

CHUKA



UNIVERSITY

**UNIVERSITY EXAMINATIONS  
EXAMINATION FOR THE AWARD OF DOCTOR OF PHILOSOPHY IN  
MICROBIOLOGY AND BIOTECHNOLOGY**

**MICB 942: APPLIED ENVIRONMENTAL BIOTECHNOLOGY**

**STREAMS: PHD MICB**

**TIME: 3 HOURS**

**DAY/DATE: THURSDAY 07/08/2025**

**2.30P.M. –5.30 P.M**

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**Answer Question 1 (compulsory) and any two other questions**

**QUESTION ONE (20 MARKS)**

Design a plan of a microbial fermentation-based wastewater treatment system monitored by biosensors for effective removal of organic pollutants and nutrients. Describe how you would manage microbial consortia, select biosensor parameters for monitoring, and optimize treatment efficiency while minimizing environmental risks.

**QUESTION TWO (20 MARKS)**

Evaluate the contribution of microbial biodegradation to the management of synthetic polymer waste. Highlight important microbial enzymes involved, factors affecting degradation efficiency, and biotechnological approaches to improve polymer breakdown.

**QUESTION THREE (20 MARKS)**

Describe a framework for assessing environmental risks of genetically engineered microorganisms in bioremediation

**QUESTION FOUR (20 MARKS)**

Design a phytoremediation plan for soil contaminated with heavy metals and petroleum hydrocarbons. Include criteria for selecting plants and microbial partners, and explain the mechanisms involved in contaminant removal.

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