

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

FIRST SEMESTER EXAMINATIONS

FOOD TECHNOLOGY – SECOND YEAR DEGREE

FT 213 FOOD MICROBIOLOGY I

11TH JUNE 2021

STARTING TIME: 12:50 P.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:

<u>QUESTION 1</u>	[26 MARKS]
<u>QUESTION 2</u>	[10 MARKS]
<u>QUESTION 3</u>	[19 MARKS]
<u>QUESTION 4</u>	[24 MARKS]
<u>QUESTION 5</u>	[7 MARKS]
QUESTION 6	[14 MARKS]
TOTAL	[100 MARKS]

ANSWER ALL QUESTIONS

1. (a) Name the bacterial structures that agree with the following statements. [4 marks]
- (i) Provides strong rigid structure that can withstand high osmotic pressure and protects the cell.
 - (ii) Contains lipopolysaccharide also known as endotoxin.
 - (iii) Is used for movement.
 - (iv) Selectively permeable and allows certain ions and molecules to pass into or out of the cell while preventing the movement others. It is more selective than the cell wall.
 - (v) Prevents desiccation or drying of cells during adverse conditions by binding to water.
 - (vi) Composed mainly of peptidoglycan, a polymer consisting of amino acids and sugars n-acetylmuramic acid and n-acetyl glucosamine.
 - (vii) Are densely packed throughout the cytoplasm and are involved in protein synthesis.
 - (viii) Used in conjugation or transfer of genetic material from one cell to another.
- (b) Differentiate between the gram positive bacteria and gram negative bacteria with reference to the following: [4 marks]
- (i) Cell wall thickness.
 - (ii) Amount of peptidoglycan or murein layer in the cell wall.
 - (iii) Techoic acid.
 - (iv) Lipid content in the cell wall.
 - (v) Outer layer or outer membrane.
 - (vi) Lipopolysaccharide (LPS) content.
 - (vii) Periplasmic space.
 - (viii) Colour of bacterial cells after gram staining.
- (c) Name the component of cytoplasmic membrane that gives fluidity to the structure and explain its importance [2 marks]
- (d) Describe ANY TWO of the following bacterial flagella arrangements: [2 marks]
- (i) Lophotrichous.
 - (ii) Amphitrichous.
 - (iii) Monotrichous.

(iv) Peritrichous.

- (e) Explain what endospores are and their importance in the food industry. Name two bacterial genera that produce endospores. [3 marks]
- (f) Describe the general characteristics of virus. [3 marks]
- (g) Viruses have three major components; envelope, capsid and nucleic acid. Explain the functions of capsid. [3 marks]
- (h) Describe the different stages involved in viral replication. [5 marks]

(Total = 26 marks)

2. (a) Name the different methods used by bacteria for reproduction [2 marks]
- (b) Describe the typical growth phases of bacteria when grown in a closed system. [6 marks]
- (c) Describe continuous culture system. [2 marks]

(Total = 10 marks)

3. (a) What are the functions of major and trace elements respectively? [2 marks]
- (b) Explain what growth factors are and why they are needed by certain microorganisms. [2 marks]
- (c) Describe selective differential medium and give an example. [3 marks]
- (d) Name four groups of organisms that are able to grow in the presence of oxygen. Explain why they are able to grow in the presence of oxygen while obligate anaerobes are unable to. [5 marks]
- (e) What is the optimum growth temperature (range) for the mesophilic bacterial pathogens *Escherichia coli* and *Staphylococcus aureus*? [1 mark]
- (f) How would you store chicken sandwich to prevent growth of *E.coli* and *S.aureus*? [1 mark]

- (g) Discuss the effects on microbial cells in a hypertonic environment such as when solutes like salt and sugar are added to foods to reduce water activity. [3 marks]
- (h) With respect to water activity, name the types or groups of organisms which are most likely to grow in honey, sundried fish, salted beef jerky and pawpaw jam respectively. [2 marks]

(Total = 19 marks)

4. (a) How can control of microorganisms be achieved? [3 marks]
- (b) Differentiate between fungistatic and fungicidal agents. [1 mark]
- (c) Explain ANY TWO of the following terms: [2 marks]
- (i) Sterilization.
 - (ii) Sanitization.
 - (iii) Disinfection.
- (d) Describe the general mode of actions of antimicrobial agents. [5 marks]
- (e) Certain factors are known to affect the effectiveness of antimicrobial agents. List and explain ANY TWO. [3 marks]
- (f) Discuss the mode of actions of moist heat. [2 marks]
- (g) Discuss ANY TWO effects of freezing on microbial cells. [3 marks]
- (h) Chlorine and chlorine compounds are widely used as sanitizers and disinfectants. Describe their mode of actions. [3 marks]
- (i) Describe the mode of actions of UV or ionizing radiation. [2 marks]

(Total = 24 marks)

5. (a) What are desirable microorganisms? [2 marks]
- (b) What are indicator microorganisms? [1 marks]

- (c) There is an increase in foodborne illness in both developed and developing nations. Several factors are known to contribute to increase in foodborne illness. List all and explain ANY ONE. [4 marks]

(Total = 7 marks)

6. (a) List the primary or environmental sources of contamination of foods and explain ANY ONE. [5 marks]
- (b) Name the virus family for each of the following common foodborne viruses: [2 marks]
- (i) Astrovirus.
 - (ii) Rotovirus.
 - (iii) Norwalk virus or small round structured viruses (SRSVs).
 - (iv) Hepatitis A virus.
- (c) Which of the above in (b), food borne viruses cause the following: [1 mark]
- (i) Illness it causes may last several weeks and usually includes malaise, nausea, jaundice, anorexia and vomiting.
 - (ii) Causes acute gastroenteritis in humans worldwide. It is common in adults and older children. The disease symptoms include vomiting and/or diarrhoea accompanied by anorexia, headache, abdominal discomfort, nausea, and low grade fever often in several different combinations.
- (d) Briefly explain ANY THREE control measures or how foodborne illnesses caused by virus can be prevented. [3 marks]
- (e) Name the type of diseases caused by the following species of protozoa. [2 marks]
- (i) *Giardia lamblia*.
 - (ii) *Entamoeba histolytica*.
 - (iii) *Toxoplasma gondii*.
 - (iii) *Cryptosporidium parvum*.
- (f) Which of the above species of protozoa causes dysentery or loose stool or diarrhoea with blood and mucus due to ulceration of the colon. [1 mark]

(Total = 14 marks)