

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

FIRST SEMESTER EXAMINATIONS

FOOD TECHNOLOGY – THIRD YEAR DEGREE

FT 351 FOOD MICROBIOLOGY

THURSDAY 25TH JUNE 2020

STARTING TIME: 12:50 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:

<u>QUESTION 1</u>	[12 MARKS]
<u>QUESTION 2</u>	[24 MARKS]
<u>QUESTION 3</u>	[24 MARKS]
<u>QUESTION 4</u>	[26MARKS]
<u>QUESTION 5</u>	[14 MARKS]
TOTAL	[100 MARKS]

ANSWER ALL QUESTIONS

1. (a) What are desirable microorganisms. Give ONE example. [3 marks]
- (b) Explain what indicator microorganisms are and give ONE example. [3 marks]
- (c) There is increase in foodborne illnesses which have been here for some time such as salmonellosis caused by *Salmonella* and also those caused by emerging pathogens such as haemolytic uraemic syndrome caused by *E.coli* 0157:H7. Several factors have contributed to increase in these foodborne illnesses. List and explain ANY THREE of these factors. [6 marks]

(Total = 12 marks)

2. (a) List ANY SIX major sources of contamination of foods. [3 marks]
- (b) List ANY THREE changes in physical properties and ANY THREE biochemical reactions that occur in foods due to growth of microorganisms. [3 marks]
- (c) The intrinsic and extrinsic parameters or environmental conditions have profound influence on the types and number of microorganisms that are likely to survive and grow in foods.
- (i) With respect to pH of foods, which groups of microorganisms are most likely to grow in fresh pineapple juice and fresh poultry respectively. Explain your answer. [3 marks]
- (ii) With respect to the effect of pH on the keeping quality or storage life of fresh meat, explain the importance of resting animals prior to slaughter. [3½ marks]
- (iii) With reference to water activity explain why dried foods have longer storage life compared to fresh foods. [3 marks]
- (iv) The nutritional requirements vary with different groups or species of microorganisms. Some require more nutrients compared to others for normal cellular functions. List in order the nutritional requirements by different groups starting with the highest. [2 marks]

- (v) Temperature is an important extrinsic factor that influences the rate of growth of microorganisms in foods. Explain the storage life of fresh meat with bacterial load of 10^3 cfu/gm when stored at 0°C , 5°C , 10°C , 20°C and 30°C respectively. [3 marks]
- (vi) Explain the hurdle concept in relation to prevention of germination of proteolytic Group 1 strain of *Clostridium botulinum*. Refer to the following factors; pH, water activity (a_w), NaCl concentration, NO_2 concentration and storage temperature. [3½ marks]

(Total = 24 marks)

3. (a) Explain why it is impossible to test for all the pathogens on routine basis. [2½ marks]
- (b) Give two examples of foodborne pathogenic bacteria which are tested for in foods on routine basis because they cause moderate hazard. [2 marks]
- (c) Explain why those foodborne microorganisms that cause severe hazards are not tested for in foods on routine basis. Give ONE example of an organism that causes severe hazard. [3 marks]
- (d) Explain those factors that influence the degree of hazards. [3 marks]
- (e) For quality assurance purposes final products maybe tested for relevant microorganisms. Which bacterial pathogens would be tested for in the following foods:
- (i) Foods unlikely to be treated or ready-to-eat foods (RTEF).
 - (ii) Beef, hamburger or dessicated coconut.
 - (iii) Starch based foods or various rice dishes.
 - (iv) Cooked foods and other types of foods extensively handled.
 - (v) Seafoods. [2½ marks]
- (f) Name two microbiological tests which are carried out to determine the shelf life of foods. [1 marks]
- (g) Explain ANY Four reasons why *Salmonella* is the bacterial pathogen of most concern and that it frequently occurs in microbial criteria for a wide variety of foods. [4 marks]

(h) In a two-class sampling plan variable data are classified into two classes. Explain the following two-class sampling plans.

(i) *Salmonella* in liquid egg,
 $n = 6, C = 0$ in 25 g of liquid egg. [1 mark]

(ii) *Salmonella* in infant formula
 $n = 30, C = 0$ in 25 g of milk. [1 mark]

(iii) Which of the above sampling plan in (h) (i) and (h) (ii) is more stringent. Explain why it is more stringent. [2 marks]

(i) Explain the three class sampling plan for *Staphylococcus aureus* in frozen precooked foods.

$n = 5, c = 1, m = 10^2$ cfu/g, $M = 10^3$ cfu/g [2 marks]

(Total = 24 marks)

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

(b) What does presence of *E.coli* in food indicate? [2 marks]

(c) List ANY TWO hurdles that foodborne pathogens have to overcome to cause diseases after consumption of contaminated foods. [2 marks]

(d) There are TWO types or groups of foodborne diseases. Name and explain. [4 marks]

(e) Name the TWO species of *Salmonella*. [1 mark]

(f) Name the Two types of diseases caused by *Salmonella*. [2 marks]

(g) Poultry such as chicken, duck, geese and turkey are probably the most important reservoir of *Salmonella* in the human food chain. Write short notes on how poultry acquire *Salmonella* on the farm. [3 marks]

(h) *Salmonella* can be controlled on the farm, during processing, handling and storage of foods. Discuss ANY THREE control measures on the farm and ANY TWO during processing, handling and storage of foods. [5 marks]

(i) The *E.coli* strains that cause foodborne illness include Enteropathogenic *E.coli*, Enteroinvasive *E.coli*, Enterotoxigenic *E.coli*, Enterohaemorrhagic *E.coli* and Enteraggregative *E.coli*.

Match *E.coli* Strains that agree with each statement given below. [3 marks]

- (i) The major reservoir is intestinal tract of cattle and sheep, may also occur in buffalo, deer and goat, but not chicken and pig.
- (ii) Produces dysentery like symptoms – bloody stools, fever, chills, dehydration, convulsion and bacteraemia.
- (iii) Causes mild diarrhoea to cholera-like symptoms and is common among travellers and hence known as ‘travellers’ diarrhoea.
- (iv) Globally associated with infantile gastroenteritis, and is more severe in infants than most other forms of diarrhoea. Outbreaks in hospitals and nurseries are due to infant to infant transmission through hands of nursing staff and feeding bottles.
- (v) Causes haemorrhagic colitis (bleeding effect), haemolytic uraemic syndrome (HUS) and thrombotic thrombocytopenic purpura (TTP).
- (vi) Which strain causes the most severe type of disease?

(j) Describe the natural habitat of *Staphylococcus aureus*. [2 marks]

(Total = 26 marks)

5. (a) List and discuss the primary and secondary sources of contamination of fresh meat and what you would do to prevent or reduce the level of contamination. [8 marks]

(b) Discuss the causes of microbial spoilage of canned foods. [6 marks]

(Total = 14 marks)