B.TECH/CE/5TH SEM/CIVL 3104/2016

ENVIRONMENTAL ENGINEERING
(CIVL 3104)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Treatment of Iron and Manganese present in ground water is done by
(a) Coagulation (b) Softening
(c) Aeration (d) Chlorination.

(ii) Design period for water treatment plant is
(a) 50 yrs (b) 30 yrs (c) 40 yrs (d) 15 yrs.

(iii) A water having pH=9 will have hydroxyl ion concentration of
(a) 10^{9} moles /l (b) 10^{-9} moles/l
(c) 10^{-5} moles/l (d) 10^{5} moles/l

(iv) Permanent hardness in water is caused by
(a) Bicarbonates of Ca++ and Mg++
(b) Sulphates of Ca++ and Mg++
(c) Chlorides of Ca++ and Mg++
(d) both (b) and (c).

(v) The treatment units where only physical or gravitational forces are involved are known as
(a) unit processes (b) unit operations
(c) step units (d) none.

(vi) The residual chlorine existing in chemical combination with ammonia or organic nitrogen compounds is known as:
(a) Combined available residual chlorine
(b) Free available residual chlorine
(c) Residual chlorine
(d) Chlorine demand.

(vii) Wastewater from bathrooms, kitchens, washbasins containing negligible amount of organic matter is termed as:
(a) Sewage (b) Sullage
(c) Sub-soil water (d) Night Soil.

(viii) A primary sedimentation tank is not required for
(a) ASP (b) Extended aeration system
(c) Trickling filter (d) none of above.

(ix) Hydraulic mean depth for a circular sewer is
(a) D/2 (b) D/4 (c) 3D/4 (d) D.

(x) Example of suspended growth system is
(a) Aerated lagoon (b) Oxidation ditch
(c) Oxidation pond (d) All of the above.

Group – B

2. (a) Find out pH of mixture of following solution:
Solution A Volume=350ml, pH = 8
Solution B Volume=750 ml, pH = 6

(b) Given sample pH = 6, ionization constant at $20^{o}C=2.5X10^{-8}$ moles /litre. Find the percentage of HOCl and OCl^{-}

6 + 6 = 12

3. Write down the permissible values of the following drinking water quality parameters as per IS code and also mention their harmful effects on human health and welfare. **(Any four)**
(i) Iron, (ii) Fluoride, (iii) Alkalinity, (iv) Hardness, (v) Chloride.

4 × 3 = 12

Group – C

4. Calculate the storage required to supply the demand shown in the following table if the inflow of water to the reservoir is maintained at a uniform rate throughout 24 hrs.

Time	0-04	04-08	08-12	12-16	16-20	20-24
Demand in million litre	0.48	0.87	1.33	1.00	0.82	0.54

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5. (a) State the difference between slow sand filter and rapid sand filter.

(b) What are the operational troubles in rapid sand filter and state their remedial measures.

6 + 6 = 12

Group – D

6. What do you understand by "storm water"? How can you determine dry weather flow? A catchment area of 20 sq km consists of two third rural and one third urban area The rainfall intensity in the area is recorded as 25 mm/hr. Find the quantity of storm water in the area in litres/sec. K for rural area = 0.3, K for urban area = 0.5.

3 + 3 + 6 = 12

7. Design the diameter of combined sewer having the following data
Area = 500 hectares, population = 100000, water supply 50 l/c/d, intensity of rainfall = 15 mm/hr, impermeability factor = 0.5, maximum permissible velocity 2 m/s, assume reasonable data if necessary.

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Group – E

8. An average operation data for ASP is as below:
(i) Wastewater flow = 10,000 cum per day
(ii) Influent BOD_5 = 150 mg/l
(iii) Effluent BOD_5 = 5 mg/l
(iv) MLSS = 3000 mg/l
(v) Underflow concentration = 10000 mg/l from secondary clarifier
(vi) Biomass decay rate (k_d) = 0.05 d^{-1}.
Based on above calculate (a) Volume of tank , (b) Mass and volume of solid waste per day and (c) Recycling ratio.

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9. The following observation was made on BOD test :
(i) 4% wastewater in diluted sample
(ii) DO of aerated water required for dilution = 4 mg/l.
(iii) DO of diluted sample after 5 days incubation at 20 degree Celsius = 0.6 mg/l.
(iv) DO of original sample = 0.5 mg/l.
Calculate BOD_5 and ultimate BOD considering BOD rate constant = 0.15 d^{-1}.

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