(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY

(MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

MAIN EXAM

2023/2024 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIEN CE IN EPIDEMIOLOGY AND BIOSTATISTICS/ BSC ENVIRONMENTAL HEALTH

COURSE CODE: PPE 114/ PPP 112

COURSE TITLE: BASIC MATHEMATICS / TECHNICAL MATHEMATICS

DATE:5/12/2023 TIME: 2.00-4.00 PM

INSTRUCTIONS TO CANDIDATES:

Instructions to candidates:

Answer Question ONE (Compulsory) and ANY other TWO Questions

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

Paper Consists of 3 Printed Pages. Please Turn Over

## QUESTION ONE (COMPULSORY) (40 MARKS)

(a ) Given the universal set $U = \{0,1,2,3,4,5,6,7,8,9,10\}$ and sets $A = \{0,1,2,3,5,8\}$ ,

$B = \{0,2,4,6\}$ and $C = \{1,3,5,7\}$ .Using the Venn diagram, find

*i)* $A \cap B$ (2 marks)

*ii)* $B \cup C^C$ (2 marks)

*iii)* $A^c \cup C$ (2marks)

iv) the symmetric difference of A and B, $A \Delta B$.

(4marks)

(b) Provide an explanation on the use of the following common logical connectives and show their implication using a truth table

(i) Conjunction (2marks)

(ii) Disjunction (2marks)

(c) Evaluate the following complex operations;

(i)(-4 + i6) - (3 - i5) (2marks)

(ii) $(1 - 3i)(4 + 2i)$ (2MARKS)

(d) State wether the following statements are TRUE or FALSE; (5marks)

(i) $\{\mathbb{Z}\} \subseteq \{\mathbb{R}\}$

(ii) $\{\mathbb{Q}\} \subset$ {Irrationals}

(iii) $\{0\} \subset$ {Positive integers}

(iv) $\{0\} \subset \{\mathbb{N}\}$

(v) {irrationals}$\subset \{\mathbb{R}\}$

(e) (i) How many 5-letter code words can be formed from the letters of the word MATRICES ? (3marks)

(ii) Find the number of permutations of the word MISCELLANEOUS. (3marks)

(f) Determine the inverse functions for the following functions;

(i) $f: x \to 3 - \frac{2}{x}\ ; x \neq 0$ (4marks)

(ii) $f: x \to \frac{4x+3}{7x-6}\ ; x \neq 6/7$ (5marks)

(g) $Simplify\ \cos 80^0 \sin 20^0 + \sin 80^0 \cos 20^0$ (2marks)

## QUESTION TWO (15MARKS)

a) Evaluate the following limits:

i $\lim_{x\to 1}\frac{x^2-1}{x-1}$ (2 Marks)

ii. $\lim_{t\to 0}\frac{\sqrt{t^2+9}\ -3}{t^2}$ (3Marks)

(b) Solve the equation $8sin^2x + 2\sin x = 1$ (5marks)

(c) Find the square root of the complex number 5-12i (5marks)

## QUESTION THREE (15MARKS)

(a)Given $Z_1 = 3 - i$ *and* $Z_2 = -2 + i5$ ;

(i) Find $\frac{Z_1}{Z_2}$ (3marks)

(ii) Determine its modulus (2marks)

(iii) Represent it on an Argand diagram (3marks)

(b) i. Use the first principle rule of differentiation to find the derivative of

$$f(x) = 2x^2 - 16x + 35$$ (4marks)

(c) A set of 15 numbers consists of nine positive and six negative numbers. Three numbers are selected from the lot and multiplied. In how many ways can a negative product be obtained? (3marks)

## QUESTION FOUR (15 MARKS)

(a) *Evaluate* $\int_1^4 (t^2 - t - 6)dt$ (3marks)

(b) Consider $f: \mathbb{Z} \to \mathbb{Z}$ and $g: \mathbb{Z} \to \mathbb{Z}$ defined by $f(x) = 2x + 1$ and $g(x) = x - 3$. Find $fo\,g$ and $f^{-1}o\,g^{-1}$ (5marks)

(c) Evaluate $Cos\ 105^o$ using special angles (4marks)

(d) Determine the truth table for $(A \to B) \to (A \vee B)$ (3marks)