Department of Civil Engineering

CEL212 Environmental Engineering

Major Examination | Max Marks= 100 | Time = 2 hr

Q.1 Draw a neat and well labeled schematic diagram of a water treatment plant for a city which draws its water supply from a large reservoir having turbidity in the range of 30-50 units and BOD5 of 2 mg/l. [5]

Q.2 Suppose that a column is filled with water containing a uniform suspension of particles A (having diameter of 0.4 mm), B (having diameter of 0.8mm) and C (having diameter of 0.2mm). Particle B is removed with 100% efficiency in exactly 10 sec. What is the percentage removal of Particle A and C in the same period? [10]

Q.3 A water treatment plant is to process 10,000 m^3/d. A settling basin for type 2 suspension is to operate at 0.50 m^3/m^2/hr. Determine the dimensions of the basin for a circular unit. Check detention time, horizontal velocities and weir overflow rates. [10]

Q.4 Settling column analysis is run on a type 2 suspension with following results. Entries are suspended solids concentrations (mg/L) at stated times. Determine the theoretical efficiency of settling basin with a depth of 2.5 m, a volume of 2000 m^3 and an inflow of 10,000 m^3/d. [10]

Depth (m)	Time (min)							
	0	40	80	120	160	200	240	280
0.5	786	369	238	164	107	66	41	33
1.0	786	442	369	279	213	164	115	90
1.5	786	631	476	361	287	230	180	148
2.0	786	672	558	426	353	287	238	187
2.5	786	713	590	492	402	344	262	230
3.0	786	722	615	533	460	394	320	262

Q.5 A sand filter consists of 1.5 m depth of uniform sand with a diameter of 0.85 mm and a shape factor of 0.7. The porosity of the bed is 0.4 throughout and the specific gravity of the sand is 2.65. Determine the head required to maintain the flow of 10 l/hr through the bed. The water temperature is 15°C. [10]

Q.6 A filter plant is to be constructed to process 75000 m3/d of water. Analysis on mixed media indicates that a filtration rate of 15 m^3/m^2 hr will be acceptable. Assuming a surface configuration of approximately 5 x 8 m, how many filters will be required, if one unit is allowed out of service for backwashing. [10]

Q.7 A proposed paper manufacturing industry is expected to emit 500 of H_2S kg per day from a single stack. The nearest receptor is a village 1700 m northeast of the industry site. Southwest winds are expected to occur 15% of the time. The stack at the industry must be sufficiently high so that the H_2S concentration in the village will not exceed 30μg/m^3 at the ground level (the background concentration is 10μg/m^3). The physical characteristics of the emissions and the ambient atmosphere are as follows: Gas exit velocity = 15 m/s, Gas exit temperature = 140°C, Stack Diameter = 1.2 m, Ambient temperature = 17°C, wind velocity = 2 m/s at 10 m height, temperature lapse rate = 6°C/km. Estimate the required height of the stack at the industry. [15]

Q.8 Wastewater from a small community averages 2000 m^3/d in winters and 4500 m^3/d during the summers the average temperature in winters is 8°C and in summers is 25°C. The average BOD5 is 120 mg/l. The reaction coefficient at 20°C is 0.23/d. Design a facultative pond system to remove 90% of the BOD5. [10]

Q.9 Flow of 20,000m^3/d from a primary clarifier with a BOD5 of 150 mg/l is fed to an RBC. The required effluent BOD5 is 20 mg/l. Find out the hydraulic loading rate, rotation speed and surface area required, numbers and diameter of disks, for the RBC system. [10]

Q.10 Write a short note on the role of an Environmental Engineer in sustainable development. [5]

Q.11 Discuss in brief the key considerations in devising a successful municipal solid waste management plan for a city. [5]