



UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF CHEMICAL AND BIO-ENGINEERING TECHNOLOGY

FINAL EXAMINATION
OCTOBER 2025 SEMESTER

COURSE CODE : CBD22103
COURSE TITLE : PRINCIPLES OF MICROBIOLOGY
PROGRAMME NAME : DIPLOMA IN CHEMICAL ENGINEERING TECHNOLOGY
DATE : 03 FEBRUARY 2026
TIME : 9:00AM - 11:00AM
DURATION : 2 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consist of TWO sections.
4. Section A consist total of 60 marks. Answer ALL questions.
5. Section B consist of three questions. Answer TWO (2) questions only.
6. Please write your answer on the answer booklet provided.
7. Please answer all questions in English only.
8. Refer to the attached Formula/ Appendies. ☐ *Tick if applicable*

THERE ARE 8 PAGES OF QUESTIONS INCLUDING THIS PAGE

SECTION A (Total: 60 marks)

Answer ALL questions.

Please use the answer booklet provided.

Question 1

Aseptic technique and staining methods are fundamental practices in microbiology laboratories.

- (a) Define aseptic technique in the context of microbiological laboratory work.
(2 marks)

- (b) Explain why aseptic technique is essential when handling microbial cultures.
(4 marks)

- (c) Explain how single bacterial colonies are obtained from a mixed microbial culture. In your answer, describe two (2) plating techniques used in microbiology laboratories to achieve single-colony isolation.
(6 marks)

- (d) Describe the theory behind Gram staining and explain how it differentiates between Gram-positive and Gram-negative bacteria.
(8 marks)

Question 2

The growth of microorganisms can be controlled using physical methods and chemical agents in laboratory and industrial settings to reduce or eliminate microbial populations.

- (a) Define the following terms used to measure the killing power of heat sterilization:
- i. Thermal death time (TDT)
(2 marks)
 - ii. Thermal death point (TDP)
(2 marks)
 - iii. Decimal reduction time (D-value)
(2 marks)
- (b) Differentiate between antiseptics and disinfectants in terms of their application and effectiveness in controlling microbial growth.
(6 marks)
- (c) Describe two (2) physical methods used to control the growth of microorganisms and how each method affects microbial cells.
(8 marks)

Question 3

Microorganisms are classified into different groups based on their cellular organization, organelles, and biological characteristics. These groups include Archaea, Bacteria, Algae, Fungi, Protozoa, and Viruses.

- (a) Differentiate between prokaryotic and eukaryotic microorganisms.

(6 marks)

- (b) Based on cellular organization, classify the following microorganisms as prokaryotic, eukaryotic, or acellular:

i. *Escherichia coli*

(1 marks)

ii. Yeast

(1 marks)

iii. Amoeba

(1 marks)

iv. Virus

(1 marks)

v. *Halobacterium*

(1 marks)

vi. *Staphylococcus aureus*

(1 marks)

vii. *Chlamydomonas*

(1 marks)

viii. *Aspergillus*

(1 marks)

- (c) Identify any three (3) groups of microorganisms from the list below and describe one (1) biological role or importance of each group.
- i. Archaea
 - ii. Bacteria
 - iii. Algae
 - iv. Fungi
 - v. Protozoa
 - vi. Viruses

(6 marks)

SECTION B (Total: 40 marks)

Answer TWO (2) questions only.

Please use the answer booklet provided.

Question 1

Microorganisms obtain energy through metabolic processes that involve the breakdown and synthesis of molecules, as well as different pathways of energy production.

- (a) Distinguish between catabolism and anabolism in microorganisms.
(4 marks)
- (b) List three (3) types of phosphorylation reactions used by microorganisms to generate ATP.
(3 marks)
- (c) Differentiate between aerobic respiration and anaerobic respiration in microorganisms based on oxygen requirement and final electron acceptor.
(6 marks)
- (d) Answer the questions below related to fermentation.
 - i. Define fermentation in microorganisms.
(2 marks)
 - ii. Explain why fermentation produces less ATP compared to respiration.
(5 marks)

Question 2

Microorganisms display a wide range of nutritional needs and environmental adaptations, allowing them to thrive in different settings. Exploring their nutritional modes, growth requirements, and techniques for cultivation and study is essential in microbiology. The following questions focus on microbial growth, nutrition, and culture methods.

- (a) Provide an explanation of microbial nutrition and discuss the role of macro and micronutrients in supporting microbial growth. Describe how nutrient deficiencies impact microorganisms.

(6 marks)

- (b) Explain the use of selective and differential media in promoting microbial growth. Include examples of both types of media along with their specific applications.

(4 marks)

- (c) Analyze the impact of environmental factors like pH, temperature, and oxygen towards microbial growth. Include the classification of microorganisms based on the conditions they are adapted reflecting to the above factors.

(10 marks)

Question 3

A laboratory technician inoculates a bacterial culture into a fresh nutrient broth and incubates it under suitable conditions. The bacterial population is monitored over time, and a plate count method is used to estimate the number of viable cells.

- (a) During the first few hours of incubation, the bacterial cells adjust to the new growth medium before active cell division occurs. Based on this observation, identify the phase of bacterial growth involved.

(2 marks)

- (b) Explain two (2) cellular activities that occur during this phase, which prepare the bacteria for rapid growth.

(6 marks)

- (c) To estimate the number of viable bacteria, the technician performs a serial dilution before plating the culture. Explain why serial dilution is necessary when determining bacterial cell numbers using plate count methods.

(6 marks)

- (d) The technician plates 0.1 mL from the 10^{-5} dilution of the culture. After incubation, 120 colonies are counted on the agar plate. Calculate the colony-forming units per millilitre (CFU/mL) of the original culture.

(6 marks)

END OF EXAMINATION PAPER

