



UNIVERSITI KUALA LUMPUR
ROYAL COLLEGE OF MEDICINE PERAK

FINAL EXAMINATION
MARCH 2026 SEMESTER

COURSE CODE : RCB11103
COURSE NAME : PHARMACEUTICAL BIOTECHNOLOGY
PROGRAMME NAME : BACHELOR IN PHARMACEUTICAL TECHNOLOGY
(HONOURS)
DATE : 30 JUNE 2026
TIME : 2.30 PM – 4.30 PM
DURATION : 2 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read CAREFULLY the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of TWO (2) sections; Section A and Section B.
4. Answer ALL questions in Section A. For Section B, answer THREE (3) questions WITH AT LEAST ONE (1) question from question 3 or question 4.
5. Please write your answers on the OMR answer script and answer booklet provided.
6. Answer all questions in English language ONLY.

THERE ARE 9 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)**I) MULTIPLE CHOICE QUESTIONS (20 marks)****INSTRUCTION: Answer ALL questions.****Use the OMR sheet provided.**

1. Select the **CORRECT** recombinant DNA products.
 - I. Serotonin
 - II. Humulin
 - III. Protopine
 - IV. Chymosin
 - A. I, II, and III
 - B. I, II, and IV
 - C. I, III, and IV
 - D. II, III, and IV
 - E. I, II, III, and IV
2. Identify the first antibiotic discovered from fungi.
 - A. Tetracycline
 - B. Ciprofloxacin
 - C. Penicillin
 - D. Doxycycline
 - E. Vancomycin
3. Select the **CORRECT** statement about gel electrophoresis of DNA fragments.
 - A. Fragments are separated on the basis of their molecular sizes.
 - B. Fragments migrate towards the cathode.
 - C. Fragments are separated based on their charge differences.
 - D. Fragments migrate towards the anode because of the positive charge of the bases.
 - E. Larger fragments migrate faster than smaller fragments.

4. Identify the **CORRECT** components involved in human gene therapy.
- I. Stem cells
 - II. Skin cells with genetic defect
 - III. Recombinant protein
 - IV. Artificial chromosome
- A. I and II
B. I, II, and IV
C. I, III, and IV
D. II, III, and IV
E. I, II, III, and IV
5. Identify the term given for the excised part of plant to be regenerated in plant tissue culture.
- A. Explant
B. Cotyledon
C. Callus
D. Embryo
E. Stigma
6. Identify the most widely used basal medium for plant tissue culture.
- A. Mueller-Hinton medium
B. Lysogeny broth medium
C. MacConkey medium
D. Murashige-Skoog medium
E. Nutrient rich medium
7. Identify the **CORRECT** reaction for the enzyme which falls under the class of ligases.
- A. Oxidation–reduction reactions
B. Transfer of functional groups
C. Isomerization reactions
D. Formation of bonds with ATP cleavage
E. Addition to double bonds

8. Select the **CORRECT** statement regarding the relationship between an enzyme and its substrate.
- A. Forms a temporary association at active site.
 - B. The association is stabilized by a covalent bond.
 - C. Substrate causes permanent change to the enzyme configuration.
 - D. Causes a permanent mutual alteration in structure.
 - E. Forms a non-complementary binding.
9. Select the **CORRECT** uses of papain.
- I. Used as meat tenderizer.
 - II. Consumed as a digestive aid.
 - III. Added as a component of Accuzyme for wound cleaning.
 - IV. Added as tooth whitener in toothpaste.
- A. I, II, and III
 - B. II, III, and IV
 - C. I, II, and IV
 - D. I, III, and IV
 - E. I, II, III, and IV
10. Identify the method to separate proteins.
- A. Agarose gel electrophoresis
 - B. Polymerase chain reaction (PCR)
 - C. Western blot
 - D. Sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE)
 - E. Flow cytometry
11. Identify the **CORRECT** sense strand sequence for antisense strand 5'TATAGGCCATC3'.
- A. 5'GATGGCCTATA3'
 - B. 5'ATATCCGGTAG3'
 - C. 5'AUAUCCGGUAG3'
 - D. 5'UAUAGGCCAUC3'
 - E. 5'GAUGGCCUAUA3'

