

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES
BACHELOR OF SCIENCE HONOURS DEGREE EXAMINATIONS
DEPARTMENT OF APPLIED BIOLOGY AND BIOCHEMISTRY

THEORY: GENERAL MICROBIOLOGY ILSBB 2105

DECEMBER 2005

2 ^{1/2} HOURS (100 marks)

INSTRUCTIONS

Answer Four (4) Questions. 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.

- 1.(a) Describe substrate utilization, microbial growth and exoenzyme secretion in a named culture media under defined conditions favourable to catabolite repression. (9 marks)
- (b) Discuss the molecular basis of enzyme induction with particular reference to the *lac* operon. (8 marks)
- (c) Using an appropriate named example discuss diauxy in terms of catabolite repression of enzyme synthesis. (8 marks)
- 2.(a) "The production of antibiotics is considered to be one of the most important mechanisms involved in interference competition." Discuss the above statement with respect to microbe-microbe interaction strategies of antagonism and competition. (15 marks)
- (b) Discuss the following microbial interactions.
- (i) Commensalisms (3 marks)
 - (ii) Symbiosis (4 marks)
 - (iii) Synergism (3 marks)
- 3.(a) Describe how each of the following environmental factors affect the growth of microorganisms.
- (i) temperature (5 marks)
 - (ii) moisture availability (5 marks)
- (b) Explain how each of the following groups of microorganisms are able to survive in their respective environments.
- (i) thermophiles (3 marks)
 - (ii) acidophiles (3 marks)
 - (iii) aerobes (how O₂ toxicity is overcome) (6 marks)
- (c) Briefly explain the need for microbiologists to understand various environmental factors affecting microbial growth. (3 marks)

- 4.(a) Discuss the factors that influence effectiveness of antimicrobial agents. (10 marks)
- (b) Describe the mode of action of each of the following agents used in control of microorganisms.
- (i) Halogens (3 marks)
 - (ii) Heat (3 marks)
 - (iv) Penicillin (3 marks)
- (c) Describe the mechanisms involved in antibiotic resistance in microorganisms. (6 marks)
- 5.(a) A bacterial culture contains 10^5 cells per millilitre at time zero. After 5 hours the cells are 10^8
Calculate: (i) the generation time (3 marks)
(ii) growth rate (3 marks)
(iii) number of generations (3 marks)
- (b) Describe the characteristics of a culture in the log and stationary phase of growth outline the factors that affect the duration of the lag phase when an organism is inoculated into a fresh medium. (10 marks)
- (c) Explain the principle and operation of the chemostat taking into account the effect of varying the flow rate of the medium. (6 marks)
6. Write notes on the following mechanisms of nutrient transport in microorganisms.
- (a) Passive diffusion (4 marks)
 - (b) Facilitated diffusion (4 marks)
 - (c) Active transport (4 marks)
 - (d) Group translocation (5 marks)
 - (e) Iron uptake (4 marks)
 - (f) Proton motive force (4 marks)

END OF EXAMINATION