

UNIVERSITY OF SWAZILAND

FACULTY OF HEALTH SCIENCES

DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCES

FINAL EXAMINATION 2010/2011

TITLE OF PAPER: INTRODUCTION TO MICROBIOLOGY AND IMMUNOLOGY

COURSE CODE: HSC 105

DURATION: 3 HOURS

- INSTRUCTIONS:
1. READ THE QUESTIONS & INSTRUCTIONS CAREFULLY
 2. THIS PAPER IS DIVIDED INTO **TWO** SECTIONS:-
SECTION A (NURSING SCIENCE) &
SECTION B (ENVIRONMENTAL SCIENCE)
 3. ANSWER **ANY** FOUR QUESTIONS IN **YOUR** SECTION
 4. EACH QUESTION CARRIES TWENTY FIVE (25) MARKS
 5. NO PAPER SHOULD NEITHER BE BROUGHT INTO NOR TAKEN OUT OF THE EXAMINATION ROOM
 6. BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER

SPECIAL REQUIREMENTS: NONE

THIS PAPER SHOULD NOT BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATORS.

SECTION A (NURSING SCIENCE)
Answer any four questions from this section.

Question 1

- (a) What are the practical applications of gram and negative staining? (3 marks)
- (b) Why is the Gram stain a differential staining technique? (2 marks)
- (c) Separate the following into gram-negative and gram-positive organisms:
Mycobacterium, Haemophilus, Clostridium, Staphylococcus, Escherichia, Klebsiella, Vibrio, Shigella, Bacillus, Neisseria, Salmonella and Corynebacterium species. (8 marks)
- (d) Name one disease caused by each of the bacteria in 1(c) above. (6 marks)
- (e) Distinguish between an isograft and an allograft. (1 mark)
- (f) Draw a diagram of bacteriophage. (2 marks)
- (g) Define the terms '50% infectious dose' and '50% lethal dose'. (1 mark)
- (h) Give a generalised sequence of stages of infection by microorganisms. (2 marks)

[Total = 25 marks]

Question 2

- (a) Provide a flow chart to demonstrate that cells of both the innate and adaptive immune systems arise from the bone marrow stem cell. (5 marks)
- (b) Show that the specific immune response results from the cooperation of various cells of the immune system. (5 marks)
- (c) Explain the following:
(i) role of T-cells in immune response, (4 marks)
(ii) structure of an antibody, (4 marks)
(iii) names and classes of immunoglobulins, (3 marks)
(iv) immunologic memory. (4 marks)

[Total = 25 marks]

Question 3

- (a) Explain the economic importance of fungi. (6 marks)
- (b) What are the major mechanisms of fungal pathogenesis? (4 marks)
- (c) Briefly explain the following:
(i) superficial mycoses, (3½ marks)
(ii) subcutaneous mycoses, (3 marks)
(iii) systemic mycoses. (3½ marks)
- (d) Elaborate on the toxic effects of aflatoxins. (5 marks)

[Total = 25 marks]

Question 4

- (a) Draw a well labelled diagram of a bacterium (5 mark)
- (b) What are the shapes of bacteria? Elaborate (3 marks)
- (c) Why do some species of bacteria produce endospores? (1 mark)
- (d) Draw and explain the logistic curve in bacteria. (4 marks)
- (e) Classify bacteria in terms of their temperature requirements. (4 marks)
- (f) Explain the pathogenicity of any two bacterial human pathogens. (8 marks)

[Total = 25 marks]

Question 5

- (a) What is a virus? (5 marks)
- (b) Explain the following:
(i) biology of influenza virus, (5 marks)
(ii) viral reproduction within cells, (5 marks)
(iii) effects of viral infection on cells. (4 marks)
- (c) Write an essay on the relevance of viruses to humans. (6 marks)

[Total = 25 marks]

Question 6

- (a) What is an antigen? (1 mark)
- (b) Explain the types of antigens we are exposed to from the environment. (7 marks)
- (c) What is anaphylaxis? Elaborate. (4 marks)
- (d) Write short notes on the following:
(i) immune defects, (3 marks)
(ii) B-cells and their functions, (6 marks)
(iii) transplantation immunity. (4 marks)

[Total = 25 marks]

SECTION B (ENVIRONMENTAL SCIENCE)
Answer any four questions from this section.

Question 7

- (a) Draw and fully label a flagellated F⁺ bacillus. (5 marks)
- (b) Discuss the composition and function of the following:
- (i) capsule, (2 marks)
 - (ii) fimbria, (2 marks)
 - (iii) plasmid, (2 marks)
 - (iv) cell membrane, (2 marks)
 - (v) cytoplasm. (2 marks)
- (c) Explain phage-mediated chromosomal recombination in bacteria. Illustrate all the key steps. (10 marks)
- [Total = 25 marks]**

Question 8

- (a) Explain asexual reproduction methods in bacteria. (5 marks)
- (b) Draw and fully explain the various regions of a generalised bacterial growth curve. (10 marks)
- (c) Explain how a plasmid acts as a vehicle of transfer of genetic information during the mating of an Hfr and an F⁻. Illustrate your answer. (10 marks)
- [Total = 25 marks]**

Question 9

- (a) Prepare a table to compare eukaryotic and prokaryotic cells. (5 marks)
- (b) Explain how fungi affect human welfare. (5 marks)
- (c) Prepare annotated diagrams to explain reproduction processes in the bread mold *Rhizopus stolonifer*. (15 marks)
- [Total = 25 marks]**

Question 10

- (a) What procedures should be observed when collecting water for potability tests? (5 marks)
- (b) What are the characteristics of an indicator organism? (10 marks)
- (c) Explain a typical municipal water supply purification method. (10 marks)
- [Total = 25 marks]**

Question 11

- Write an essay on Salmonella gastroenteritis and the role played by environmental scientists in its prevention. (25 marks)
- [Total = 25 marks]**

Question 12

Write an essay on innate immunity defences.

(25 marks)

[Total = 25 marks]

END OF EXAMINATION PAPER