BINDURA UNIVERSITY OF SCIENCE EDUCATION

BIOLOGICAL SCIENCES DEPARTMENT

BACHELOR OF SCIENCE HONOURS DEGREE IN BIOTECHNOLOGY

BZG

~~BZ~~405 FERMENTATION TECHNOLOGY/BTECH217 PRINCIPLES OF FERMENTATION

EXAMINATION 2 HOURS (100 MARKS)

INSTRUCTIONS

Answer FOUR (4) questions. You MUST answer QUESTION 1 from Section A and any THREE (3) questions from SECTION B. Each question carries 25 marks. Where a question contains subdivisions, the mark value of each part is given in brackets. Illustrate your answer were appropriate with large clearly labeled diagrams. You should not spend more than 30 minutes on each question.

SECTION A (COMPULSORY)

1. (a) Explain the complex and synthetic media types. [4]

   (b) Outline the features of regulated and unregulated batch fermentations. [4]

   (c) In a chemostat system, give reasons what would happen under the following experimental parameter conditions:

   (i) $D > \mu$. [3]

   (ii) $D < \mu$. [3]

   (iii) $D = \mu$. [3]

   (d) Fill in with the correct information on the following table that is comparing batch and chemostat cultivations using the following terms: **increasing**, **decreasing**, and **constant**. [8]

	Batch cultivation at exponential phase	**Chemostat at steady-state phase**
Growth rate of culture		
Specific growth rate of the culture		
Culture volume		
Available nutrients		

SECTION B. Choose any THREE (3) from FIVE (5) questions below.

2. (a) Derive the model kinetics of the microbial development under exponential phase, using the following diagrams. [15]

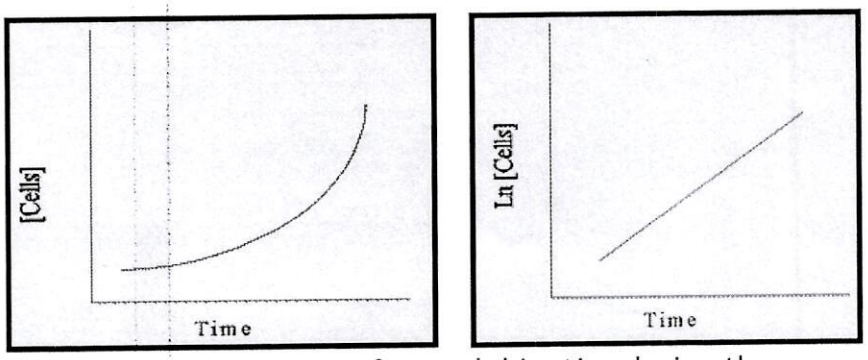

Figure 1: Graphical representations of growth kinetics during the exponential phase

(b) Redraw the following diagram in your answer sheet and fully label the parts of a penicillin fermentor: [10]

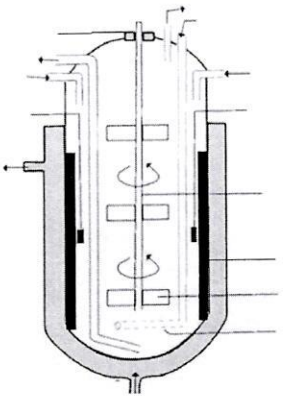

Figure 2: A diagram showing the penicillin fermentor.

3. Identify the stages of fermentation scaling-up from phase **A** to **C** shown below and explain the role of each stage.

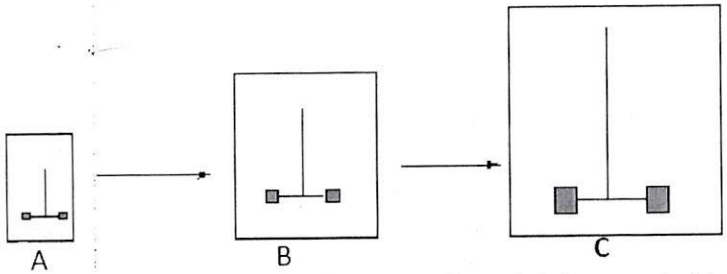

Figure 3: Scaling up procedures for an industrial fermentation process.

4. Describe the environmental factors that affect microbial growth rate and explain at the molecular level how they do so.

5. (a) Calculate the time taken to increase the cell number from 10^6 CFU/ml to 10^8 CFU/ml assuming its generation time of 1.5 h. [5]
   (b) Define the critical dilution rate, D_c. [3]
   (c) Explain what happens when D_c is greater than D in a continuous culture. [5]
   (d) Discuss the advantages and disadvantages of continuous cultivations. [12]

6. Write notes on the microbial growth developmental phases in a fed-batch system.

END OF EXAMINATION PAPER