THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

FIRST SEMESTER EXAMINATIONS

FOOD TECHNOLOGY – SECOND YEAR DEGREE

FT 215 FOOD MICROBIOLOGY 1 MONDAY 22nd JUNE 2020

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:

**QUESTION 1** **[22 MARKS]**

**QUESTION 2** **[26 MARKS]**

**QUESTION 3** **[25½ MARKS]**

**QUESTION 4** **[13½ MARKS]**

**QUESTION 5** **[13 MARKS]**

**ANSWER ALL QUESTIONS**

1. (a) Match the following bacterial structures In AA to the statements given in BB. Note that certain bacterial structures may agree with more than one statement given in BB. [11 marks]

**AA. Bacterial structures.**

Flagella.
Pili.
Cell wall.
Glycocalyx or slime layer.
Cytoplasmic membrane.
Outer membrane (layer) of gram negative bacteria.
Ribosomes.
Endospore.

**BB. Statements.**

(i) Provides strong rigid structure that can withstand high osmotic pressure and protects the cell.

(ii) Lipid portion of lipopolysaccharide (LPS) is also known as endotoxin. It acts as poison and cause fever, diarrhoea, destruction of red blood cells, and may be potentially fatal.

(iii) Composed mainly of peptidoglycan, a polymer consisting of amino acids and sugars N-acetylmurmaric acid and n-acetyl glucosamine.

(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) This bacterial structure is used for movement.

(vi) Used in conjugation or transfer of genetic material from one cell to another.

(vii) Prevents desiccation or drying of cells during adverse conditions by binding to water.

(viii) Contain enzymes for metabolic reactions such as nutrient breakdown, energy production, photosynthesis and synthesis of cellular constituent.

(ix) Are densely packed throughout the cytoplasm and are involved in protein synthesis.

(x) Contain special receptor molecules that help bacteria detect and respond to chemicals in their surrounding.

(xi) Dormant structures formed by certain species of bacteria that are resistant to processes such as heating, freezing, dehydration and toxic chemicals.

(b) LIST the methods used by bacteria for reproduction. [2 marks]

(c) LIST and fully discuss the FOUR phases of growth of bacteria in a closed system. [7 marks]

(d) Describe continuous culture system. [2 marks]

(Total = 22 marks)

2. (a) What are the functions for major and trace (minor) elements. [1½ marks]

(b) Explain what growth factors are and why they are required by certain organisms. [3 marks]

(c) Name ANY TWO categories of growth factors an explain their functions. [3 marks]

(d) Most microorganisms are chemoheterotrophs. Explain their nutritional requirements with respect to their source of carbon and energy. [1 mark]

(e) Describe selective differential medium. Give an example of a selective differential medium and name the selective and differential agents in this medium. [3 marks]

(f) Explain fully why some microorganisms such as *Clostridium botulinum* are not able to grow in the presence of oxygen. [4 marks]

(g) The optimum temperature for the growth of *E.coli* is $37^0$C. Its minimum growth temperature is $10^0$C and maximum is $45^0$C. How would you store your chicken sandwich which you have just prepared to prevent growth of *E.coli*. [1 mark]

(h) Discuss fully why thermophilic microorganisms are unable to grow at low temperature while psychrophiles are able to. [3 marks]

(i) Extreme pH or changes in pH to below or above the optimum range for growth reduces or prevents microbial growth. Discuss how these affect macromolecules such as DNA, proteins and amino acids in bacterial cells. [3 marks]

(J) Many foods are preserved by addition of solutes such as salt and sugar or by removal of water using heat.

(i) Discuss the effects on microbial cells. [2 marks]

(ii) Which groups of microorganisms are likely to grow in salted fish, honey and sundried fish respectively. [1½ marks]

(Total = 26 marks)

3. (a) Differentiate between bacteriostatic and bacteriocidal agents. [1 mark]

(b) Explain **ANY TWO** of the following terms:

(i) Sterilization.
(ii) Disinfection.
(iii) Sanitization [2 marks]

(c) Describe the general mode of actions of antimicrobial agents. [5 marks]

(d) Certain factors are known to affect the effectiveness of antimicrobial agents. Explain ANY THREE of these factors. [4½ marks]

(e) Fully discuss the mode of actions of moist heat. [3 marks]

(f) Explain why moist heat destroys microbial cells more rapidly compared to dry heat. Give examples with reference to temperatures and exposure times to achieve sterility for dry heat and moist heat. [3 marks]

(g) Discuss ANY THREE effects of freezing on microbial cells. [3 marks]

(h) Electromagnetic radiation is energy in the form of electromagnetic waves transmitted through space or through a material. Explain the mode of actions of UV radiation OR ionising radiation on microbial cells. [2 marks]

(i) Chlorine and chlorine compounds are widely used as disinfectants and sanitizers. Describe their mode of actions. [2 marks]

(Total = 25½ marks)

4. (a) What are desirable microorganisms? [2 marks]

(b) Explain what indicator microorganisms are and give ONE example of an indicator organism. [2½ marks]

(c) Describe the disease symptoms caused by the most common types of foodborne pathogens. [1½ marks]

(d) Name the group of microorganisms which are associated with certain animals and are transmitted through raw, or inadequately cooked meat and fish and in some cases plants. [1 mark]

(e) Name the group of microorganisms that produce mycotoxins with serious health implications such as cancer of the liver and kidney. [½ marks]

(f) There is increase in foodborne illnesses in both developed and developing nations. This is due to increase in certain foodborne illnesses which have been in existence for some time such as salmonellosis and also those caused by emerging pathogens such as haemolytic uraemic syndrome caused *by Escherichia coli* 0157:H7. Several factors are known to contribute to this increase in foodborne illnesses. List and discuss ANY THREE of these factors. [6 marks]

(Total = 13½ marks)

5. (a) List the primary and environmental sources of microorganisms found in foods and write short notes on ANY ONE. [5 marks]

(b) Match the common foodborne viruses listed under AA with their respective family given in BB. [2 marks]

| AA | BB |
|---|---|
| Hepatitis A virus | Picornaviridae |
| Astrovirus | Caliciviridae |
| Rotovirus | Astroviridae |
| Norwalk virus or SRSVs | Reoviridiae |

(c) Explain how foodborne illnesses caused by virus can be prevented. [4 marks]

(d) Name the diseases caused by the following species of protozoa.

(i) *Giardia lamblia*
(ii) *Entamoeba histolytica.*
(iii) *Toxoplasma gondii.*
(iv) *Crytosporidium parvum* [2 marks]

(Total = 13 marks)