(Knowledge for Development)

KIBABII UNIVERSITY

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UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE MATHEMATICS

COURSE CODE: MAP 111

COURSE TITLE: FOUNDATION MATHEMATICS I

DATE: 04/02/2022 **TIME:** 9:00 AM - 11:00 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 4 Printed Pages. Please Turn Over.

QUESTION ONE COMPULSORY (30 MARKS)

a) Define the following

i. Set (2marks)

ii. Power set (2marks)

iii. Disjoint sets (2marks)

iv. Cartesian product of sets (2marks)

v. Subset (2marks)

a) In a survey of 500 students of a college, it was found that 49% liked watching football, 53% liked watching hockey and 62% liked watching basketball. Also, 27% liked watching football and hockey both, 29% liked watching basketball and hockey both and 28% liked watching football and basketball both. 5% liked watching none of these games.

i. How many students like watching all the three games? (2marks)

ii. Find the ratio of number of students who like watching only football to those who like watching only hockey. (3marks)

iii. Find the number of students who like watching only one of the three given games. (2marks)

iv. Find the number of students who like watching at least two of the given games. (3marks)

b) If x is congruent to 13 modulo 17 then $7x - 3$ is congruent to which number modulo 17? (4marks)

b) Convert $(4182.75)_{10}$ to

i. Binary (2marks)

ii. Octal (2marks)

iii. Hexadecimal (2marks)

QUESTION TWO (20 MARKS)

a) Solve the equation $13x + 16 \equiv -1 \; mod \; 31$ (7marks)

b) Determine the truth tables of the following proposition (5marks)

i. $(A \Rightarrow B) \Leftrightarrow (A \; V {\sim} B)$

c) In a group of 6 boys and 4 girls, four children are to be selected. In how many different ways can they be selected such that at least one boy should be there? (5marks)

c) Show that $1 + Sin\ 2\theta = (Sin\ \theta + Cos\ \theta)^2$ (3marks)

QUESTION THREE (20 MARKS)

a) Solve $z^3 = i$ (6marks)

b) Solve $\cos^2(\alpha) + \cos(\alpha) = \sin^2(\alpha)$ on the interval $0° \leq x < 360°$ (5marks)

c) Convert the following numbers into decimals

   i. $(101.01)_2$ (2marks)

   ii. $(123.4)_8$ (3marks)

d) Consider a function $f: (1, -\infty) \to (0,1)$ defined by $f(x) = \frac{x-1}{x+1}$. Find the inverse of $f(x)$ (4marks)

QUESTION FOUR (20 MARKS)

a) A zip code contains 5 digits. How many different zip codes can be made with the digits 0–9 if no digit is used more than once and the first digit is not 0? (5marks)

b) Define;

   i. a one-to-one function (2marks)

   ii. an on to function (2marks)

c) State the domain and range of $y = \sqrt{x+4}$ (4marks)

d) Find the value of x and the value of y in the following equation

   $(x + iy)(3 + 4i) = 3 - 4i$ (4marks)

d) Simplify$(1 - i)^3$ (3marks)

QUESTION FIVE (20 MARKS)

a) A given company has 1500 employees. Of those employees, 800 are computer science majors. 25% of those computer science majors are also mathematics majors. That group of computer science/math dual majors makes up one third of the total mathematics majors. How many employees have majors other than computer science and mathematics? (5marks)

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

   i. fog (3marks)

   ii. gof (3marks)

c) How many different committee members can be selected from eight men and 10 women if a committee is composed of three men or three women? (4marks)

d) Convert the $(1032.6875)_{10}$ to octal number system (5marks)