



**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**FACULTY OF APPLIED SCIENCE**  
**DEPARTMENT OF APPLIED BIOLOGY AND BIOCHEMISTRY**  
**BACHELOR OF SCIENCE HONOURS IN APPLIED BIOLOGY AND**  
**BIOCHEMISTRY**  
**PRINCIPLES OF FERMENTATION TECHNOLOGY (SBB2109)**

**Main Examination Paper**

**DECEMBER 2024**

This examination paper consists of 2 pages

Time Allowed : 3 hours  
Total Marks : 100  
Special Requirements : Scientific calculator  
Examiner's Name : DR N NLEYA

**INSTRUCTIONS**

1. Answer **Four (4)** questions. Each question carries 25 marks.
2. Where a question contains subdivisions, the mark value for each subdivision is given in brackets.
3. Illustrate your answer where appropriate with large, clearly labelled diagrams.

**MARK ALLOCATION**

<b>QUESTION</b>	<b>MARKS</b>
1.	25
2.	25
3.	25
4.	25
5.	25
6.	25
<b>TOTAL</b>	<b>100</b>

1. With the aid of a diagram describe microbial growth stages in a batch fermentation culture and the products associated.
2. (a) State the dual role of carbon substrates in fermentation. (2 marks)  
 (b) State the factors that influence the choice of a carbon substrate. (3 marks)  
 (c) Discuss the various carbon sources that are used in fermentation. (20 marks)
3. (a) With the aid of a diagram describe the interrelationships of the component parts of a typical fermentation process. (15 marks)  
 (b) Explain the functions of the different components of a fermentor. (10 marks)
4. (a) At the beginning of a fermentation process, there were 10,000 ( $10^4$ ) cells in a culture that has a generation time of 2 h. Calculate the expected number of cells in the culture after:
  - (i) Four (4) hours and (2 marks)
  - (ii) Forty eight (48) hours (3 marks)
 (b) (i) Define the term washout. (2 marks)  
 (ii) Given that the specific growth rate of a culture in a continuous fermentation is 0.8 generations per hour and the vessel has a capacity of 500 L, calculate the maximum flow rate to avoid culture washout. (3 marks)  
 (c) Describe how you can isolate an  $\alpha$ -amylase producing microorganism from a soil sample. (5 marks)  
 (d) Explain the importance of fungal morphology during inoculum development with reference to penicillin production. (5 marks)  
 (e) Highlight the importance of sterilisation of media and air for a fermentation process. (5 marks)
5. Explain the various processes involved in the treatment of fermentation effluent, highlighting the significance of microorganisms.
6. Describe the mechanism of action of the following cell disruption methods used for extraction of intracellular products:
  - (a) Liquid shear. (5 marks)
  - (b) Solid shear. (5 marks)
  - (c) Chemical methods. (5 marks)
  - (d) Freeze-thawing. (5 marks)
  - (e) Ultrasonication. (5 marks)

**END OF EXAMINATION**