Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: B.tech CE+RP **Semester: III**
Programme: Introduction to Bioengineering **Time: 03 hrs.**
Course Code: CHCE2006 **Max. Marks: 100**
Instructions:

SECTION A

S. No.		Marks	CO
Q 1	What are enzymes? What is the chemical basis of enzyme specificity?	**4**	**CO1**
Q 2	Briefly describe the structured and unstructured models of microbial growth?	**4**	**CO2**
Q 3	What is a fed-batch reactor? Mention two advantages/ disadvantages.	**4**	**CO3**
Q 4	Mention key variables that impact mass transfer coefficient, $K_{L,a}$ in bioreactors	**4**	**CO3**
Q 5	Discuss the role of dialysis in protein purification.	**4**	**CO4**

SECTION B

Q 6	The enzyme, fumarase, has the following kinetic constant: $S+E \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} ES \xrightarrow{k2} P+E$ Where $k_1 = 10^9\ M^{-1}\ s^{-1}$ $k_{-1} = 4.4 \times 10^4\ s^{-1}$ $k_2 = 10^3\ s^{-1}$ a. What is the value of Michaelis constant for this enzyme? b. At an enzyme concentration of 10^{-6}, what will be the initial rate of product formation at a substrate concentration of 10^{-3} M?	**10**	**CO1**
Q 7	Aerobic degradation of an organic compound by a mixed culture of organisms in waste water can be represented by the following reaction. $C_3H_6O_3 + a\ O_2 + b\ NH_3 \longrightarrow c\ C_5H_7NO_2 + d\ H_2O + e\ CO_2$ a. Determine a, b, c, d and e, if $Y_{X/S} = 0.4$ g X/g S b. Determine the yield coefficient $Y_{X/O2}$ and $Y_{X/NH3}$ c. Determine the degree of reductions for the substrate, bacteria, and RQ for the organisms. **OR** Aerboic growth of S. cerevisiae on ethanol is simply described by the following overall reaction:	**10**	**CO2**

	$C_2H_5OH + a\ O_2 + B\ NH_3 \longrightarrow c\ CH_{1.704}N_{0.149}O_{0.408} + d\ CO_2 + e\ H_2O$ a) Determine the coefficients a, b, c, and d, where RQ = 0.66 b) Determine the biomass yield coefficient, $Y_{X/S}$, and oxygen yield coefficient, $Y_{X/O2}$ (gdw/gO2).		
Q 8	Explain, why, in most fermentation, batch sterilization is preferred over continuous sterilization.	**10**	**CO4**
Q 9	a) What are the different types of bioreactor? Describe briefly the function of key components in a bioreactor b) Write a short note on selection of impellers and which one is most suitable for animal cells.	**10**	**CO3**
	SECTION-C		
Q 10	a) Perform mass balance on ideal CSTR reactor assuming steady-state performance and decay reaction of first order and express the outlet concentration. b) 2 CSTRs are placed in series for a first-order reaction. 40% conversion is obtained in the first CSTR. What is the relative size of the second CSTR, compared to the first, to obtain 80% overall conversion	**20**	**CO3**
Q 11	Write a short note on (i) Fluidized bed bioreactor (ii) Plug flow reactor (iii) Chromatography (iv) Electrophoresis	**20**	**CO3 and CO4**