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Total Number of Pages : 2

AR-17

B.TECH

**B.TECH 5<sup>th</sup> SEMESTER EXAMINATIONS, NOV/DEC 2019****BCHPE5041 BIOCHEMICAL ENGINEERING**

Chemical Engineering

Time : 3 Hours

Maximum : 100 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

**PART – A: (Multiple Choice Questions) 10 x 2=20 Mark****Q.1. Answer ALL Questions**

- a Water insoluble enzymes can be prepared by using multifunctional agents that are bifunctional in nature and have CO2 PO1
- a) low molecular weight    b) high molecular weight  
c) high equivalent weight    d) low reactivity
- b Which of the following statements is true about uncompetitive inhibitors? CO2 PO1
- a) They bind covalently at a site distinct from the substrate active site  
b) They increase the measured  $V_{max}$   
c) In the presence of an uncompetitive inhibitor, the Michaelis-Menten equation becomes
- $$V_0 = \frac{V_{max}[S]}{K_m + \alpha'[S]}$$
- d) Apparent  $K_m$  also increases
- c Bacterial growth curve is obtained by plotting CO4 PO2
- (i) Number of cells versus time    (ii) number of spores versus time  
(iii) log of number of cells versus time    (iv) log of number of cells survived versus time
- d Which of the following statements is not true about RNA? CO1 PO2
- a) Does not have a double stranded structure    b) Thymine is present  
c) Does not obey Chargaff's rule    d) The sugar contained in RNA is a ribose
- e In an activated sludge process, the biomass is recycled to CO4 PO1
- a increase the efficiency of the process    b. reduce sludge volumes  
c increase the concentration of cells    d all of the above
- f Which of the following is a true statement? CO1 PO1
- a) Tryptophan and tyrosine are significantly more polar than phenylalanine  
b) Leucine is commonly used as an ingredient in the buffers of SDS page  
c) Aspartate is an essential amino acid  
d) Lysine is a non-essential amino acid
- g Which of the following is false about lipids? CO1 PO2
- a) They are either strongly hydrophobic or amphipathic  
b) They are insoluble in water  
c) Extraction of lipids from tissues require organic solvents  
d) They are more soluble in water
- h In which of the following fermenters the impellers are replaced by the constant flow of gas? CO3 PO2
- a) Airlift fermenter    b) Tower fermenter    c) Hollow fibre    d) Perfusion bioreactor
- i Which of the following is not used in DO measurement? CO3 PO2
- a) Polarographic electrode    b) Tubing method    c) Tachometers    d) Galvanic electrode
- j Which of the following factors are not involved in the scale-up process? CO3 PO1
- a) Inoculum development    b) Sterilization    c) Temperature    d) Medium design

**PART – B: (Short Answer Questions) 10X2=20 Marks****Q.2. Answer ALL questions**

- a State three differences between a chemical reaction and its biochemical counterpart. CO1 PO2
- b Present the classification of microorganisms. Compare Prokaryote and Eukaryotes in terms of their internal structures. CO1 PO1
- c Define Enzyme inhibition and role of cofactors. CO2 PO2
- d Define Growth Yield and the other various Yield Coefficients used in cell culture. CO1 PO1
- e What types of common on-line instrumentation are used on bioreactor? CO4 PO2



- |   |   |         |
|---|---|---------|
| f | What is meant by “limiting substrate concentration”?  | CO3 PO2 |
| g | What do you understand by ‘critical dilution rate’ and ‘wash out’ in context with continuous culture. | CO4 PO2 |
| h | What is denaturation of proteins? State three factors responsible for denaturation of protein.        | CO1 PO2 |
| i | Explain glycosidic linkage in polysaccharides.  | CO1 PO1 |
| j | What is generation time?  | CO1 PO2 |

**PART – C: (Long Answer Questions) 4X15=60 Marks****Answer ALL questions**

- Q.3.
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|----|---|-----|---------|
| a. | Differentiate between the Gram-positive and Gram-negative cell wall.                                    | [8] | CO1 PO1 |
| b. | Draw a schematic of a fermenter vessel. Label the major components and briefly explain their functions. | [7] | CO4 PO2 |
- OR**
- |    |   |     |         |
|----|---|-----|---------|
| c. | State various methods of mass transfer coefficient ( $K_L$ ) determination for aerobic system. Discuss any one in details.                    | [8] | CO3 PO3 |
| d. | Discuss the air sterilization process for a large-scale aerobic fermenter with a schematic diagram. Name a few materials used as air filters. | [7] | CO4 PO2 |
- Q.4.
- |    |   |     |         |
|----|---|-----|---------|
| a. | Discuss in detail the difference between batch culture and Fed-batch culture. | [8] | CO3 PO3 |
| b. | Explain the Lock and Key model with diagram for enzymatic reactions.          | [7] | CO2 PO2 |
- OR**
- |    |   |     |         |
|----|---|-----|---------|
| c. | Explain different methods of enzyme immobilization with the help neat sketches  | [8] | CO2 PO2 |
| d. | Discuss with examples the application of fermentation technology in food and beverage, industrial solvents, and antibiotics production. | [7] | CO4 PO2 |
- Q.5.
- |    |   |     |         |
|----|---|-----|---------|
| a. | Before inoculation of the batch reactor, you need to sterilize the medium, which contains $10^5$ spores $L^{-1}$ . The value of thermal death rate constant ( $K_d$ ) has been determined to be $1 \text{ min}^{-1}$ at $121^\circ\text{C}$ and $61 \text{ min}^{-1}$ at $140^\circ\text{C}$ . For each temperature, determine the required time in the holding section so as to insure that the medium is 95% sterile. The volume of reactor ( $V_{\text{Liquid}}$ ) is 20 L. Neglect heating and cooling. | [8] | CO4 PO2 |
| b. | Define sterilization and distinguish it from pasteurization. Describe all the methods of air sterilization.   | [7] | CO4 PO2 |
- OR**
- |    |   |  |  |
|----|---|--|--|
| c. | Aerobic degradation of benzoic acid by a mixed culture of microorganisms can be represented by the following reaction. Assume two-thirds of carbon from substrate converted to biomass. |  |  |
|----|---|--|--|
- $$\underset{\text{(Substrate)}}{C_6H_5COOH} + aO_2 + bNH_3 \Rightarrow \underset{\text{(Biomass)}}{cC_5H_7NO_2} + dH_2O + eCO_2$$
- |    |  |     |         |
|----|--|-----|---------|
|    | (i) Determine stoichiometric coefficients a, b, c, d and e       |     |         |
|    | (ii) Determine the yield coefficients, $Y_{x/s}$ and $Y_{x/O_2}$ | [8] | CO3 PO3 |
| d. | Write short note on antibiotics and its application.             | [7] | CO1 PO1 |
- Q.6.
- |    |   |     |         |
|----|---|-----|---------|
| a. | Explain in details with neat sketch about Plate and frame filter press.                             | [8] | CO1 PO2 |
| b. | Describe the growth associated and non-growth associated product formation in fermentation process. | [7] | CO1 PO1 |
- OR**
- |    |   |     |         |
|----|---|-----|---------|
| c. | Explain the importance of selective, differential and maintenance Microbiology.                           | [8] | CO1 PO1 |
| d. | Discuss in detail how could the transport of ions and molecules takes place between cell and environment. | [7] | CO3 PO1 |