

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

FIRST SEMESTER EXAMINATIONS

FOOD TECHNOLOGY – SECOND YEAR DEGREE

FT 213 FOOD MICROBIOLOGY I

6th JUNE 2022

STARTING TIME: 8:20 A.M

TIME ALLOWED: 3 HOURS

INFORMATION FOR CANDIDATES:

1. You have 10 minutes to read the paper. You must not begin writing in the answer book during this time.
2. ANSWER ALL QUESTIONS.
3. ALL answers must be written in the answer books provided.
4. Write your name and number clearly on the front page. Do it now.
5. Calculators are permitted in the examination room. Notes and textbooks are not allowed.
6. Show all working and calculations in the answer book.

MARKING SCHEME:

SECTION A

QUESTION 1 [14½ MARKS]

QUESTION 2 [11 MARKS]

QUESTION 3 [24½ MARKS]

QUESTION 4 [20 MARKS]

SECTION B

QUESTION 5 [8½ MARKS]

QUESTION 6 [13 MARKS]

QUESTION 7 [4½ MARKS]

QUESTION 8 [4 MARKS]

TOTAL [100 MARKS]

SECTION A ANSWER ALL QUESTIONS

1. (a) Explain two negative impact of microorganisms in food and/or consumers. [3 marks]
- (b) Write short notes on ANY THREE desirable or positive impact of microorganisms. [3 marks]
- (c) The major bacterial structures include the cell wall, glycocalyx, flagella, pili, cytoplasmic membrane, ribosomes and DNA. Indicate which statements given below agree with any one of these structures. [5 marks]
- (i) This structure enables bacteria to move.
 - (ii) Composed mainly of peptidoglycan, a polymer consisting of amino acids and sugars N-acetylmuramamic acid and n-acetyl glucosamine.
 - (iii) Selectively permeable and allows certain ions and molecules to pass into or out of the cell while preventing the movement others.
 - (iv) Enables bacteria to adhere to surfaces.
 - (v) Prevents desiccation or drying of cells during adverse conditions by binding to water.
 - (vi) Contain various enzymes for metabolic reactions such as nutrient breakdown, energy production, photosynthesis, and synthesis of cellular constituents.
 - (vii) Used in conjugation or transfer of genetic material from one cell to another.
 - (viii) Are densely packed throughout the cytoplasm and are involved in protein synthesis.
 - (ix) Provides strong rigid structure that can withstand high osmotic pressure.
 - (x) Contains lipopolysaccharide (LPS) also known as endotoxin which cause fever, diarrhoea, destruction of red blood cells and can be potentially fatal.
- (d) Name the component of cytoplasmic membrane that gives fluidity to the structure and explain its importance. [1½ marks]
- (e) Explain what bacterial endospore is and its importance in the food industry. [2 marks]

(Total = 14½ marks)

2. (a) Name the different methods used by bacteria for reproduction. [2 marks]
- (b) Discuss the different growth phases when bacteria is grown in a closed system. [7 marks]
- (c) Describe continuous culture system. [2 marks]

(Total = 11 marks)

3. (a) What are the functions of major and trace elements? [3 marks]
- (b) Explain what growth factors are and why they are required by certain microorganisms. [2½ marks]
- (c) Name ANY TWO categories of growth factors and explain their functions. [3 marks]
- (d) Describe selective differential medium. Give an example and explain its use. [4 marks]
- (e) The response of an organism to oxygen in its environment depends upon the occurrence and distribution of various enzymes that react with oxygen and various oxygen radicals that are generated by the cells in the presence of oxygen.
- (i) Name these enzymes and explain their roles. [3 marks]
- (ii) Name the group of organisms which do not have these enzymes and therefore are unable to grow in the presence of oxygen. [½ marks]
- (f) Explain why psychrophilic microorganisms are able to grow at low temperature. [3 marks]
- (g) Name the groups of organisms which have optimum temperature range of 30° C-40° C and 50° C-60° C respectively. [1 mark]
- (h) Discuss the effects on microbial cells in a **hypertonic environment** such as when solutes like salt and sugar are added to foods or when water is evaporated from foods during dehydration to reduce water activity. [2½ marks]
- (i) Explain ANY TWO of the following terms: [2 marks]
- (i) Aerobic.
- (ii) Facultative anaerobe.

- (iii) Heterotrophs.
- (iv) Xerophiles.
- (v) Osmophiles.

(Total = 24½ marks)

4. (a) How can control of growth of microorganisms be achieved? [3 marks]
- (b) Differentiate between bacteriostatic and bactericidal agents. [1 mark]
- (c) Define ANY TWO of the following terms: [2 marks]
- (i) Sterilization.
 - (ii) Disinfection.
 - (iii) Sanitization.
 - (iv) Antisepsis.
- (d) Explain the general mode of actions of antimicrobial agents. [5 marks]
- (e) Certain factors are known to affect the effectiveness of antimicrobial agents. State and explain ANY THREE of these factors. [4 marks]
- (f) Explain the mode of actions of moist heat. [3 marks]
- (g) Explain ANY TWO effects of freezing on microbial cells. [2 marks]

(Total = 20 marks)

SECTION B.

5. Microorganisms are everywhere around us on living and non-living things. Food is one of the items that microorganisms are found on.

- (a) Name the primary sources of microorganisms in food. [4 marks]
- (b) Listed are some microorganisms: *Escherichia*, *Mucor*, *Pichia*, *Penicillium*, *Staphylococcus*, *Pediococcus*, *Salmonella*, *Candida* and *Saccharomyces*. Group these microorganisms into three main genera of moulds, yeasts and bacteria. [4½ marks]

(Total = 8½ marks)

6. Describe the following:

- (a) The general characteristics of virus. [4 marks]
- (b) Head and tail shape of a virus and give an example of one. [2 marks]
- (c) The principle stages in virus replication process. [5 marks]
- (d) The mode of transmission and symptoms for Rotavirus including the disease that the virus is associated with. [2 marks]

(Total = 13 marks)

7. Protozoa is a group of animal parasite that can be contracted from eating certain foods.

- (a) Name the type of diseases caused by the following species of protozoa.
- (i) *Giardia lamblia*. [½ mark]
- (ii) *Entamoeba histolytica*. [½ mark]
- (iii) *Toxoplasma gondii*. [½ mark]
- (iv) *Cryptosporidium*. [½ mark]
- (b) Name the FIVE routes of transmission of disease caused by *Cryptosporidium parvum*. [2½ marks]

(Total = 4½marks)

8. Match the following by writing the letter and putting the roman numerals to it. [4 marks]

	Word		Definition
a.	Phylogeny	I	Double stranded Deoxyribonucleic acid.
b.	Virion	II	Virus that infect bacteria,
c.	Nucleic acid	III	Have 8 flagella that arise on the ventral surface that give rise to 'falling leaf' motility.
d.	Nucleocapsid	IV	The nucleic acid and the outer protein layer that are closely intergrated.
e.	Tropozoites	V	The evolutionary of ancestral history of microorganisms.
f.	ds DNA	VI	The mature infectious viral particle (outside of a virus)
g.	Bacteriophages	VII	The protein coat that surrounds the virion.
h.	Capsid	VIII	The engine of the virus that contain hereditary and viral traits.

(Total = 4 marks)