



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

2022/2023 ACADEMIC YEAR

SECOND YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE

OF

**BACHELOR OF SCIENCE IN RENEWABLE ENERGY
TECHNOLOGY**

COURSE CODE: RET 233

COURSE TITLE: BIOPROCESS ENGINEERING

DATE: 5/12/2022

TIME: 8:00 - 10:00

INSTRUCTIONS TO CANDIDATES

1. This paper consists of **FOUR** questions
2. Answer Question **ONE (Compulsory)** and any other **TWO** Questions
3. All symbols have their usual meaning

TIME: 2 Hours

MMUST observes **ZERO** tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over

QUESTION ONE**[30 marks]**

- A. Describe the main distinctive feature between fluidized bed bioreactor and bubble column bioreactor (3 Marks)
- B. Using Michaelis-Menten model, describe the effect of substrate concentration on the rate of enzyme catalyzed reaction (7 Marks)
- C. Using a well labelled diagram, describe the operation of a packed bed bioreactors (7 Marks)
- D. Using equation, describe the process of ethanol fermentation (7 Marks)
- E. Giving an example, describe the term enzyme specificity (5 Marks)
- F. Describe the function of the following parts in a bio-reactor (6 Marks).
- (i) Baffles
- (ii) Impeller
- (iii) Sparger

QUESTION TWO**[20 marks]**

- A. Describe the working principle of a bioreactor (5 Marks)
- B. Outline five key features of a bioreactor (5 Marks)
- C. Explain the three main applications of a photo bioreactor (6 Marks)
- D. List the two main limitations of a stirred tank fermenter (4 Marks)

QUESTION THREE**[20 marks]**

- A. Explain the three main characteristics of a lactic starter culture (6 Marks)
- B. Describe the cell growth during batch cultivation (14 Marks)

QUESTION FOUR**[20 marks]**

- A. Outline the process of moist heat sterilization (10 Marks)
- B. Describe two advantages and two disadvantages of a batch fermenter (4 Marks)
- C. In most fermentation factories, urea or ammonia water is often used as a fed-batch substance, what's the function of it? (2 marks)
- D. List four factors affecting dissolved oxygen concentration during fermentation process (4 Marks)