydraulic Engineering) Examination, 2025
(1st Semester-Supplementary Odd Sem Examination)
AQUATIC ECOLOGY AND ENVIRONMENT
(Paper - I)

Time: Three Hours

Full Marks: 100

Answer any *four* questions.

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

$$\frac{dD}{dt} = K_D L - K_R D$$

Deduce the mathematically to establish the value of D_c and t_c when the maximum oxygen deficit occurs for formation of sag curve equation

- (b) A wastewater treatment plant disposes of its effluent in a surface stream. Characteristics of the effluent are.

Parameters	Wastewater	Stream
Flow (m ³ /d)	17280	432000
DO (mg/l)	1.0	7.0
Temp	15.0	20.2
BOD (20 ⁰ c)	100.0	3.0
K_D (/day) (20 ⁰ C)	0.2	-
K_R (/day) (20 ⁰ C)	-	0.3

What will be the D_c and t_c for a continuous discharge with a total span 7 days at an interval of 1 day during mixing condition using sag curve-graphical plot?

(15+10)

2. (a) What is DBU, describe them in brief?

(b) How much exposure time (maximum) will be needed when a man doing some physical activity ($\alpha=2.5$) is exposed if the ratio of CO and O₂ in the blood is found to be 1:18 for the CO in air breathed is 180 ppm_v?

- (c) Write shot note on Effect of Carbon monoxide in human health.

(8+10+7)

3. (a) Estimate the quantity of carbon (in gigatonne) in the atmosphere corresponding to a concentration of CO₂ of 1.7 ppm_v. Assume the total mass of air equals to 5.21×10^{21} gm. Density of air at 25⁰ C and 800 mm of Hg pressure is 2.24 kg/m³.

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(b) Give a Schematic Diagram for Global Average Energy Flow in case of short and long wave side. Mention some major gases which are directly effect on greenhouse.

(c) Deduce an expression for BOD & oxygen- equivalent relationships (12+7+6)

4. Design waste stabilization pond for treatment of 8 MLD wastewater generating from a town having population of 60000. Following information are available for the design:

Characteristics of wastewater:

pH = 7.6, SS = 135 mg/l, BOD = 150 mg/l, COD = 210 mg/l, FC = 5×10^6 /100 ml

Solar radiation:

Winter: Maximum = 170 cal/cm² day

Minimum = 110 cal/cm² day

Sky clearance factor = 0.7

Wastewater temp = 24°C

Average ambient temperature = 18°C

K_p for pond at 20°C = 0.12/day

Expected treated effluent characteristics:

pH = 6.5 to 8, BOD ≤ 10 mg/l, FC ≤ 230 MPN/100 ml

Assume any other value for the design, if required.

(25)

5. (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) The BOD₅ of a waste water is determined to be 250 mg/l at 20°C. The K value is known to be 0.22 per day. What would be the BOD₈ be if the test were run at 18°C?

(10+10+5)

6. (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?

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- (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...				