M.E. (Water Resources & Hydraulic Engineering) Examination, 2019

(Evening) (1ST Year-2nd Semester)

AQUATIC ECOLOGY AND ENVIRONMENT

(Paper - I)

Time : Three Hours

Full Marks : 100

Answer any *four* questions.

1. (a) Design an over-ground household compost tank. Estimate the time to fill-up the tank with solid-waste using the following information available as given below:
Gram Panchayat/Village Population=7500; S.W. generation: 200 gms/day Solid waste generation= 1500 kg/day; Number of family members (av.) = 6/family; Average density of S.W.= 500 kg/m^3; Assume any suitable data if required.

(b) Mention some salient features of Municipal Solid Wastes Management and Handling Rules, 2016.

(c) What is composting? What are the different types of composting available in the treatment system and describe them in brief?

15+5+5=25

2. (a) A milk-products industry discharges a wastewater to a stream. Characteristics of the wastewater and stream and effluent are shown below:

Assume Sat. DO= 6.5 mg/L (8.3^{0}C)

Characteristics	Wastewater	Stream
Flow (m^3/d)	1000	19,000
Dissolved Oxygen (mg/L)	0.0	10.0
Temperature (°C)	50	10
BOD_5 at 20°C (mg/L)	1250	2.0
K_D at 20°C, d^{-1}	0.35	-
K_R at 20°C, d^{-1}	-	0.55

If no treatment at all is given to the wastewater, what will be the lowest oxygen level in the stream as a result of the discharge?

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

$\frac{dD}{dt}=K_1L-K_2D$

Deduce the mathematically to establish oxygen sag curve equation

(15+10)

3. (a) What is DBU? Classify the different types of streams sanitation and quality criteria.
(b) Explain briefly different types of waste products. What is self-purification of stream? Classify different types of self-purification and describe them in brief.

(c) How much exposure time will be needed when a man doing some physical activity (α=3) is exposed if the ratio of CO and O_2 in the blood is found to be 1:16 for the CO in air breathed is 160 ppm_v?

(d) Write shot note on Nitrogen cycle. (7+7+7+4)

4. (a) Estimate the quantity of carbon (in gigatonne) in the atmosphere corresponding to a concentration of CO_2 of 2.0 ppm_v. Assume the total mass of air equals to 4.58×10^{21} gm. Density of air at 26^0 C and 815 mm of Hg pressure is 2.88 kg/m^3.

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

(c) Deduce an expression for BOD & oxygen- equivalent relationships (10+9+6)

5. (a) Design WSP for treatment of 8 MLD wastewater generating from a town having population of 65000. Following informations are available for the design: Characteristics of Waste Water: Assume more than one maturation pond to be considered for this design.

pH = 7.4, SS = 125 mg/l, BOD = 120 mg/l, COD = 230 mg/l, FC = 6×10^6/100 ml

Solar Radiation:

Winter: Maximum = 170 cal/cm^2.day
Minimum = 110 cal/cm^2.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 $\leq$ 20 mg/l, TC $\leq 10^4$/100 ml

Assume any other value for the design, if required.

(b) What are the advantages and disadvantages of WSP?

(20+5)

6. (a) Briefly highlight aims and objectives of "Environmental Impact Assessment"
(b)What are the important steps in the EIA with EMP Process to be followed?
(c) What are the environmental components of EIA?

(8+8+9)

7. (a) Write short notes on 'Landfill' land disposal technique of hazardous waste.
(b) Write brief note on National Water Policy 2012

(c) If the per capita contribution of SS and BOD is 105 gm and 85 gm, find the population equivalents of

(i) A combined system serving 1500 persons and having 65 gm per capita daily of BOD

(ii) 49,000 litres daily of industrial wastewater containing 2050 mg/L of SS

(d) Change in concentration of organic matter, L, with time, t, is given by

$\frac{dL}{dt} = -KL$ Calculate the organic matter remaining after 3 days if the initial concentration was 270 mg/L, and k=0.43/d.

(8+7+5+5)