



QUALIFICATION : BACHELOR OF SCIENCES HONOURS	
QUALIFICATION CODE: 08BOSH	LEVEL: 8
COURSE: ADVANCED MICROBIOLOGY	COURSE CODE: AMB821S
DATE: NOVEMBER 2023	SESSION: 1
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY EXAMINATION : QUESTION PAPER

EXAMINER: *Dr Munyaradzi Zivuku*

MODERATOR: *Prof Jane Misihairabgwi*

INSTRUCTIONS

1. Answer all questions in section A and any **three** questions from section B.
2. Each question must be answered on the separate answer sheet.
3. Please write neatly and legibly.
4. Do not use the left side margin of the exam paper. This must be allowed for the examiner.
5. No books, notes and other additional aids are allowed.
6. Mark all answers clearly with their respective question numbers.

PERMISSIBLE MATERIALS

1. Non-Programmable Calculator

This paper consists of 4 pages including this front page

SECTION A: [40 MARKS]**QUESTION 1 (20)**

- 1.1 You wish to determine the number of bacteria in an actively growing broth culture of *E. coli*. To do this you remove 1.0 ml of the culture from the flask and dilute this in 9 ml of nutrient broth to obtain 10^{-1} dilution. You then serially dilute the sample further until you obtain a range of dilutions between 10^{-2} and 10^{-6} . From each dilution you then spread plate 0.1 ml of suspension onto the nutrient agar and incubate overnight. The next morning you has the following results.

Plate number	Dilution	Colonies on plate
1	Neat	Too many to count
2	10^{-1}	Too many to count
3	10^{-2}	Too many to count
4	10^{-3}	280
5	10^{-4}	27
6	10^{-5}	2
7	10^{-6}	0

- Determine how many bacteria per ml there were in the original sample taken from the overnight culture. (5)
- 1.2 You adjust the density of the cell suspension so that there are 1×10^6 bacteria per ml in broth and add 1 ml of this to a new culture flask. Assuming exponential growth and a doubling time of 30 minutes, how many bacteria will be in the flask after 5 hours. Show your working. (5)
- 1.3 A minimum inhibitory concentration (MIC) test was carried out using the results and the MIC was found to 3.1 ug/ ml of ampicillin drug. Briefly detail how the test is performed. (10)

QUESTION 2 (20)

- 2.1 Briefly evaluate the principle underlying the IMViC test in the differentiation and identification of specific microorganisms? (8)

- 2.2 Imagine, you are hired as a consultant microbiologist to solve a dispute that has arisen between the local resident of a town X and the town authorities. The resident is claiming that the authorities are supplying untreated raw water to the community and consequently which has led to outbreak of diarrhoea in the community. Furthermore, they are claiming the water is contaminated with many germs that cause diseases. Briefly describe the advice you would give to the municipal authorities and the community to ascertain that water is free from pathogens. (12)

SECTION B [60 MARKS]

Answer only three questions from this section. Each question carries 20 marks

QUESTION 3 (20)

- 3.1 Outline the main characteristics to be considered when selecting an organism for industrial use. (4)
- 3.2 Briefly define the term coliforms and discuss their role in the diagnostics of waste water treatment. (8)
- 3.3 Discuss how protoplast fusion has been used to manipulate microorganisms genetically for industrial use. (8)

QUESTION 4 (20)

- 4.1 The basic reproductive number, (R_0), defines the mean number of individuals directly infected by an infectious case through the total infectious period, when introduced to a susceptible population, is given by the equation

$$R_0 = p \cdot c \cdot d$$

Define the terms p, c, d and how they can be used to combat infections such as sexually transmitted diseases (STI). (4)

- 4.2 Briefly evaluate the implication of R_0 as used in epidemiology. (6)
- 4.3 Discuss five factors leading to the emerging of infectious diseases in the 21st century. (10)

QUESTION 5 (20)

- 5.1 Outline the benefits of the human gut microbiome. (10)
- 5.2 Briefly describe the changes in antibody concentrations following the initial dose of the Covid-19 jab and how that leads to conferment of long lasting immunity to an individual. (10)

QUESTION 6 (20)

- 6.1 Discuss the role of lactic acid bacteria in the production of hard cheese such as Gouda. (10)
- 6.2 A conglomerate Mine in Southern part of Namibia has been mining, copper, gold, manganese and iron for the past 60 years using conventional open pit and later underground mine methods. The management of the mine are contemplating the closure of the mine since the minerals are now of low grade. However, one the director of the mine still believes that the life of the mine can be extended by 50 years if they venture into other methods of mining. You have been hired as a consultant to give advice on how they can utilize other methods to mine the low grade ores and extend the life of the mine. Detail the advice you will give to the mine authorities to convince them to continue to mine at the same premises. (10)

END OF QUESTION PAPER