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University Examinations 2024/2025

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF MEDICAL MICROBIOLOGY

HMM 3415: MICROBIAL BIOTECHNOLOGY

DATE: JANUARY 2025 **TIME: 3 HOURS**

INSTRUCTIONS:
Answer ***All*** *questions*
Ensure that all your answers are properly numbered
Part I multiple Choice Questions (MCQ): Write the correct answer on the space provided in the answer booklet. Each MCQ is one mark
Part II: Short Answer Questions – Answer questions following each other on the answer booklet
Part III: Long Answer Questions – Answer each question on the answer booklet

SECTION A: MULTIPLE CHOICE QUESTIONS (20 marks)

1. Which of the following is a type of fermentation process?
   a) Batch fermentation
   b) Continuous fermentation
   c) Solid-state fermentation
   d) All of the above
2. What is the primary purpose of downstream processing in microbial biotechnology?
   a) Enhancing microbial growth
   b) Isolating and purifying microbial products

c) Increasing substrate availability

d) Monitoring microbial metabolism

3. Which of the following microorganisms is used in the production of Baker's yeast?
   a) Saccharomyces cerevisiae
   b) Escherichia coli
   c) Bacillus subtilis
   d) Lactobacillus acidophilus
4. What is the function of a stirred tank reactor in microbial biotechnology?
   a) Substrate feeding
   b) Mixing microbial cultures
   c) Enzyme purification
   d) DNA sequencing
5. Which of the following is NOT a microbial enzyme used in the detergent industry?
   a) Protease
   b) Amylase
   c) Lipase
   d) Lactase
6. Penicillin is classified as:
   a) An antiviral
   b) An antibiotic
   c) A vitamin
   d) A growth hormone
7. Which method is commonly used to separate microbial proteins based on their size?
   a) Gel filtration chromatography
   b) SDS-PAGE
   c) Differential centrifugation
   d) Electrophoresis

8. What does PCR stand for?
   a) Polymerase Chain Reaction
   b) Protein Complex Reagent
   c) Phosphate Chain Reduction
   d) Prokaryotic Cell Regulation
9. Which type of chromatography is used to separate molecules based on their charge?
   a) Affinity chromatography
   b) Ion-exchange chromatography
   c) Size-exclusion chromatography
   d) Gas chromatography
10. The production of insulin using recombinant DNA technology involves which of the following?
   a) Gene cloning
   b) RNA interference
   c) Metagenomics
   d) Protein degradation
11. Which of the following is used in the preservation and maintenance of microbial cultures?
   a) Lyophilization
   b) Sonication
   c) Incubation
   d) Filtration
12. What is the primary purpose of using bioweapons in microbial biotechnology?
   a) Vaccine development
   b) Antibiotic production
   c) Biological warfare
   d) Gene editing
13. What does "metabolic pathway engineering" involve in microbial biotechnology?
   a) Enhancing the rate of natural microbial fermentation

b) Altering genetic pathways to increase metabolite production

c) Isolating novel microorganisms for fermentation

d) Scaling up bioreactors for industrial processes

14. Which of the following is an example of a microbial metabolite?

a) Amino acids

b) Ethanol

c) Insulin

d) Growth hormone

15. In microbial biotechnology, the term "downstream processing" refers to:

a) Fermentation control

b) Separation, purification, and packaging of products

c) Inoculum preparation

d) Media sterilization

16. What kind of microbial biotechnology technique is used to analyze gene expression?

a) Metagenomics

b) PCR

c) SDS-PAGE

d) Spectrophotometry

17. Which method separates proteins based on their molecular weight?

a) SDS-PAGE

b) Ion-exchange chromatography

c) Affinity chromatography

d) Ultrafiltration

18. Which microorganism is commonly used in the production of citric acid?

a) Aspergillus Niger

b) Saccharomyces cerevisiae

c) Pseudomonas aeruginosa

d) Lactobacillus delbrueckii

19. Which technique is used to purify microbial proteins based on density?
    a) Differential centrifugation
    b) Affinity chromatography
    c) SDS-PAGE
    d) Electrophoresis
20. What is the role of 2D-PAGE in microbial biotechnology?
    a) To analyse DNA sequences
    b) To separate proteins based on charge and size
    c) To amplify DNA
    d) To quantify microbial growth

SECTION B: SHORT ANSWER ALL QUESTIONS (40 MARKS)

1. Describe the process of isolating and selecting industrially important microorganisms (5 Marks)
2. Explain the differences between solid-state and submerged fermentation processes (5 marks)
3. Outline the key components of microbial media formulation for fermentation (5 Marks)
4. What are the industrial applications of microbial biomass production? Give examples (5 Marks)
5. Discuss the production of penicillin and its significance in the pharmaceutical industry (5 Marks)
6. Explain the role of microbial enzymes in the food industry, providing specific examples (5 Marks)
7. What is the role of bioreactors in microbial biotechnology? Mention at least two types (5 Marks)
8. Briefly describe the principles of spectrophotometry and its applications in microbial biotechnology (5 Marks)

SECTION C: LONG ANSWER TWO QUESTIONS (40 MARKS)

1. a) Discuss the microbial processes involved in the production of antibiotics such as penicillin (10 Marks)

b) Explain how recombinant DNA technology has revolutionized the production of antibiotics (18 Marks)

2.a) Discuss the use of recombinant DNA technology in producing growth hormones (10 Marks)

b) Compare the use of microbial biotechnology in medical and agriculture, highlighting key benefits in each sector (10 Marks)

3.a) Explain the techniques used for the purification of microbial proteins, such as SDSPAGE and chromatography (10 Marks).

b) Describe the application of metagenomics in the discovery of novel microbial enzymes (10 Marks)