

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

FRIDAY 18<sup>TH</sup> 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>	[14 MARKS]
<u>QUESTION 2</u>	[25½ MARKS]
<u>QUESTION 3</u>	[17 MARKS]
<u>QUESTION 4</u>	[28½ MARKS]
<u>QUESTION 5</u>	[15 MARKS]
<b>TOTAL</b>	<b>[100 MARKS]</b>

**ANSWER ALL QUESTIONS**

1. (a) What is biotechnology? [1 mark]
- (b) Name the key microbial groups involved in food fermentation. [2½ marks]
- (c) Describe the key biochemical reactions in food fermentation. [5½ marks]
- (d) After isolation of microorganisms in pure culture, they are characterized and identified using one or combination of various methods. Name and describe ANY TWO of these methods. [5 marks]

(Total = 14 marks)

2. (a) Animals and plants have been used as sources of certain enzymes.
- (i) Name ONE enzyme produced from plant, its source and application [1½ marks]
- (ii) Name ONE enzyme produced from animal tissues, its source and application. [1½ marks]
- (b) Microorganisms are major sources of enzymes on industrial scale. Name TWO enzymes, the microorganisms that produce them and their applications. [3 marks]
- (c) List ANY THREE reasons why microorganisms are major sources of enzymes on industrial scale. [3 marks]
- (d) Explain constitutive and inducible enzyme biosynthesis. [2 marks]
- (e) Explain how increased production of lipolase enzyme has been achieved through genetic manipulation. [3 marks]
- (f) Explain catabolite repression of enzyme synthesis when both glucose and lactose are present in the culture medium. [3 marks]
- (g) List ANY THREE advantages of using immobilized enzymes. [3 marks]
- (h) The three commonly used enzyme immobilization methods include carrier bound enzymes, cross-linked enzymes and encapsulated systems.
- (i) Name three carrier bound enzyme methods and describe one. [3½ marks]

- (ii) Describe cross linked enzymes or encapsulated systems. [2 marks]

(Total = 25½ marks)

3. (a) Discuss alcoholic fermentation of wine by addition of yeast starter culture and by natural fermentation. [5½ marks]
- (b) Describe the primary and secondary end products of yeast alcoholic fermentation of grape juice. [3 marks]
- (c) Describe the changes that occur during malolactic fermentation of wine and its benefit to wine quality. [3½ marks]
- (d) 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]

(Total = 17 marks)

4. (a) Name the groups of microorganisms involved in cocoa bean fermentation and explain the roles for ANY TWO. [5 marks]
- (b) Explain the roles of sugar and salt in fermented sausages. [2 marks]
- (c) Explain the biochemical changes that occur during fermentation of sausages. [2 marks]
- (d) Fermentation of *poi* goes through several stages by different microorganisms. Discuss. [5 marks]
- (e) Discuss *koji* and *moromi* fermentation during soy sauce production. [7 marks]
- (f) Discuss how high yield of citric acid can be obtained during fermentation by *Aspergillus niger*. [3 marks]
- (g) Amino acids such as L-Lysine and glutamic acids are produced by *Corynebacterium glutamicum*. The difficulty associated with production of these acids is getting the cells to secrete sufficient quantities to permit commercial production. Describe the methods which could be used to enable secretion of glutamic acid. [4½ marks]

(Total = 28½marks)

5. (a) Explain the immunoassay tests. [1½ marks]
- (b) Describe the principle for Enzyme-linked immunoabsorbent assay (ELISA) technique. [2 marks]
- (c) Describe the principles for agglutination assays and immunocapture or immunomagnetic separation techniques. [3 marks]
- (d) Explain the principle for polymerase chain reaction (PCR) method. [2½marks]
- (e) Explain what PCR primers are and what they are used for. [3 marks]
- (f) The technology of bioluminescence for the estimation of total viable population in food or food contact surfaces can be achieved by measurement of their ATP.
- (i) Discuss why light is emitted in the presence of ATP. [2 marks]
- (ii) How many femtogram ATP is equivalent to one bacterial and one yeast cells respectively? [1 mark]

(Total = 15 marks)