Model Question Paper

SEVENTH SEMESTER B.TECH DEGREE EXAM (MODEL) NOVEMBER 2016

BIOTECHNOLOGY & BIOCHEMICAL ENGINEERING

13.704 DESIGN OF BIOLOGICAL WASTE TREATMENT SYSTEMS

Time: 3 hours **Max. Marks: 100**

PART A

Answer **all** questions. Each question carries **2** marks

1. What are the objectives of biological treatment?
2. Define BOD and COD. Which one of these is a better parameter for determining the strength of polluted waste water and why?
3. Discuss the mechanism of biological phosphorus removal.
4. What is Food-to-Microorganism (F/M) ratio? What is its significance in ASP?
5. Differentiate between an oxidation pond and an oxidation ditch.
6. What is the major difference between suspended growth and attached growth processes?
7. What is sludge digestion? What are the two basic types of sludge digestion units?
8. What is sludge bulking? How can it be controlled?
9. Define sludge volume index (SVI) and explain its significance in the design of aerobic biological wastewater treatment?
10. What is biogas? Explain the biochemical process of biogas production.

PART B

Answer **any one full** question from **each** Module. Each carries **20** marks

MODULE I

11. (a) Discuss the physical, chemical and biological characteristics of wastewater. **(10 marks)**

(b) Discuss the effect of temperature on BOD reaction rate constant. The BOD_6 of a wastewater is determined to be 400 mg/L at 20 ^oC. The *k* value at 20 ^oC is known to be 0.23 d^{-1}. What would be BOD_8 if tests were run at 15 ^oC? **(10 marks)**

OR

12. (a) Distinguish between the various kinds of activated sludge processes. Explain the significant design criteria and steps for designing a conventional activated sludge process. **(10 marks)**

(b) An activated sludge plant is designed to reduce 90% of influent BOD of 250 mg/L. Compute (a) net sludge (solids) produced per day, (b) mean cell residence time, (hydraulic retention time), and (d) the F/M ratio for the assumed design data given below.

1) Wastewater flow = 2 MLD
2) Volume of the aeration tank = 500 m^3
3) MLVSS in the aeration tank = 2500 mg/L
4) Kinetic coefficients, $Y = 0.5$ and $k_d = 0.08\ d^{-1}$ (**10 marks**)

MODULE II

13. (a) What are the various empirical equations used for the design of trickling filters? State the limitations of these equations. **(10 marks)**

(b) Differentiate between standard and high rate trickling filters. What are the drawbacks of trickling filters? **(10 marks)**

Or

14. (a) What are the disadvantages of waste stabilization pond systems? Discuss the modifications that can be made to the waste stabilisation pond for overcoming these disadvantages. **(10 marks)**

(b) Explain the working of a Rotating Biological Contactor. What are the assumptions and design criteria adopted for the design of a rotating biological contactor? (**10 marks**)

MODULE III

15. (a) Explain the different types of anaerobic treatment processes. Anaerobic treatment is not generally accepted for wastewater treatment. Why? **(10 marks)**

(b) Explain with neat sketches the different types of digesters used for anaerobic sludge digestion. **(10 marks)**

Or

16. (a) Describe the major factors that are considered in the design of reactors for anaerobic biological treatment processes.

(**10 marks)**

(b) With a neat sketch, explain the working of an up-flow anaerobic sludge blanket reactor (UASBR). What are its main advantages and disadvantages? **(10 Marks)**

MODULE IV

17. (a) Explain the production of biogas in an anaerobic digester. What are the factors that affect biogas production in a digester? **(10 marks)**

(b) Explain the design features of common types of biogas plants. **(10 Marks)**

Or

18. (a) Explain the various methods used to enhance biogas production ? **(10 marks)**

(b) Describe the construction and working of a floating gas holder type plant (KVIC plant). **(10 marks)**