BINDURA UNIVERSITY OF SCIENCE EDUCATION

BIOLOGICAL SCIENCES DEPARTMENT

BACHELOR OF SCIENCE HONOURS DEGREE IN BIOTECHNOLOGY

BZG405/BTEC238/BTEC222/BTEC217

FERMENTATION BIOTECHNOLOGY/ FERMENTATION TECHNOLOGY/ PRINCIPLES OF FERMENTATION TECHNOLOGY

EXAMINATION NOV 2024 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 term fermentation. [2]

   (b) Outline the advantages of performing fed-batch fermentation. [6]

   (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

2. (a) Describe the principles of the following types of cultivation techniques:
   (i) Batch [5]
   (ii) Continuous [5]
   (iii) Fed-batch [5]

   (b) Redraw the diagram below in your answer sheet and fully label it. [7]

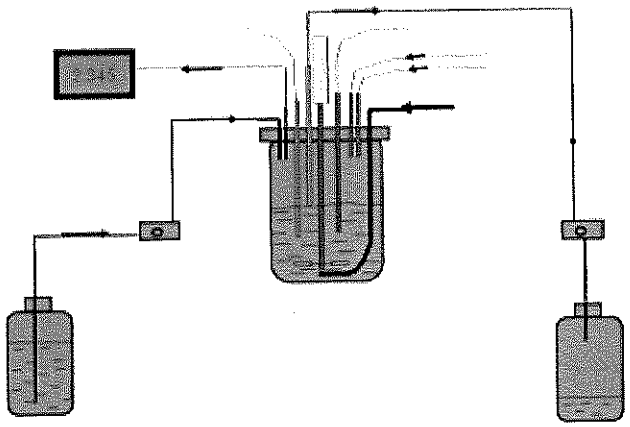

Figure 1: Illustration of a chemostat cultivation.

(c) In the following table, fill-in the missing information labeled **A** to **D** with appropriate identities. [7]

Fermentation Product	**Organism**	**Use or application**
A	*Saccharomyces cerevisiae*	**B**
Glycerol	**C**	Production of explosives
Lactic acid	**D**	Food and pharmaceutical
E	*Clostridium acetobutylicum*	**F**
▫amylase	*Bacillus subtilis*	**G**

3. Describe the microbial growth developmental phases in a batch system.

4. Describe the different means of microbial enumeration using offline methods.

5. Discuss the environmental factors that affect fermentation processes.

6. Describe the possible types of fermentation technologies applicable in Zimbabwe that can be of commercial and industrial benefit, highlighting their relevance to the discussed processes.

END OF PAPER