12. Identify the bond that connects two nucleotides in a single DNA strand.
- A. Phosphodiester bond
 - B. Peptide bond
 - C. Hydrogen bond
 - D. Glycosidic bond
 - E. Ionic bond
13. Identify the enzyme that initiates DNA transcription process.
- A. DNA polymerase
 - B. Primase
 - C. Gyrase
 - D. Ligase
 - E. RNA polymerase
14. Identify the chemical used in SDS-PAGE to denature proteins by breaking the disulfide bonds.
- A. β -Mercaptoethanol
 - B. SDS
 - C. Tetramethylethylenediamine (TEMED)
 - D. Ammonium persulfate
 - E. Glycerol
15. Choose the **CORRECT** statements about flow cytometry.
- I. Multiple stained cells are passing through fluorimeter at a time.
 - II. Cells are stained with fluorescent labelled probes that are specific to targeted molecules.
 - III. It measures the fluorescence signals from individual cells.
 - IV. It measures forward and side light-scattering properties of cells which reflect the cell size and internal complexity.
- A. I and II
 - B. III and IV
 - C. I, III, and IV
 - D. II, III, and IV
 - E. I, II, III, and IV

20. Identify the protein that delivers the structural function in human body system.
- A. Collagen
 - B. Antibodies
 - C. Hormones
 - D. Enzymes
 - E. Blood clotting factors

16. Identify the technique to observe the location of targeted proteins on the cells under microscope.
- A. Immunofluorescence
 - B. Enzyme-linked immunosorbent assay (ELISA)
 - C. Western blot
 - D. Flow cytometry
 - E. PCR
17. Choose the **CORRECT** example of medicine that is classified as biologics.
- A. Omeprazole
 - B. Insulin
 - C. Paracetamol
 - D. Ciprofloxacin
 - E. Aspirin
18. Identify the **CORRECT** category for variants of biologics that possess properties comparable to the desired product.
- A. Process-related impurities
 - B. Contaminants
 - C. Product-related substances
 - D. Product-related impurities
 - E. Excipients
19. Select the common chemicals used to detach anchorage-dependent cells.
- I. Dimethyl sulfoxide
 - II. Trypsin
 - III. Accutase
 - IV. Trypan blue
- A. I and II
 - B. II and III
 - C. I, II, and IV
 - D. I, III, and IV
 - E. II, III, and IV

II) SHORT ANSWER QUESTIONS (20 marks)**INSTRUCTION: Answer ALL questions in the answer booklet provided.****Each question carries TWO (2) marks.**

1. Describe plasticity in plant tissue culture.
2. State **TWO (2)** examples of intracellular enzymes.
3. Describe promoter and terminator of DNA.
4. State **TWO (2)** applications of PCR.
5. Describe the function of topoisomerase II and helicase.
6. Describe the method to transfer recombinant vector into *Escherichia coli* by transformation.
7. Describe the function of reverse transcriptase.
8. Differentiate generic and biosimilar products.
9. List **TWO (2)** disadvantages of conducting *in vitro* cell culture technique.
10. State **TWO (2)** limitations of producing transgenic animals.

SECTION B: MODIFIED ESSAY QUESTIONS (Total: 60 marks)

INSTRUCTION: This section consists of **FOUR (4)** questions.

You are required to answer **THREE (3)** questions in the answer booklet provided.

Question 1 and 2 are COMPULSORY.

Answer EITHER Question 3 OR 4.

Question 1

- (a) Explain the problems in producing human protein using *E. coli*. (5 marks)
- (b) Explain the properties of a vector. (5 marks)
- (c) Outline the procedure of protein isolation using affinity column chromatography technique. (10 marks)

Question 2

- (a) Outline the steps in plant tissue culture technique. (10 marks)
- (b) Compare between primary and secondary cell cultures. (10 marks)

Question 3

- (a) Explain the process of PCR. (5 marks)
- (b) Describe **FIVE (5)** advantages of covalent bonding immobilization technique. (5 marks)
- (c) Outline sandwich ELISA technique. (10 marks)

Question 4

- (a) Explain the process of mRNA translation. (5 marks)
- (b) Describe **FIVE (5)** advantages of whole cell immobilization technique. (5 marks)
- (c) Explain the principle and steps in producing monoclonal antibody using hybridoma technology. (10 marks)

END OF EXAMINATION PAPER