Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI EXAMINATION – SUMMER 2025

Subject Code: 3161304 Date:20-05-2025

Subject Name: Biological Processes for Wastewater Treatment

Time: 10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q.1 **(a)** Differentiate between biological and physicochemical analysis. **3**

(b) Give classification of Biological Wastewater treatment processes **4**
i. Based on metabolic function ii. Based on type of microbial growth.

(c) Enlist and explain factors affecting Reaction rate constant for BOD test. **7**

Q.2 **(a)** Why incubation period is fixed for 5 days at 20 °C in BOD test as per the Standard method? **3**

(b) Explain the phases of Bacterial Growth Curve with the help of figure. **4**

(c) Differentiate Between Aerobic Process and Anaerobic Process. **7**

OR

(c) Explain the Bio-tower treatment process for wastewater treatment with neat sketch, highlight its advantages. **7**

Q.3 **(a)** Define following terms: Substrate, anaerobic respiration, obligate bacteria. **3**

(b) Explain the following terms along with its importance in biological treatment **4**
i. Food to microbes ratio
ii. MCRT
iii. Growth yield
iv. Specific growth rate

(c) Prepare mass balance for CFSTR without recycle for biomass and substrate & hence derive the equation to determine bio-kinetic constants. **7**

OR

Q.3 **(a)** Draw a neat sketch of UASB highlight its components. **3**

(b) Differentiate between suspended growth and attached growth process with examples. **4**

(c) Explain the symbiotic relationship between the acetogenic bacteria and methanogenic bacteria. **7**

Q.4 **(a)** Write a note on aquaculture system with figure. **3**

(b) Explain the microbiology of anaerobic degradation of organic matter by endocellular enzymes and exocellular enzymes in the bacterial cell. **4**

(c) Give classification of anaerobic digester and explain each briefly with neat sketch. **7**

OR

Q.4 **(a)** Enlist the objectives of natural treatment system **3**

(b) Differentiate between High Rate Anaerobic Reactor and Conventional Anaerobic Reactor **4**

(c) Give classification of reactor and explain them with sketch. **7**

Q.5 **(a)** An industry generates wastewater with following value of parameters. Draw a suitable treatment train for disposal of waste water in river. Assume other parameters are with limits. **3**

BOD: 600 mg/L	COD: 1100 mg/L	TS: 500 mg/L	Oil and Grease: 100mg/L

(b) Draw a neat sketch of activated sludge process and explain the working of following components: (i) Aeration tank (ii) SST (iii) Mixing. **4**

(c) A sample of wastewater was incubated for 7 days at 20^0C and showed a BOD of 210 mg/L. Assume k= 0.3 day^{-1}(base e). Calculate **7**

i. Ultimate BOD at 20^0C	ii.5-day BOD at 20^0C
iii. 10-day BOD at 20^0C	iv. 5-day BOD at 33^0C

OR

Q.5 **(a)** Enlist and explain briefly any two factors affecting anaerobic treatment. **3**

(b) Give classification of reactions and explain the biodegradation reaction of organic matter. **4**

(c) BOD result of sewage at 20^0C are as follows: Determine the values of rate constant and ultimate BOD using least square method. **7**

t, day	0	1	2	3	4	5
y, mg/l	0	60	108	151	182	201