SEAT No. :

P-7514

[6180]-21
T.E. (Civil)
WASTE WATER ENGINEERING
(2019 Pattern) (Semester - II) (301012)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :

    1)   *Attempt Q.l or Q.2. Q.3 or Q.4, Q.5 or Q.6, and Q.7or 08*

    2)   *Figures to the right indicates full marks*

    3)   *Draw neat figures wherever necessary*

    4)   *Assume necessary data*

    5)   *Use of scientific calculators is allowed*

Q1) a) What do you understand by biological treatment of wastewater? List the different types of microorganisms and explain their role in wastewater treatment. **[8]**

b) An activated sludge process is treating wastewater in an aeration tank of volume 10000 m^3. MLSS in aeration tank is 3000 mg/l. If the sludge wasted at a rate of 200 m^3/day with a suspended solids of 10000mg/l then find sludge age(days) and HRT (hrs) if flow rate is 15000 m^3/day and effluent suspended solids concentration is 40mg/l **[6]**

c) An aeration tank of volume 2000 m^3 treating 10000 m^3/day of waste water with influent BOD 150 mg/l aimed to reduce BOD to 30 mg/l. Find F/M ratio used in the design. Take MLSS : 3000 mg/l **[4]**

OR

Q2) a) Explain the following terms . i)F/M ratio, ii) Hydraulic retention time iii) Sludge age, iv) SVI **[8]**

P.T.O.

b) Conventional activated sludge plant is designed for a town to treat settled domestic sewage with diffused air aeration system for the given data as follows **[6]**

    i) Population of town: 1 lakh

    ii) Per capita sewage contribution: 100 lpcd

    iii) Settled sewage BOD = 100 mg/l

    iv) Effluent BOD desired = 10mg/l

    v) MLSS in aeration tank = 3000mg/l

    vi) F/M = 0.2

Find A) BOD loading in Kg/d, B) Aeration tank volume C) Volumetric loading in kg BOD/m^3

c) Calculate the SVI (in ml/gm) for an activated sludge sample for the given data: **[4]**

Volume of sludge sample = 500 ml

30-minute settable solids volume = 75 ml

MLSS =3000 mg/l

Comment on settling characteristics based on SVI value.

Q3) a) What are Oxidation ponds? Explain the bacteria - algae symbiosis with a neat sketch **[7]**

b) A town having a population of 1.2 lakhs is producing sewage at a rate of 100 lpcd having 200 mg/l of BOD. A trickling filter having recirculation ratio 1.5 is design to produce effluent of BOD 20mg/l. The operating depth of filter is 2.5m. Find the diameter of the trickling filter is m. **[6]**

c) The volume of a single stage high-rate trickling filter having efficiency of 82% is 1365 m^3 along with the recirculation ratio of 1.5. Take treatability factor = 0.9. Find the BOD entering the filter unit (in kg/day,). Use NRC formula **[4]**

OR

Q4) a) Explain wastewater treatment principle of phytoremediation technology with neat sketch and give its application. **[7]**

b) A single stage trickling filter is designed for an organic loading of 10,000 kg of BOD in raw sewage per hectare meter per day. This filter treats a flow of 4 MLD of raw sewage with BOD of 220mg/L. Considering no recirculation determine the BOD concentration in the effluent. Assume primary clarifier removes 30% of total BOD. **[6]**

c) Find the recirculation factor (R), required for a single stage trickling filter of volume 800 m^3 with recirculation having BOD load of raw sewage as 800kg/day desired to have BOD load in the effluent as 200 kg/day. Use NRC formula. **[4]**

Q5) a) Explain the working principle with neat sketch of following terms with the advantages and applications: **[8]**

    i)   Up-flow Anaerobic Sludge Blanket (UASB)

    ii)   Moving Bed Bio Reactor (MBBR)

b) Design a septic tank for 290 users. Water allowance is 120 L per head per day. Assume suitable data if required. **[6]**

c) Explain the importance of advanced oxidation processes used for wastewater treatment. **[4]**

OR

Q6) a) Explain the working principle with neat sketch of following terms with the advantages and applications: **[8]**

    i)   Packed Bed Reactor (PBR),

    ii)   Sequential Batch Reactor (SBR)

b) Design the dimensions of septic tank for small colony of 165 persons provided with an assured water supply from municipal head works at the rate of 120 lit per person per day. Assume suitable data if required. **[6]**

c) Difference between Secondary treatment and Tertiary treatment of wastewater. **[4]**

Q7) a) What is a Sludge? Why Sludge digestion is necessary. In activated sludge process, 1 MLD (by volume) of secondary sludge has to be returned to keep the required MLSS concentration in the aeration tank. This sludge has a water content of 99%. If the sludge water content is reduced to 98%, what volume of the sludge will be needed to be recycled? **[7]**

b) Explain the wastewater reuse opportunities in municipal, industrial and agricultural sector. **[6]**

c) Explain what do you understand by primary and secondary sludge **[4]**

OR

Q8) a) Enlist any three different processes involved in sludge treatment. The moisture content of a sludge is found out to be 99%. After dewatering the sludge water content was reduced to 95%. What will be the percentage change in the volume of sludge? Find the volume of the sludge after dewatering if volume of sludge before dewatering was 5 MLD. **[7]**

b) Explain the working principle of anaerobic digestion. Enlist the different factors governing anaerobic digestion. **[6]**

c) Explain the characteristics of sludge produced in different treatment processes. **[4]**

▶◀ ▶◀ ▶◀