I SEMESTER M.TECH. (INDUSTRIAL BIOTECHNOLOGY)

END SEMESTER EXAMINATIONS, NOV/DEC 2017

SUBJECT: BIOPROCESS ENGINEERING [BIO 5121]

REVISED CREDIT SYSTEM
(16/11/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** questions.
- Missing data may be suitable assumed.

1A.	What could happen if you substituted a tyrosine for a cysteine in the active site? What might happen if the substitution occurred elsewhere?	**3M**
1B.	What are mutagenic agents and does every gene mutation cause alteration in the protein the gene normally codifies?	**2M**
1C.	You wish to produce a high value protein using recombinant DNA technology. Would you try to develop a chemical defined medium or a complex medium? Why?	**2M**
1D	List the essential criteria of the culture used for inoculation of productive fermentation medium.	**3M**
2A.	A medium containing a vitamin is to be sterilized. Assume that the number of spores initially present is 10^6/L. The values of the pre-Arrhenius constant and E_d for the spores are 1 x 10^{36} min^{-1} and 65 kcal/mol respectively. For the inactivation of the vitamin, the values are 1 x 10^4 min^{-1} and 10 kcal/mol respectively. The initial concentration of vitamin is 30 mg/L. compare the amount of active vitamin in the sterilized medium for 10 L and 10000 L fermenter when both are sterilized at 121^{o}C where we require in both cases that the probability of an unsuccessful fermentation be 0.001. Ignore the effects of the heat up and cool down periods.	**4M**
2B	If a batch sterilization process carried out in a 10,000 dm^3 and 1,00,000 dm^3 vessel with a medium containing 10^6 organisms cm^{-3} requiring a probability of contamination of 1 in 1000, what would be the Del factor in both the cases? Give the significance of Del Factor.	**2M**
2C	Contrast depth and absolute filters. With a neat labelled diagram explain the sterilization of animal cell culture medium.	**4M**
3A	Lipase is being investigated as an additive to laundry detergent for removal of stains from fabric. The general reaction is: Fats -------→ Fatty acids + Glycerol. The value of K_m is 5 mM. At 60^{o}C, lipase is subjected to deactivation with a half-life of 8 min. Fat hydrolysis is carried out in a well - mixed batch reactor which stimulates a top loading washing machine. The initial fat concentration is 45 gmol/m^3. At the beginning of the reaction the rate of hydrolysis is 0.07 mmol/s. How long does it take for the enzyme to	**4M**

	hydrolyze 80 % of the fat present?	
3B	List the advantages and disadvantages of immobilization of enzyme. Describe in brief the matrix entrapment method of immobilization.	**4M**
3C	Define the following: a. Holoenzyme c. Cryptic growth b. Cofactor d. Diauxic growth	**2M**
4A	Develop an unstructured-non segregated growth model for bacterial culture grown in batch reactor in terms of biomass and substrate concentrations and list the assumptions made.	**5M**
4B	With a neat labelled diagram explain the method for measuring cell number and cell size distribution with a particle counter using the electrical resistance.	**3M**
4C	Illustrate how the hydrogen ion concentration affects the microbial growth kinetics.	**2M**
5A	Aerobic degradation of an organic compound by a mixed culture of organisms in waste water can be represented by the following reaction. $C_3H_6O_3 + a\ O_2 + b\ NH_3 \text{-------}\rightarrow c\ C_5H_7NO_2 + d\ H_2O + e\ CO_2$ a. Determine a, b, c, d and e, if Yx/s = 0.4 g x/g s. b. Determine the yield coefficients $Y_{x/O2}$ and $Y_{x/NH3}$. c. Determine the degree of reductions for the substrate, bacteria, and RQ for the organism	**5M**
5B	The chemical reaction equation for conversion of ethanol to acetic acid is $C_2H_6O + a\ O_2 + NH_3 \text{-------}\rightarrow c\ CH_{1.8}O_{0.5}N_{0.2} + d\ CO_2 + e\ H_2O + f\ C_2H_4O_2$. Acetic acid is produced from ethanol during growth of *Acetobacter aceti* which has the composition $CH_{1.8}O_{0.5}N_{0.2}$. Biomass yield from substrate is 0.14 g/g; Y_{ps} = 0.92 g/g. NH_3 is used ad N_2 source. How does growth in this culture affect oxygen demand for acetic acid production?	**5M**