(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2022/2023 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: **MAP 111/MAT 101**

COURSE TITLE: **FOUNDATION MATHEMATICS I**

DATE: 13/12/2022 **TIME:** 9:00 AM - 11:00 AM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE (30 MARKS)

a) Define the following

i. Set (2marks)

ii. Universal set (2marks)

iii. Disjoint sets (2marks)

iv. Proper Subset (2marks)

v. Singleton set (2marks)

b) Find the number of permutations of the word MISCELLANEOUS (3marks)

c) Bank XYZ has 300 customers. 200 customers have taken car loans, 155 of them have mortgage loans and 108 of them school fees loans. Of these, 65 of them have both school fees and mortgage loans, 48 have taken both school fees and car loans and 90 customers have taken both car and mortgage loans. 20 customers have taken all 3 loans.

i. Draw a Venn diagram to illustrate the above information (3marks)

ii. How many customers have not taken any loan from the bank? (2marks)

iii. How many customers have exactly one loan from the bank? (2marks)

iv. How many customers have exactly two loans from the bank? (1marks)

d) Convert $(64.625)_{10}$ to

i. Binary (3marks)

ii. Octal (3marks)

iii. Hexadecimal (3marks)

QUESTION TWO (20 MARKS)

a) Using truth tables, show that $A \vee (B \wedge C) = (A \vee B) \wedge (A \vee C)$ (6marks)

b) Find the square root of $3 + 4i$ (6marks)

c) Solve the equation $7x \equiv 1 \, mod \, 31$ (5marks)

d) A girl has 3 skirts, 5 blouses and 4 scarves. How many different outfits consisting of a blouse, skirt and scarf can she make out of this? (3marks)

QUESTION THREE (20 MARKS)

a) Given $z_1 = (1 - i)(1 + 2i)$, $z_2 = \frac{2+i6}{3-i}$, $z_3 = \frac{-i4}{1-i}$

i. Express each of these complex numbers in the form $x + iy$ (4marks)

ii. Show that $|z_1 - z_3| = |z_1 - z_2|$ (3marks)

iii. Find $\left| \frac{z_1+2z_2-z_3}{i4+3z_1} \right|$ (6marks)

b) Find the inverse function of $y = \sqrt{\frac{1-x}{1+x}}$ (4marks)

c) Divide 10010 by 11 (3marks)

QUESTION FOUR (20 MARKS)

a) A box contains 15 balls 5 of which are red, 4 are green and 6 are blue. In how many ways can 3 balls be chosen if

i. If there is no restriction (2marks)

ii. The balls are of different color (3marks)

iii. Only two balls are of the same color (5marks)

b) State the domain and range of $y = \sqrt{16 - x^2}$ (4marks)

c) Convert $(0001\ 0111\ 0111\ 0110)_{BCD}$ to Decimal number system (3marks)

d) Show that $Sin\, x + \cos xcotx = cosecx$ (3marks)

QUESTION FIVE (20 MARKS)

a) Define;

i. Domain (2marks)

ii. Range (2marks)

iii. an on to function (2marks)

b) In an examination, 40% of the students passed in Arithmetic, 45% passed in English and 30% passed in both subjects. If 90 students failed in both subjects, find the total number of students (4marks)

c) Let $f: \mathbb{R} \to \mathbb{R}$ defined by $f(x) = 2x - 1$ and $g: \mathbb{R} \to \mathbb{R}$ by $g(x) = x - 3$. Find

i. fog (2marks)

ii. gof (1marks)

iii. $(fog)^{-1}$ (3marks)

iv. $f^{-1}og^{-1}$ (4marks)