NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

BACHELOR OF SCIENCE HONOURS DEGREE EXAMINATIONS

DEPARTMENT OF APPLIED BIOLOGY AND BIOCHEMISTRY

SUPPLEMENTARY EXAMINATION: GENERAL MICROBIOLOGY II SBB 1207

JULY 2005

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

INSTRUCTIONS

Answer Question **(1) one** and any other **(3) three** 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. (i) a) Describe the contribution of Joseph Lister to the germ theory of disease. (2 marks)
   b) What contribution did John Tyndall make in the study of Microbiology? (3 marks)

   (ii) Using named species and diagrams, illustrate a staphylococcus, vibrio, sarcina, streptococcus and a spirochete. (5 marks)

   (iii) Describe the important features of the actinomycetes and their economic importance. (5 marks)

   (iv) Name the following: (7 marks)
   a) a bacterium commonly associated with faeces
   b) a bacterium resident on the skin, hands and nasal passages.
   c) Two bacterial genera that usually produce endospores.
   d) The bacterium associated with the discovery of the mechanism of gene transfer.
   e) The group of bacterium devoid of peptidoglycan
   f) The extrachromosomal genetic element in microorganisms.

   (v) Fungi are important to human beings in both harmful and beneficial ways. Give one named example of each of the cases stated and explain the effects of each of the named fungi. (3 marks)

2.a) What are coliforms? What is the classical genera and explain why they are used as indicators of water sanitary quality. (9 marks)

b) Describe the scientific bases for the following tests:
   i) catalase
   ii) oxidase
   Give two named bacterial species or genera and indicate how they are used to illustrate differential value of each test. (6 marks)

c) Describe a staining technique used to differentiate between Gram positive and Gram negative bacteria and explain the basis of the reactions that are observed in the test. (10 marks)

Discuss the factors that affect microbial sensitivities to lethal agents. (9 marks)

b) Write short notes on pasteurization. (6 marks)

c) Discuss the consequences of uncontrolled use of antibiotics. (4 marks)

d) What are the principles of autoclaving? (6 marks)

4 a). Describe the characteristics of a culture in the logarithmic phase of growth. (4 marks)

b) If 275 and 163 colonies are obtained when 0.1 ml of a 10^{-4} dilution of a milk sample is plated on duplicate plates of a suitable agar medium, calculate the viable cell count of the sample. (3 marks)

c) Explain the difference between total and viable count. In which of the counts is the haemocytometer used and what is the principle behind the use of the instrument. (5 marks)

d) Describe the enrichment technique for the isolation of *Salmonella* from faeces. (5 marks)

e) What are the events that led to the use of agar as a solidifying agent in media and explain the advantages it has over other agents? (8 marks)

5.a) Define the terms culture medium, pure culture and general purpose medium. (3 marks)

b) The composition of MacConkey agar is as follows:

Peptone	17g/l
Proteose peptone	3g
Lactose	10g
Bile salts	1.5g
NaCl	5g
Neutral red	0.03g
Crystal violet	0.001g
Agar	18 g

Explain how specific components of the medium make it selective and differential. (5 marks)

c) What are the three classes of compound which can be used to make media selective? (3 marks)

d) What bacterial structures can be demonstrated by the following reagents: malachite green and India ink? Explain the principle behind the staining techniques. (4 marks)

e) Explain the differences between a Gram positive and a Gram negative bacterial cell. (4 marks)

f) Draw and label a generalized bacterial cell. (6 marks)

a) What is resolution in microscopy? What factors affect resolution and how can it be improved in light microscopy.
(6 marks)

b) What features of microbial cells are generally revealed by the scanning transmission electron microscope?
(4 marks)

c) Explain what the immersion oil lens is and why oil is used with this lens.
(4 marks)

d) Explain the principle of following types of microscopes and give an example of the applications of each:
   i) dark field microscope
   ii) fluorescent microscope
   iii) phase contrast microscope
(6 marks)

e) How would you prepare wet mount slide? Give examples in which this type of preparation is used.
(5marks)

END OF EXAMINATION

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