NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCE

DEPARTMENT OF APPLIED BIOLOGY AND BIOCHEMISTRY

BACHELOR OF SCIENCE HONOURS DEGREE IN BIOTECHNOLOGY

FUNDAMENTALS OF ENVIRONMENTAL MICROBIOLOGY (SBT4201)

Main Examination Paper

MARCH 2025

This Examination Paper consists of 2 pages

Time Allowed: 3 hours
Total Marks: 100
Special Requirements: NONE
Internal Examiner: MR N. MANGOMA
External Examiner:

INSTRUCTIONS

1. Answer **(4)** Questions.

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

QUESTION	MARKS
1.	25
2.	25
3.	25
4.	25
5	25
6	25
TOTAL	100

1. Describe, using specific examples, the mechanisms of energy generation and carbon acquisition employed by the following categories of microorganisms, and discuss the physiological and ecological implications of these processes in microbial communities.
   (a) Photoautotrophs. (10 marks)
   (b) Chemoautotrophs. (10 marks)
   (c) Mixotrophs. (5 marks)

2.(a) Describe the roles of named microorganisms in the following biogeochemical cycles, and explain the ecological importance and possible biotechnological potential of these processes.
   (i) Nitrogen cycle. (5 marks)
   (ii) Sulphur cycle. (5 marks)
   (b) Discuss the use of metagenomics in the study of environmental microbial community composition and function. (15 marks)

3.(a) Describe the mechanism of microbial respiration, highlighting the significance of this process in microbial ecosystems. (6 marks)
   (b) Discuss the following microbial habitats, highlighting the role of different physicochemical parameters in influencing the distribution and diversity of microorganisms in these habitats:
   (i) Freshwater. (10 marks)
   (ii) Soil. (9 marks)

4. Give an account of the positive and negative microbial associations that exist in natural environmental microbiomes, and highlight the ecological significance and possible biotechnological applications of some of these associations.

5. Discuss the impact of climate change on environmental microbial diversity, and suggest ways through which microorganisms may be harnessed to prevent and mitigate climate change.

6. Discuss the potential application of microorganisms in the following technologies:
   (a) Plastic pollution management. (13 marks)
   (b) Organic fertiliser production. (12 marks)

END OF EXAMINATION PAPER