CLASS: BE   SEMESTER : VI/ADD
BRANCH: CHEM/CHEM(P&P)   SESSION : SP/19

SUBJECT: CL6001 BIOCHEMICAL ENGINEERING

TIME: 3.00 Hrs.   FULL MARKS: 60

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a)   Draw a typical growth curve of microbes and classify bacteria based on temperature.   [2]
Q.1(b)   Illustrate an Eukaryotic cell structure showing all internal organelles with a neat diagram.   [4]
Q.1(c)   List the various types of enzyme assays and describe in detail types of chromatography used in protein   [6]
purification.

Q.2(a)   Write short notes on structure and functions of DNA and RNA.   [2]
Q.2(b)   Explain TCA cycle with a neat diagram.   [4]
Q.2(c)   Describe Electron Transport Chain process in cells with all details, figures, flow sequence and total   [6]
number of ATPs made.

Q.3(a)   Discuss the use of Lineweaver-Burk plot.   [2]
Q.3(b)   Explain different types of reversible inhibitions.   [4]
Q.3(c)   An enzyme with a K_M of 0.001M was assayed using an initial substrate concentration of 0.00003M. After   [6]
2 mins, 5% of the substrate was converted. How much substrate will be converted after 10, 30 and 60
min.

Q.4(a)   Write down the significance of Damkohler number in biochemical reaction.   [2]
Q.4(b)   A carbohydrate decomposes is presence of an enzyme. The Mischaelis-Menten kinetic parameters were   [10]
found to be 200 mol/m^3 and 100 mol/m^3. Min.
i) Calculate the change of substrate concentration with time in a batch reactor where the initial
concentration of substrate is 300 mol/m^3.
ii) A CSTF runs with various flow rates were carried out the decomposition. If the substrate
concentration is 300 mol/m^3 and the flow rate is 100 cm^3/min, what is the steady-state concentration
of the outlet? The reactor volume is 300 cm^3.

Q.5(a)   Depict the flow sequence steps followed by O_2 from air bubbles to inside of cell in a bioreactor.   [2]
Q.5(b)   Microcarrier beads with 120 microns dia are used in a microbial culture. A 6 cm dia turbine impeller   [4]
is used to mix the solution of density 1010 kg/m^3 and viscosity 1.3 x 10^{-3} Pa.s. Estimate the Stirrer
power to avoid damage due to shear.
Q.5(c)   List K_La estimation methods and describe any one method in detail. Explain why it has unit of $time^{-1}$?   [6]
Also write the governing rate equations of bioreactors in batch, PFR and CSTR modes

Q.6(a)   What is sewage? Mention the composition of sewage.   [2]
Q.6(b)   Explain the significance of dual fermentation process with a suitable example.   [4]
Q.6(c)   Suggest a model to describe the prey-predator interaction. Explain.   [6]

Q.7(a)   Write the chemical reactions involved in the following processes related to ethanol: (i) direct   [4]
hydration (ii) indirect hydration (iii) ethanol decomposition in human body (iv) molasses
Q.7(b)   Describe production of ethanol using Malt fermentation process with a detailed flow sheet   [8]

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