

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY
FIRST SEMESTER EXAMINATIONS
FOOD TECHNOLOGY – FOURTH YEAR DEGREE
FT 411 FOOD BIOTECHNOLOGY AND INDUSTRIAL MICROBIOLOGY
FRIDAY 26TH 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:

<u>QUESTION 1</u>	[14½ MARKS]
<u>QUESTION 2</u>	[13 MARKS]
<u>QUESTION 3</u>	[10 MARKS]
<u>QUESTION 4</u>	[16½ MARKS]
<u>QUESTION 5</u>	[9 MARKS]
QUESTION 6	[14½ MARKS]
QUESTION 7	[22½ MARKS]
TOTAL	[100 MARKS]

ANSWER ALL QUESTIONS

1. (a) Name the key microbial groups involved in food fermentation. [2½ marks]
- (b) Describe the key biochemical reactions in food fermentation. [6 marks]
- (c) After isolation of microorganisms in pure culture, they are characterized and identified using one or combination of various methods. Name and describe ANY THREE of these methods. [6 marks]

(Total = 14½ marks)

2. Immunoassay techniques are widely used for detection of pathogens in foods.

- (a) Explain the principle for immunoassay method. [2 marks]
- (b) The three applications of immunoassay widely used in microbiological analysis of foods include enzyme-linked immuno-adsorbent assay (ELISA), immunocapture or immunomagnetic separation techniques and agglutination assay.
- (i) Discuss the principle for ANY ONE of the immunoassay techniques described above in 2 (b). [3 marks]
- (ii) Explain situations where false negative results can occur with the ELISA method. [3 marks]
- (c) Conductance and Impedance method is also used for determining microbial population in a food sample. Describe the principle for this method. [2 marks]
- (d) The technology of bioluminescence for the estimation of total viable population in food or on food contact surfaces can be achieved by measurement of ATP by their bioluminescent reaction. Answer either d (i) or d (ii).
- (i) Discuss why light is produced in the presence of ATP.
- (ii) Describe the application or how ATP is measured. [3 marks]

(Total = 13 marks)

3. (a) Explain the principle for polymerase chain reaction (PCR) method. [2 marks]
- (b) Fully discuss the polymerase chain reaction processes. [6 marks]

- (c) After performing polymerase chain reaction, the DNA products or amplicons from the reaction are identified or detected using agarose gel electrophoresis. Describe the principle or what it does. [2 marks]

(Total = 10 marks)

4. Animals and plants have been used as sources of certain enzymes.

- (a) Name ONE enzyme produced from plant, its source and application. [1½ marks]

- (b) Name ONE enzyme produced from animal, its source and application. [1½ marks]

- (c) Microorganisms are major sources of enzymes on industrial scale.

- (i) List ANY TWO enzymes, name organisms that produce these enzymes and their applications. [3 marks]

- (ii) Name the species of mould that produces the largest number of enzymes in good quantities. [½ mark]

- (iii) List ANY THREE reasons why microorganisms are major sources of enzymes on industrial scale. [3 marks]

- (iv) List ANY THREE features that need to be taken into account when selecting a microbial species or strain for production of enzymes. [3 marks]

- (d) Explain constitutive and inducible enzyme biosynthesis. [1 mark]

- (e) Give ANY TWO examples of inducible enzymes, their respective inducer substrates and producer organisms. [3 marks]

(Total = 16½ marks)

5. High yield enzyme production can be achieved through genetic manipulation and manipulation of environmental conditions such as culture media, pH, and temperature for growth of microorganisms.

- (a) Explain how increased production of lipolase enzyme has been achieved through genetic manipulation. [3 marks]
- (b) Explain catabolite repression of enzyme synthesis when both glucose and lactose are present in the culture medium and what can be done to prevent catabolite repression in such situation. [4 marks]
- (c) Write short notes on recovery and purification of enzymes. [2 marks]

(Total = 9 marks)

6. (a) Explain why harvesting dates for grapes is important for wine production. [2 marks]
- (b) Discuss alcoholic fermentation of wine by addition of yeast starter culture and by natural fermentation. [5 marks]
- (c) Describe the primary and secondary end products of yeast alcoholic fermentation of grape juice. [4 marks]
- (d) Describe the changes that occur during malolactic fermentation of wine and its benefit to wine quality. [3½ marks]

(Total = 14½ marks)

7. (a) Hop is an important ingredient used in production of beer. List ANY THREE roles or functions of hops in beer. [3 marks]
- (b) Fermentation of *wort* occurs in the fermentation tanks after cooling and pitching with yeast. The fermentation process goes through four steps. Explain these steps. [3½ marks]
- (c) Beer can be produced either by warm (top) or cool (bottom) fermentation processes. Describe the two processes and the species of yeast used for each process. [5 marks]

- (d) What are the purposes of aging beer? [2 marks]
- (e) Several ingredients are used during production of fermented sausages. Explain the roles of sugar and salt in fermented sausages. [2 marks]
- (f) Describe the changes that occur during fermentation of sausages. [2 marks]
- (g) Explain the fermentation process for *gari* (fermented cassava) and *poi* (fermented taro). [5 marks]

(Total = 22½ marks)