(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2017/2018 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER

SPECIAL/ SUPPLEMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

MATHEMATICS

COURSE CODE: MAT 101

COURSE TITLE: FOUNDATION MATHEMATICS I

DATE: 05/10/18 **TIME:** 3 PM -5 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE (30 MARKS)

a. Let U = {1,2,3,4,5,6,7,8,9,10,11,12,13,14,15}. Further let A = {2,4,7,8,9,12,14} , B ={1,3,5,7,11,13,15} and C ={9,10,11,12,13,14,15} be the subsets of U. Find

   (i) A^c (ii) B ∩ A (iii) C ∪ B (iv) A – C (v) $(A ∩ B)^c$. **(5mks)**

b. (i) Write the inverse, converse and contrapositive of the statement, "if I get a pay rise; I will buy a car". **(3mks)**

   (ii) Represent the compound proposition (A ⇒ B)Λ (B ⇒ A) in a truth table. **(5mks)**

c. If $z = \frac{1+i}{3+yi} + \frac{3+2i}{y+3i}$ and the Re(z) = Im(z), find the value of y. **(4mks)**

d. Find the number of permutations of the word MISCELLANEOUS. **(2mks)**

e. A box contains 4 black and 3 white balls. Five balls are taken from the box and arranged in a row from left to right. In how many ways might this be done? **(4mks)**

f. If f: x → 2x + 1 and g: x → x – 3. Determine f· g **(2mks)**

g. Evaluate Cos 105^0. **(3mks)**

h. Compute (i) -18 mod 7   (ii) 24 mod 6. **(2mks)**

QUESTION TWO (20 MARKS)

a. Express in x + yi; $\frac{7+5i}{2+3i}$. **(3mks)**

b. If a = 3 – I and b = 1 + 2i, find the modulus of 2a + b. **(2mks)**

c. Find the square root of the complex number 3 + 4i. **(3mks)**

d. Solve $z^2 – 4z + 24 = 0$ **(4mks)**

e. Express 3 – 4i in polar form. **(3mks)**

f. Express $(1 + \sqrt{3}i)^6$ in the form a + bi where a,b are real numbers. **(5mks)**

QUESTION THREE (20 MARKS)

a. Define the following terms giving an example in each case;

   i.   A set **(2mks)**

   ii.   A singleton set **(2mks)**

b. Given set A = {1,2,5,6,8,10} and set B = {4,6,8,10,12} ; find A ∪ B and represent it in a venn diagram. **(3mks)**

c. Given X = {2,4,6,8,10,12}, Y = {2,3,4,5,6,7,8} and Z = {1,2,5,8,4,9,11}. Find n(X∪Y∪Z). **(3mks)**

d. Umoja Bank has 300 customers. 200 of the customers have taken car loans; 155 of them have taken mortgage loans and 108 have taken school fees loans. Of these, 65 have taken both school fees and mortgage loans, 48 have taken both school fees and car loans and 90 have taken both car and mortgage loans. 20 customers have taken all the three loans

   (i)   Draw a venn diagram to illustrate the above information.

(ii)   How many customers have not taken any loan from the bank?
(iii)   How many customers have exactly one loan from the bank?
(iv)   How many customers have exactly two loans from the bank?   (10mks)

QUESTION FOUR (20 MARKS)

a. Define the set of rational numbers and give an example of a rational number. (2mks)
b. Prove that $\sqrt{2}$ is not a rational number   (6mks)
c. Giving specific examples, show that the set of natural numbers are closed under addition and multiplication but not under subtraction and division.   (8mks)
d. Clearly state the laws of arithmetic operations on rational numbers   (4mks)

QUESTION FIVE (20 MARKS)

a. Let $S = \{0,1,2,3,4,5,6,7,8,9,10,11\}$. Define a relation $\sim$ on S such $x \sim y$ if $y - x$ is a multiple of 3
   (i)   Which elements are related to 0?   (2mks)
   (ii)   Which elements are related to 1   (2mks)
b. Let $g: x \rightarrow \frac{1}{2}x$ be a mapping. If the domain of the mapping is $\{0,1,2,3,4\}$. List down the range of the mapping.   (2mks)
c. Given $f: x \rightarrow x + 2$. Write down the value of $f(5)$.   (2mks)
d. Determine inverse functions for the following
   (i) $f: x \rightarrow 3 - \frac{2}{x}$; $x \neq 0$ (3mks)
   (ii) $f: x \rightarrow \frac{4x+5}{7x-6}$; $x \neq \frac{6}{7}$ (3mks)
e. What is an
   (i)   Even function   (2mks)
   (ii)   Odd function   (2mks)
f. Determine whether the following functions are odd, even or neither
   (i) $f: x \rightarrow x^3$ (1mrk)
   (ii) $f: x \rightarrow 4x^2 - 5$ (1mrk)