UNIVERSITY OF FORT HARE

TECHNIQUES IN MICROBIOLOGY

HONOURS EXAMINATIONS

MAY/JUNE

YEAR
2023

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Time: **3 hours**

Subject: **MIC 512**

Marks: **100**

This paper consists of 3 pages including the cover page

Internal Examiners

Prof AI Okoh

External Examiners
(If externally moderated)
Prof E Green

INSTRUCTIONS

Answer all questions.

MAY/JUNE HONOURS EXAMINATION

Question 1 [20 marks]

(a) In the proper sequence, list the steps involved in preparing biological samples for scanning electron microscopy examination and explain why each step is required; and mention three reasons for coating a specimen. [10 marks]

(b) Explain the basic principle of operation of the electron microscope and give five differences between scanning and transmission electron microscope. [10 marks]

Question 2 [20 marks]

(a) The Sanger sequencing technique is basically DNA sequencing that involves an electro-kinetic process which separates DNA, RNA, or protein molecules based on their size and electrical charge. (10 marks)

(i) Discuss comprehensively, the fundamental steps involved in the Sanger sequencing technique. (4 marks)

(ii) Describe the difference between dideoxynucleotide Triphosphates (ddNTPs) and deoxynucleotide Triphosphates (dNTPs) in a Sanger sequencing method. (2 marks).

(iii) Discuss any 4 (Four) purposes for sequencing DNA **[4 Marks].**

(b) Since its discovery by Kary Mullis in 1985, Polymerase Chain Reaction has evolved extensively. It became the basis for several molecular biology practices and has opened incredible avenues for the research community. To date, Polymerase Chain Reaction technique has a wide range of applications. Discuss exhaustively any 5 (Five) known Polymerase Chain Reaction applications. (10 Marks)

Question 3 [20 marks]

(a) In 2020, a pesticide manufacturing plant in Port Elizabeth suspected a leakage of some of their organic compounds into their borehole water. Confronted by this challenge, the management of the company requested that a comprehensive analysis of the water from this borehole be carried out. Vuyo, a male industrial trainee was given the responsibility by the Lab Manager to analyze the water from this borehole for this contaminant. Vuyo intend to employ Gas Chromatography for trace analysis of these organic compounds in the borehole water. Provide a brief description of the type of column and injector you will advise Vuyo to employ using this instrument and give your reasons. (8 marks)

(b) Give a detailed discussion of the principles of a Flame Ionization Gas Chromatograph and Gas Chromatograph Mass Spectrophotometer. Highlight three differences and three similarities of these two instruments. (10 marks)

(c) Describe briefly provide two reasons why injectors are equipped with splitting valves.

(2 marks)

Question 4 [20 marks]

(a) Nozi wants to prepare nutrient agar plates; list the types of equipment she needs to use to achieve her preparation and highlight the function of each piece of equipment in this preparation. (10 Marks)

(b) Maureen wants to culture *E. coli,* and the optimum temperature for *E. coli* is 37 °C; discuss the equipment suitable for her to culture the organism of interest. (4 Marks)

(c) Zandi is taking maternity leave and wants to preserve her samples for one year and continue when she returns. Explain how she can keep her samples viable for this period.

(d) Name a piece of equipment used in laboratories to dissolve certain chemicals that require stirring for an extended period. (2 Mark)

Question 5 [20 marks]

(a) With the aid of well labelled diagram describe the various stages involved in a typical municipal wastewater treatment plant. (12 marks)

(b) As a follow-up to question 2(a) above, identify and explain in details, how the operation of a drinking water treatment plant differs from or similar to that of the wastewater treatment plant described above. (8 marks)