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(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS
MAIN EXAMINATIONS

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE
OF
BACHELOR OF SCIENCE IN BIOTECHNOLOGY

COURSE CODE: SBM 324
COURSE TITLE: BIOREACTOR

DATE: MONDAY, 25TH APRIL 2022 **TIME: 3:00 – 5:00 P.M.**

INSTRUCTIONS TO CANDIDATES

Answer ALL questions in section A and ANY TWO selected from section B

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 2 Printed Pages. Please Turn Over.

SECTION A (SHORT ANWSER QUESTIONS, 40 MARKS)

1. Outline the steps followed during oxygen transfer from the gas bubble to the cell. (3Mks)

2. Where G is generation time, n is number of generations and t is time in min/hours derive the equation for microbial growth by binary fission. (6Mks)

3. What is the significance of the following Michaelis-Menten parameters? (5mks)
   i. Michaelis constant, K_m
   ii. Maximum velocity, V_{max}
4. The mechanism underlying the controlling effect of the dilution rate is expressed in the Monod equation. At steady state, show that $\mu=D$ (6Mks)

5. A pilot sterilization process is carried out in $10^8 dm^3$ vessel with a medium containing 10^3 organisms/cm^3 with a probability of 1 in hundred microorganisms getting contaminated,
   a. Calculate the overall del factor(Δ) of the reaction (3Mks)
   b. Calculate the overall del factor(Δ) of the reaction if scaled up by 100 times for an industrial production (2Mks)
   c. Given the holding time=15.52 and the cooling time=10.34. Calculate the overall del factor(Δ) for the scaled up reaction process in b. (2mks)

6. What is an antifoam agent and state the properties of an ideal antifoam. (5mks)
7. Derive he equation that conforms with the thermal destruction of Nutrients in a fermentor (5Mks)
8. Explain the importance of the following in a bioreactor. (3mks)
   i. Sparger
   ii. Baffles
   iii. Sealing
   iv. Agitation
   v. Jacket
   vi. Motor

SECTION B (ESSAY QUESTIONS, 30 MARKS)

9. The following kinetic data were obtained for an enzyme in the absence of any inhibitor (1), and in the presence of two different inhibitors, (2) and (3), each at a concentration of 7.0 mM. Assume the total enzyme concentration, $[E_t]$, is the same for each experiment.

[S] μM	V (μmol/min) with 0.0 nM Inhibitor (1)	V (μmol/min) with 7.0 mM Inhibitor (2)	V (μmol/min) with 7.0 mM Inhibitor (3)
0.4	0.22	0.21	0.20
0.67	0.29	0.26	0.24
1.00	0.32	0.30	0.28
2.00	0.40	0.36	0.32

   i. Using the Lineweaver–Burk plot, determine Vmax and KM for the uninhibited enzyme. [13 marks]

   a) Determine the type of inhibition for the inhibitor binding to the enzyme, for experiments (2) and (3) [2 marks])