Seat No.:

Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY ME – SEMESTER II (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2721802

Subject Name: Treatment Process Design and Drawing

Date: 24/05/2016

Time: 10:30 am to 01:00 pm

Total Marks: 70

Instructions:

- 1. Attempt all questions.
- Make suitable assumptions wherever necessary. 2.
- 3. Figures to the right indicate full marks.
- Design a continuous flow stir tank type Activated Sludge Process for a flow of **Q.1** 14 5 MLD domestic wastewater. The BOD of waste water is 250 mg/Land it is desired to have BOD of treated wastewater as 30 mg/L.MLVSS in the reactor is 3000 mg/L and recycled sludge has a concentration of 10,000 mg/L. Mean cell residence time is 10 days and effluent contains SS = 25 mg/L of which 65% is biodegradable. Assume Kd= 0.05, Y=0.5. Also compute the air required for reaeration.

Design following units of Rapid Sand Filter for a town of population 1, 00,000. 07 Q.2 **(a)** Per capita the demand of water is 270 L/d.

- (i) Number of Filter beds
- (ii) Size of sand bed
- (iii) Size of Sand Bed
- Write a short note on UASB with neat sketch. **(b)**

OR

- **(b)** Design a tube settler module of rectangular cross section with following data: 07
 - (i) Design flow = 1.8 MLD
 - (ii) Diameter of tube = 50 mm
 - (iii) Length of tube = 1.0 m
 - (iv) Angle of inclination = 60°
- Q.3 Design a parabolic channel and rectangular weir type grit chamber for a peak 14 flow of 10 MLD. Assume grit particle size 150 µm and specific gravity of 2,65. Prepare a drawing for it.

OR

- Design a rectangular channel and sutro weir type grit chamber for a peak flow **Q.3** 14 of 10 MLD. Assume suitable data and draw a neat sketch.
- **Q.4** Design a Clariflocculator for average flow of 5 MLD. Assume suitable data & 14 draw neat sketch of it.

OR

A water treatment plant is to process average flow of 1800 m^3/d . Design a 14 **Q.4** rectangular sedimentation tank which is operate at $18m^3/m^2$.day. Check for Detention Time, Horizontal Velocity and Weir Overflow Rate.

07

- Q.5 (a) (i) We wish to use a cyclone to remove 50 % of particles 1μ in diameter from an air stream with an inlet velocity is 15 m/s. Estimate the maximum allowable value of Wi. μ_g = 1.84 x 10⁻⁵ kg.m/sec, g_p = 1600 kg/m³ g_g = 1.2 kg/m³.
 (ii) Our cyclone separator is operating with cut size diameter is 5 μ. It is now necessary to increase the flow rate to the cyclone by 25 %. (The new velocity will by 1.25 times the old velocity) Estimate the new cut size diameter. The flow of air stream is 6 m³/sec and the diameter of cyclone is 2 m.
 - (b) A bag house is to be constructed to control emissions from a grain elevator. 07 The filter bags to be used measure 0.3 m in dia and 6 m in length. The system is used to control 21 m³/sec of waste air flow & having inlet dust concentration of 5.0 g/m³. Assume air to cloth ration is 0.9 m/min.
 - (i) Determine the number of bags
 - (ii) Determine the resistance of filter medium if the pressure across the filter is 150 N/m^2 and 611 $N/m^2.$
 - (iii) Determine the filtration time for bag filter if the tr and tc value is 9 and 25 respectively. (Assume 2 compartments.)

OR

- Q.5 (a) (i) An electrostatic precipitator with a specific collection area of 0.989 07 m²/m³.min is found to have an actual overall collection efficiency of 97 %. If the value of A/Q is increased to 1.312 m² / m³.min. Estimate the anticipated collection efficiency on the basis of Deutsch equation.
 - (ii) A 1 μ diameter particle of material with a dielectric constant of 6 has reached its equilibrium change in an ESP at a place where the field strength is 300 KV/m. How many electronic charges have it? ϵ_0 8.85 x 10⁻¹² C/V.m
 - (b) Design a venture Scrubber for a flow of 10 m^3 /Sec. Assume suitable data.

07