CEL 311 Advance Water and Waste Water Engg.
MAJOR TEST   TOTAL MARKS: 40   TIME: 2 Hrs

Please do not ask doubts. The questions are self-explanatory. If there is any missing info / data, assume it suitably and mention that in a box in your answer book.

It is an open book examination: You may use the lectures notes and any textbooks during the examination. However, no exchange of notes is permitted during the examination. Please switch of your calculators.

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1. Design a complete intake facility (consisting of jack well, pumps, entrance ports, rising and gravity mains) for a water supply scheme. Source of water is a river of Low Water Level: +11.00m, Full Supply Level: +12.60m and High Flood Level: +15.00m. Water requirement for the scheme is $0.12 \ m^3/sec$.
Given: Invert level of raw water rising main at the treatment plant is +25.80m. Length of raw water rising main: 165m. The invert level of raw water gravity main at the entrance port is +10.50m. Length of raw water gravity main: 120m. Pipe friction factor: 0.01. Provide neat sketches showing the details.   **(10 marks)**

2. A settling tank is used to remove suspended solids from wastewater. The rate of flow of wastewater into the tank is 10 lit/sec. The influent concentration of suspended solids (SS) is 200 mg/lit. The removal efficiency of the settling tank is 60%. Calculate the amount of sludge accumulated in the sludge zone every day. Given: amount of water that will be withdrawn while pumping out the sludge is very small compared to the inflow of wastewater and hence may be neglected.

(04 marks)

3. Explain the treatment strategies for low strength and high strength organic wastewaters. Why these treatment units are chosen.   **(04 marks)**

4. Show with neat definition sketches the two ways of wasting and returning sludge in an Activated Sludge Process (ASP) unit. Estimate and compare the sludge wasting rate in both type of ASPs for the following data: ASP aeration tank – CSTR, Sewage flow – 0.20 m^3/sec, BOD_5 of sewage – 250 mg/lit, BOD_5 of the effluent 20mg/lit or less, Temp 20°C, influent VSS – 0 mg/lit, ratio of MLVSS/MLSS = 0.8, return sludge concentration – 10, 000 mg/lit of Suspended solids, MLVSS – 3500 mg/lit, $\theta_c = 10$ days, effluent contains 20 mg/lit of biological solids of which 65 % is biodegradable, $BOD_5 = BOD_L \times 0.68$, $Y - 0.5$, $k_d - 0.06$

(10 marks)

5. Give short answers
   a. How mean cell residence time is different from hydraulic detention time in an ASP ?
   b. Why recirculatuion of the effluent is a must with trickling filters ?
   c. Explain how an aerobic RBC works ?
   d. What is 'sloughing' in the case of attached growth treatment techniques? ?
   e. In a water treatment plant, what do you mean by 'add on' units ? Give a few examples.
   f. List the main differences between a water supply pipe and a wastewater conveyance pipe.   **(2 X 6 = 12 Marks)**