Code : 101605

B.Tech 6th Semester Exam., 2022

(New Course)

ENVIRONMENT ENGINEERING—II

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. 1 is compulsory.

(v) Assume any missing data suitably.

1. Choose the correct answer (any *seven*) : 2×7=14

(a) The ratio of maximum hourly flow to the average daily flow of wastewater for mains up to 1 m diameter is

(i) 3

(ii) $\frac{1}{3}$

(iii) 2

(iv) $\frac{1}{2}$

(b) The value of the coefficient of runoff for perfectly impervious surface tends to

(i) zero

(ii) 0·5

(iii) 1·0

(iv) infinity

(c) The gradient required to generate self-cleansing velocity in a circular sewer of 150 mm diameter, is of the order of

(i) 1 in 50

(ii) 1 in 100

(iii) 1 in 200

(iv) 1 in 500

(d) The most suitable section of a sewer in a combined sewerage system is

(i) circular

(ii) rectangular

(iii) trapezoidal

(iv) new egg-shape

(e) The primary objective of secondary treatment of wastewater is to remove

(i) inorganic matters

(ii) refractory organic matters

(iii) carbonaceous organic matters

(iv) sand, silt and floating substances

(f) Leachate is a dark-coloured liquid generated from

(i) activated sludge plants

(ii) septic tanks

(iii) compost plants

(iv) sanitary landfills

(g) The method generally not adopted for safe disposal of biomedical wastes is

(i) hydroclaving

(ii) incineration

(iii) landfilling

(iv) shredding after disinfection

(h) In treatment of sewage, trickling filters falls under the category of

(i) suspended growth process

(ii) attached growth process

(iii) anoxic process

(iv) Both (i) and (ii)

(i) The gas generated from an anaerobic sludge digester is

(i) methane only

(ii) carbon dioxide only

(iii) 70% methane and 30% carbon dioxide

(iv) 30% methane and 70% carbon dioxide

(j) A manhole is called deep manhole, if its depth is more than

(i) 0·9 m

(ii) 1·2 m

(iii) 1·5 m

(iv) 2·0 m

2. (a) Compare between combined separate and partially separate systems of sewerage. 6

(b) A population of 50000 is residing in a town having an area of 100 hectares. If the average coefficient of runoff for this area is 0·65, and the time of concentration of design rain is 30 minutes, calculate the discharge for which the sewers of a proposed combined system be designed for the town. Assume that the rate of sanitary sewage production as 120 lpcd. Make any other suitable assumptions, if required. 8

3. (a) A rectangular sewer with its width 2 times its depth is hydraulically equivalent to a circular sewer of diameter D. Find the relationship between the width of rectangular sewer and the diameter of circular sewer. Assume that the roof of rectangular sewer as a part of wetted surface. 7

(b) Write the importance of BOD/COD ratio. If 5 days 25 °C BOD of sewage sample is 180 mg/L, calculate its 5 days 20 °C BOD. Assume the deoxygenation constant at 20 °C, K_{20} as 0·23 d^{-1} at base e. Deoxygenation constant varies with temperature as $K_T = K_{20}(1 \cdot 05)^{T-20}$, where T is temperature in °C. 2+5=7

4. (a) Enumerate the National River Cleaning plans in brief. Classify various types of trickling filters. 4+2=6

(b) A single-stage trickling filter is to treat a flow of 5 MLD of raw sewage with influent BOD of 200 mg/L. It is to be designed for a loading of 12000 kg of BOD in raw sewage per hectare-metre, and the recirculation ratio is to be 2 : 1. What will the strength of the effluent, according to the recommendations of the National Research Council of USA? 8

5. (a) Give a detailed comparison between aerobic and anaerobic treatments. 4

(b) What do you understand by solid waste management? Explain the various processes and operations involved in solid waste management with neat flowchart. Enumerate the various techniques of component separation in municipal solid waste. 2+3+5=10

6. (a) Discuss the factors that must be considered in the design of solid waste transfer station. Explain the mechanical volume reduction methods for municipal solid wastes. 3+4=7

(b) Explain the area method of landfilling technique stating its merits and demerits. Define leachate and list out the factors that affect the composition of leachate. 3+4=7

7. (a) Determine the landfill area required for municipality with a population of 50000. Given that solid waste generation rate = 360 g/person/day; compacted density of landfill = 504 kg/m^3; average depth of compacted solid waste = 3 m. 6

(b) Describe and explain the importance of 'recycle and reuse' of solid waste. Enumerate the effects of solid wastes dumping on air, soil and underground water. 4+4=8

8. (a) Explain the categories of biomedical wastes and methods of their disposal. 7

(b) List the advantages and disadvantages of open dumping and ocean disposal of solid wastes. 7

9. Write short notes on any *four* of the following : 3½×4=14

   (a) Integrated solid waste management

   (b) Mechanisms of substrate conversion in aerobic treatment process

   (c) Types of hazardous wastes and their methods of disposal

   (d) Role of the Government authorities in sewage disposal

   (e) Management of solid wastes from construction activities

   (f) Color-coding of biomedical waste

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