



(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

(Main Campus)

UNIVERSITY EXAMINATIONS

2022/2023 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATIONS

EXAMINATION

FOR THE DEGREE OF

**BACHELOR OF SCIENCE DISASTER PREPAREDNESS AND ENVIRONMENTAL
TECHNOLOGY**

COURSE CODE: DPE 308

COURSE TITLE: PROCESS AND SYSTEMS SAFETY ENGINEERING

DATE: 13/4/2023

TIME: 8-10 AM

Instructions to Candidates

- This paper contains FOUR (4) questions
- Question **one is compulsory** {total =30 Marks}
- Attempt **any other two** (2) {total = 40 Marks} from the remaining questions
- Be brief and to the point

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 2 Printed Pages. Please Turn Over →

SECTION 1: COMPULSORY {30 MARKS}

Question ONE

- a) With the aid of a flow diagram, describe 'safety process analysis' [3 Marks]
- b) Explain 'process safety engineering' as applied in 'process and system safety engineering' [3 Marks]
- c) Briefly describe risk assessment matrix in systems safety process [3 Marks]
- d) Differentiate between the following.
- i) Failure mode and effects analysis (FMEA) and Fault tree analysis (FTA) [1 Mark]
 - ii) Qualitative and quantitative system analysis techniques [1 Mark]
 - iii) OR gate and Exclusive OR gate in system analysis [1 Mark]
 - iv) Basic event and External event [1 Mark]
- e) List and describe FIVE [5] steps involved in a Fault tree analysis [5 Marks]
- f) Using the intersection of the input event sets in safety process analysis, describe the probability of the following:
- i) AND gate output [2 Marks]
 - ii) An OR gate [2 marks]
 - iii) An exclusive OR gate [2 Marks]
- g) In relation to process and systems safety engineering, describe the following:
- i) Priority AND gate [1 Mark]
 - ii) Inhibit gate [1 Mark]
 - iii) Transfer in and transfer out symbols [1 Mark]
 - iv) Conditioning event [1 Mark]
- h) List and explain two categories of techniques available to reduce the probability of system failure [2 Marks]

SECTION II: ATTEMPT ANY OTHER TWO (2) QUESTIONS {40 MARKS}

Question TWO

- a) Discuss work activities in Process Safety Engineering [5 Marks]
- b) With the aid of a sketch, describe how the fault tree concept is applied in systems safety analysis [10 marks]
- c) Describe the importance of human/ergonomic factors in systems safety management [5 marks]

Question THREE

- a) Describe the FMEA process as a safety analysis technique [8 Marks]
- b) With the aid of a flow diagram describe Systems Safety processes [12 marks]

Question FOUR

- a) With the aid of a sketch, describe risk vs cost/complexity in safety analysis [10 marks]
- b) With the aid of a sketch, describe the safety analysis process [10 marks]