UNIVERSITY OF SWAZILAND

Faculty of Health Sciences

Department of Environmental Health Sciences and General Nursing

Final Examination 2012/2013

TITLE OF PAPER	:	INTRODUCTION TO MICROBIOLOGY AND IMMUNOLOGY
COURSE CODE	:	HSC 105
DURATION	:	3 HOURS
MARKS	:	100

INSTRUCTION : READ THE QUESTIONS & INSTRUCTIONS CAREFULLY.

THIS PAPER IS DIVIDED INTO TWO SECTIONS:

SECTION A (NURSING SCIENCE) &
SECTION B (ENVIRONMENTAL SCIENCE).

ANSWER ANY FOUR QUESTIONS IN YOUR SECTION
EACH QUESTION CARRIES 25 MARKS.
NO PAPER SHOULD NEITHER BE BROUGHT INTO NOR TAKEN OUT OF THE EXAMINATION ROOM.

BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER.

SPECIAL REQUIREMENTS: NONE

DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTED BY THE INVIGILATOR.

SECTION A (NURSING SCIENCE)

Question 1

a) How would you determine the therapeutic value of an antimicrobial agent? Elaborate. (3 marks)

b) Distinguish between self-infection and cross infection. (2 marks)

c) Fill in the following table:

Pathogen	**Disease caused**	**Gram's reaction**
Mycobacterium tuberculosis	?	Variable
Haemophilus spp	?	?
Staphylococcus spp	?	+
Clostridium spp	Tetanus	?
Escherichia spp	?	-
Vibrio spp	Cholera	?
Klebsiella spp	?	?
Bacillus spp	?	+
Shigella spp	Dysentry	?
Salmonella spp	?	?
Neisseria spp	Gonorrhea	-
Corynebacterium spp	Diphtheria	?

(14 marks)

d) Distinguish between an isograft and an allograft. (1 mark)

e) List some examples of penicillins and tegracyclines. (2 marks)

f) Define the terms "50% lethal dose and 50% infectious dose". (1 mark)

g) Give a generalized sequence of the stages of host infection by bacteria. (2 marks)

[Total marks = 25]

Question 2

a) Provide a flow chart to demonstrate the importance of the bone marrow stem cells. Give your own opinion of the ethical implications of the transplantation of bone marrow from for example swine to humans. (5 marks)

b) Show that 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) Dual nature of the immune system (4 marks)

(iv) Immunologic memory in disease resistance (3 marks)

[Total marks = 25]

Question 3

a) Give two examples of pleomorphic bacteria and elaborate on the common shapes of bacteria. (3 marks)

b) In less than five (5) words give the functions of each of the following structures of a bacterium:

i) an endospore
ii) a fimbriae
iii) a cell wall
iv) a pilus
v) a flagellum
vi) a ribosome
vii) a capsule
viii) a plasma/cytoplasmic membrane (8 marks)

c) Temperature control is one most important aspect of different microbial growth requirements in the laboratory. Elaborate. (4 marks)

d) Explain the pathogenecities of any two human pathogens of your choice. (10 marks)

[Total marks = 25]

Question 4

a) What is an antigen. (1 mark)

b) Outline the salient features of:
   i) a partial antigen (2.5 marks)
   ii) an incomplete antigen (2 marks)
   iii) a complete antigen (2.5 marks)

c) Draw a flow chart to demonstrate the occurrence of an anaphylaxis in humans. (4 marks)

d) Write short notes on the following:
   i) B cells (6 marks)
   ii) transplantation immunity (4 marks)
   iii) immune defects (3 marks)

[Total marks = 25]

Question 5

a) Explain the relevance of fungi to human beings. (6 marks)

b) List and elaborate on the major mechanisms of fungal pathogenesis. (4 marks)

c) Explain the following:
   i) systemic mycoses (3.5 marks)
   ii) subcutaneous mycoses (3 marks)
   iii) superficial mycoses (3.5 marks)

d) Why is it not advisable to consume and use other products that are contaminated with *Aspergillus* spp? (5 marks)

[Total marks = 25]

Question 6

a) Indicate the reasons behind the controversial definition of a virus. (5 marks)

b) Explain the following:
   i) strains of influenza virus (5 marks)
   ii) reproduction of a bacteriophage within a bacterium (5 marks)
   iii) effect of viruses on host cells (4 marks)

c) Use your knowledge of virology to explain the relevance of viruses in nature. (6 marks)

[Total marks = 25]

SECTION B (ENVIRONMENTAL)

Question 7

a) Describe <u>five</u> (5) different bacterial shapes <u>besides</u> cocci and bacilli. (5 marks)
b) Outline the steps followed in Gram staining, and point out how each wall reacts at each step (10 marks)
c) Explain five (5) sterilization procedures using dry heat. (5 marks)
d) Describe five (5) different characteristics of bacteria that make them prokaryotes. (5 marks)

[Total marks = 25]

Question 8

a) Describe at least 5 methods of disinfection or decontamination. (5 marks)
b) What factors will affect the efficacy of any disinfection procedure? (5 marks)
c) Explain the series of experiments that led to the first awareness of the process of bacterial transformation. **<u>NB</u>** Include the post mortem results of each experiment. (10 marks)
d) How does recombination occur if the donor DNA fragment is single stranded? (5 marks)

[Total marks = 25]

Question 9

Write brief notes on the following:

i) algae (5 marks)
ii) mycoplasmas (5 marks)
iii) rickettsia (5 marks)
iv) prions (5 marks)
v) archaea (5 marks)

[Total marks = 25]

Question 10

a) Discuss properties that have been used to classify viruses. (10 marks)
b) Use diagrams and brief explanations to explain virus replication and production of bacterial recombinants. (15 marks)

[Total marks = 25]

Question 11

a) Draw and fully label immunoglobulin G(IgG). (5 marks)
b) Explain the process of antibody activation in warm-blooded organisms. (5 marks)
c) How are microbes identified in the following tests (use illustrations)
   i) Ring test (5 marks)
   ii) Oudin test (single diffusion) (5 marks)
   iii) Oakley-Fulthorpe (double diffusion) (5 marks)

[Total marks = 25]

Question 12

a) Define an indicator organism. (2 marks)
b) What are the characteristics of an indicator organism? (8 marks)
c) What should one observe when collecting water for potability tests? (5 marks)
d) Explain how municipal water can be purified. (10 marks)

[Total marks = 25]

END OF QUESTION PAPER