

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**

FACULTY OF APPLIED SCIENCES

BACHELOR OF SCIENCE HONOURS DEGREE EXAMINATIONS

DEPARTMENT OF APPLIED BIOLOGY AND BIOCHEMISTRY

**THEORY: ADVANCED APPLIED MICROBIOLOGY SBB 4109**

DECEMBER 2004

3 HOURS (100 marks)

**INSTRUCTIONS**

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

**SECTION A**

- 1.(a) Define respiration in terms of microbial metabolism and distinguish aerobic from anaerobic respiration. (3 marks)
- (b) Describe a laboratory cultural test for differentiating bacteria on the basis of oxidative/fermentative metabolism and name any two groups or genera of bacteria for which the test can be important. (7 marks)
- (c) Describe the metabolic pathways leading to typical end-products in homo and heterolactic fermentation (10 marks)
- (d) Name one homolactic bacterium and discuss two industrial applications of homolactic fermentation. (5 marks)
- 2.(a) There are five major groups of chemoautotrophs recognizable on the basis of their substrate specifications.
- (i) Name the five subgroups (5 marks)
- (ii) What are the distinguishing characteristics among these subgroups with regards to:
- oxidizable substrate
  - oxidized products (10 marks)
- (b) Write short notes on the resting stages of methanotrophs. (10 marks)
- 3.(a) What are the essential components of the photosynthetic apparatus of phototrophic bacteria. (1 mark)
- (b) List major groups of phototrophs and use a table and diagrams (where possible) to compare them with Respect to:
- cell structure containing the photosynthetic pigment.
  - photosynthesis
  - reductants used for carbon dioxide assimilation
  - pigments
  - phycobiliproteins (10 marks)
- (c) Describe with a sketch the pattern of electron flow in bacterial photosynthesis. (4 marks)
- (d) Discuss briefly the properties of cyanobacteria that enable them to perform oxygenic photosynthesis and nitrogen fixation. (10 marks)

**SECTION B**

4. (a) Why is it important to treat sewage before discharging the resulting effluent into water systems. (5 marks)
- (b) Compare the use of activated sludge and anaerobic digesters for treating sewage and outline clearly the microbial and biochemical processes involved. (15 marks)
- (c) Draw a schematic diagram of a domestic or single unit structure sewage treatment system. (5 marks)
5. Define with examples type of microbial association given below.
- (a) commensalisms (5 marks)
- (b) competition (5 marks)
- (c) symbiosis (5 marks)
- (d) synergism (5 marks)
- (e) antagonism (5 marks)
6. (a) What do you understand by the terms:
- (i) primary metabolite (1 mark)
- (ii) secondary metabolite (1 mark)
- (iii) mycotoxicosis (1 mark)
- (iv) mycosis (1 mark)
- (b) What do you understand by the following terms or acronyms?
- (i) mycotoxin (1 mark)
- (ii) aflatoxin (1 mark)
- (iii) ELISA (1 mark)
- (c) You are employed by a large confectionery company dealing with large quantities of grain such as maize, wheat etc. What methods of preventing fungal damage and or toxin production will be available for you to take in terms of transport and storage? (18 marks)

**END OF EXAMINATION PAPER**