

Total No. of Questions : 8]

SEAT No. :

PA-1432

[Total No. of Pages : 3

[5926]-48

T.E. (Civil)

**WASTE WATER ENGINEERING**  
**(2019 Pattern) (Semester-II) (301012)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q1 or Q2, Q3, or Q4, Q5 or Q6, and Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data if necessary and clearly state.
- 5) Use of electronic calculator is allowed.

Q1) a) Explain the principle and working of activated sludge process with suitable flow chart. [2+3]

b) What is sludge bulking. Explain the control measure for the sludge bulking. [2+3]

c) An average operating data for the design of conventional activated sludge treatment plant is as follows: [8]

Wastewater flow=35000m<sup>3</sup>/d

Volume of aeration tank=10000 m<sup>3</sup>

Influent BOD=250 mg/l

Effluent BOD=20 mg/l

mixed liquor suspended solids=2500mg/l

Effluent suspended solids =30 mg/l

Waste sludge suspended solids=9700 mg/l

Quantity of waste sludge=220m<sup>3</sup>/d

Based on the information, above determine,

- i) Aeration period
- ii) Food to microorganism ratio (F/M ratio)
- iii) Percentage efficiency of BOD removal
- iv) Sludge age (days)

OR

P.T.O.

**Q2) a)** State modifications in ASP and hence differentiate between completely mixed ASP and extended aeration ASP. [3+3]

b) Explain the term with respect to activated sludge process. [4]

- i) Hydraulic Retention Time (HRT)
- ii) Solid Retention Time (SRT),
- iii) Mixed Liquor Suspended Solids (MLSS),
- iv) Food to Microorganism ratio (F/M ratio)

c) An average operating data for conventional activated sludge treatment plant is as follows: [8]

- i) Sewage flow = 30000 m<sup>3</sup>/day
- ii) Volume of aeration tank = 10000 m<sup>3</sup>
- iii) Influent BOD = 250 mg/lit
- iv) Effluent BOD = 20 mg/lit
- v) Mixed liquor suspended solids = 2500 mg/lit
- vi) Effluent suspended solids = 30 mg/lit
- vii) Waste sludge suspended solids = 9700 mg/lit
- viii) Quantity of waste sludge = 220 m<sup>3</sup>/d

Determine:

- a) aeration period
- b) Food to microorganism's ratio
- c) percentage of efficiency of BOD removal
- d) Sludge age

**Q3) a)** Discuss the phytoremediation technology for wastewater treatment. Also discuss the advantages and limitations of this process. [8]

b) Determine the size of a high-rate trickling filter for the following data; [9]

- i) Sewage flow = 8 MLD
- ii) Recirculation ratio = 1.5
- iii) BOD of sewage = 230 mg/l
- iv) BOD removed in primary sedimentation tank = 30%
- v) Final effluent BOD = 20 mg/l
- vi) Depth of filter = 2 m

OR

- Q4)** a) Discuss the root zone technology for wastewater treatment. Also discuss the advantages and limitations of this process. [8]
- b) Determine the size of a high-rate trickling filter for the following data; [9]
- Sewage flow = 5 MLD
  - Recirculation ratio = 1.5
  - BOD of sewage = 230 mg/l
  - BOD removed in primary sedimentation tank = 30%
  - Final effluent BOD = 20 mg/l
  - Depth of filter = 2m

- Q5)** a) Draw a neat sketch of up flow anaerobic sludge blanket (UASB) reactor. explain the working of UASB reactor and comment on its suitability for treatment of industrial waste water. [3+3+3]
- b) Explain working principle and application of MBR and MBBR. [9]

OR

- Q6)** a) Design a septic tank for 300 users. Water allowance is 120 liters per head per day also design a suitable soil absorption system if the percolation rate is 3 min/cm and depth of ground water table below GL is 1.5m. [9]
- b) Explain working principle and application of SBR and FMBR. [9]

- Q7)** a) Explain the anaerobic sludge digestion process. [5]
- b) Explain various methods of sludge treatment. [7]
- c) What are the process carried out to recycle and reuse of treated wastewater [5]

OR

- Q8)** a) Write a short note on sludge drying bed. [5]
- b) Explain any two methods of sludge disposal with advantages, disadvantages and applications. [7]
- c) Write a short note on: sludge thickener. [5]