



# MACHAKOS UNIVERSITY

University Examinations for 2021/2022 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF BIOLOGICAL SCIENCES

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (BIOLOGY)

SBT 413: ENVIRONMENTAL MICROBIOLOGY

DATE: 24/8/2022

TIME: 11.00-1.00 PM

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## INSTRUCTIONS

1. Answer Question 1 (compulsory) and **any two** questions in Section B.
2. Use clean well labelled diagrams wherever appropriate.

## SECTION A

### QUESTION ONE (30 MARKS)

- a) Explain three general characteristics of biogeochemical cycles in the nitrogen cycle. (3 marks)
- b) Calculate the  $BOD_5$  of a 15ml waste water sample in a 300ml BOD bottle whose Initial BOD is 15mg/L and Final BOD is 3mg/L. (3 marks)
- c) Illustrate the three groups of microbes based on temperature (3 marks)
- d) Explain the challenge of culturing psychrophiles in the laboratory (3 marks)
- e) Explain the principle behind the membrane filter technique of water quality assessment (3 marks)
- f) Explain why Bioremediation is a superior process of decontamination. (3 marks)
- g) Explain the process of microbial biofilm formation (3 marks)
- h) Describe the three zones of an aquatic ecosystem (3 marks)

i) Describe three scenarios that may necessitate application of risk assessment (3 marks)

j) Explain three nutritional associations in microorganisms (3 marks)

## **SECTION B**

### **QUESTION TWO (20 MARKS)**

a) Discuss economically important microorganisms living in extreme environments (12 marks)

b) Describe the presumptive step of water quality analysis (8 marks)

### **QUESTION THREE (20 MARKS)**

a) Discuss microbial mechanisms of bioremediation (10 marks)

b) Discuss methods of estimating microbial numbers and their challenges in each case. (10 marks)

### **QUESTION FOUR (20 MARKS)**

Citing specific case scenarios, discuss the process of microbiological risk analysis

### **QUESTION FIVE (20 MARKS)**

Discuss four molecular techniques of detection of microorganisms in environmental samples