Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VIII.EXAMINATION – WINTER 2016

Subject Code: 181303 Date: 21/10/2016

Subject Name: Treatment Process Design and Drawing

Time: 02:30 PM to 05:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain the following terms with reference to air pollution control equipments: **07**
(i) A/F ratio (ii) Pressure drop (iii) Relaxation time (iv) Saltation velocity
(v) Velocity ratio (vi) Number of turns (vii) Collection efficiency

(b) Enlist and explain all the necessary design considerations to design the ETP as well as STP. **07**

Q.2 **(a)** Write Carmen – Kozeny equation and determine the clear water headloss in a filter bed composed of 30 cm uniform enthracite with an average size of 1.6 mm & 30 cm of uniform sand with average size of 0.5 mm for filtration rate of 160 L/m^2 min. with use of Rose equation. **07**
Take kinematic viscosity= 1.003×10^{-6} m/s^2, α= 0.4, ϕ = 1

(b) Enlist the types of the reactors used for wastewater treatment and briefly explain any two with neat sketch. **07**

OR

(b) Design RBC to serve 1000 persons. Assume 80% BOD removal at an organic load of 20g BOD/m^2 day. Take diameter of discs is 3 m and space is 5 cm. **07**

Q.3 Design a clariflocculator for a flow of 2000 KLD. Assume suitable data. **14**

OR

Q.3 Design a mechanically cleaned bar rack for a peak flow of 80 MLD. Flow condition in incoming sewer is given below: **14**

- Diameter of sewer: 1.53 m
- Depth of flow at peak flow: 1 m
- Velocity at peak design flow: 0.8 m/sec
- Depth of screen chamber flow with respect to sewer invert is 0.08 m

Q.4 **(a)** Design tube settler module of square cross section with following data. **07**

- Average output from tube settler = 6000 KLD
- Loss of water in desludging = 2% of output
- Diameter of tube = 50 mm
- Length of tube = 1 m
- Angle of inclination = 60^0

(b) Write down the design criteria for rapid sand filter. **07**

OR

Q.4 Design a complete mix type ASP to treat 0.2 m^3/sec waste flow having BOD of 200 mg/l and BOD of treated effluent should be 20 mg/l with following assumptions: **14**

- MLVSS: 3000 mg/l
- MCRT: 10 days
- Conc. of recycled sludge: 15000 mg/l
- Effluent contains 23 mg/l of bio solids of which 63% is biodegradable
- MLVSS ratio: 0.8
- Y: 0.65
- k_d: 0.05

Q.5 **(a)** With the help of neat sketch, explain the construction and working of cyclone separator. **07**

(b) Find the dimensions of UASBR for an average flow of 4 MLD of wastewater with following data. **07**

- COD of ww: 500 mg/l
- HRT: 6 hrs.
- COD loading: 1 to 2 kg COD/ m^3/ day
- Upflow velocity: 0.75 m/hr
- Velocity of ww in settling chamber: < 1.5 m /hr
- Flow area covered by each inlet: 1 to 2 m^2

OR

Q.5 **(a)** Write down the purpose and location of following unit operation in water treatment plant. **07**
(i) Ammonia striping (ii) Pre-chlorination (iii) Sludge digestion
(iv) Flocculation (v) Sludge concentration (vi) Air floatation (vii) Coagulation

(b) With assumption of suitable criteria design a bag filter for the flow of 5 m^3/sec. **07**

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