THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

FIRST SEMESTER EXAMINATIONS

FOOD TECHNOLOGY - THIRD YEAR DEGREE

FT 313 FOOD MICROBIOLOGY AND BIOTECHNOLOGY

9th 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	[12½ MARKS]
QUESTION 2	[15½ MARKS]
QUESTION 3	[15½ MARKS]
QUESTION 4	[19 MARKS]
QUESTION 5	[8½ MARKS]
QUESTION 6	[14 MARKS]
QUESTION 7	[15 MARKS]
TOTAL	**[100 MARKS]**

ANSWER ALL QUESTIONS

1. The intrinsic and extrinsic parameters of foods influence the survival and growth of microorganisms.

   (a) Discuss growth of microorganisms in fresh fish with pH of 6.6-6.8 and grape fruit juice with pH of 3.0. [3 marks]

   (b) Explain why dehydrated foods have longer storage life compared to fresh foods. [2 marks]

   (c) The types and amount of nutrients required for growth varies widely among different microorganisms. List in order the nutritional requirements by different groups of microorganisms starting with the group which has the highest nutritional requirement. [2 marks]

   (d) Describe the rate of spoilage of fresh poultry stored at 5^0C, 10^0C and 15^0C respectively. [2 marks]

   (e) The oxidation-reduction potential of foods also influence the types or groups of microorganism that grow in them. Name the groups of microorganisms that are likely to grow in the following foods:

   (i) Solid meat cuts with negative Eh, around -200 mV [½ mark]
   (ii) Comminuted meats with positive Eh, of +200 mV. [½ mark]
   (iii) Fruit juices with positive Eh between +300 to +400 mV. [½ mark]

   (f) Explain what hurdle concept means and give an example to support your answer. [2 marks]

   (Total = 12½ marks)

2. (a) Discuss the primary and secondary or intermediate sources of contamination of fresh meat and what measures you would take to reduce the level of contamination from these sources. [5 marks]

   (b) Explain the three causes of microbial spoilage of canned foods. [3 marks]

   (c) Describe the processing operations of poultry and indicate where significant increase and reduction in microbial load may occur. [4½ marks]

(d) The initial bacterial flora of fish when caught depends on certain physical and chemical conditions. List them. [3 marks]

(Total – 15½ marks)

3. (a) Explain why it is impractical to test for all the pathogenic microorganisms. [2½ marks]

(b) Explain why pathogenic microorganisms which cause severe hazards are not tested on routine basis. [2 marks]

(c) Name two species of bacteria that cause moderate and severe hazards respectively. [2 marks]

(d) Explain three factors that influence the degree of microbiological hazards in foods. [3 marks]

(e) For quality assurance purposes certain pathogenic microorganisms are tested for in certain foods or food processing environment. Name the pathogens which are most often tested for in the following types of foods: [2½ marks]

(i) Foods unlikely to be treated or ready to eat foods (RTEF).
(ii) Starch based foods and various rice dishes.
(iii) Cooked foods and other types of foods extensively handled manually.
(iv) Seafoods.
(v) Foods such as hamburger, beef, desiccated coconut and chocolate.

(f) Explain the following sampling plans.

(i) For *Salmonella* in liquid egg. [1½ marks]
n = 5, C = 0 in 25 gram

(ii) For total aerobic plate count in pasteurized milk. [2 marks]
n = 4, c = 1, m = 10^3, M = 10^4 per ml

(Total = 15½ marks)

4. (a) Explain ANY TWO hurdles that foodborne pathogenic microorganisms have to overcome to cause a diseases. [3 marks]

(b) Describe two groups or types of foodborne illnesses caused by foodborne pathogenic microorganisms. [3 marks]

(c) Explain the two types of diseases caused by *Salmonella*. [2 marks]

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

(e) Name the *E. coli* strains or pathotypes that cause foodborne illnesses. [2½ marks]

(f) Write notes on the optimum growth conditions of *Campylobacter* with reference to pH, temperature and oxygen or carbon dioxide concentrations. [1½ marks]

(g) Describe the disease caused by ingestion of *Clostridium botulinum*. toxin produced in foods. [2 marks]

(Total = 19 marks)

5. (a) Explain what biotechnology means. [1 mark]

(b) List the key microbial groups involved in food fermentation. [2½ marks]

(c) Explain the key biochemical reactions in food fermentation. [5 marks]

(Total = 8½ marks)

6. (a) Describe constitutive and inducible enzyme biosynthesis. [2 marks]

(b) Give **ONE** example of inducible enzyme, its respective inducer substrate and the organisms that produces it. [1½ marks]

(c) Explain catabolite repression of enzyme synthesis when both glucose and lactose are present in the culture medium. [2 marks]

(d) Enzymes are used as free cells or enzymes suspended in an aqueous solution or trapped or immobilized onto a suitable matrix.

(i) State ANY THREE advantages of using immobilized enzymes. [3 marks]

(ii) Name three carrier bound enzyme methods and describe one. [3½ marks]

(iii) Describe cross linked enzyme method or encapsulated systems. [2 marks]

(Total = 14 marks)

7. (a) Describe the primary and secondary end products of yeast alcoholic fermentation of grape juice. [4 marks]

(b) Describe the changes that occur during malolactic fermentation of wine and its benefit to wine quality. Which group of bacteria are involved in the malolactic fermentation? [4 marks]

(c) The fermentation processes during beer production occur either by warm (top) or cool (bottom) fermentation. Describe each process. [4 marks]

(d) Describe 'gari' or 'poi' fermentation process. (3 marks)

(Total = 15 marks)