MACHAKOS UNIVERSITY COLLEGE

ISO 9001:2008 Certified

(A Constituent College of Kenyatta University)

UNIVERSITY EXAMINATIONS 2015/2016

THIRD YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION

SMA 101: BASIC MATHEMATICS

DATE: …………………………….. **TIME 2 HOURS**

INSTRUCTIONS TO CANDIDATES

Answer ALL the questions in Section A and ANY THREE Questions in Section B

Section A

Question one 30 marks

a) Define the following terms.

i) Absolute complement

ii) Power set

iii) Universal set

iv) Subset

v) Set

vi) Function (6 marks)

b) Express $E = ((xy)'z)'(x' + z)(y' + z')'$ as a sum of product expression. (4 marks)

c) Solve the equation $1 + cos\theta = 2sin^2\theta$, for the values of θ from 0° to $360°$ (4 marks)

d) Differentiate between existential quantification and universal quantification. (2 marks)

e) Prove that the square of an even integer is even and the square of an odd integer is odd. (4 marks)

h) Express $Z = -i + 1$ in polar form (4 marks)

i) Simplify $i(8p + 4iq)$ (3marks)

j) Find the power set of the following set $A = \{1,2,3\}$ (4 marks)

k) Determine the number of ways in which the letters of the word statistics can be arranged in a row. (3 marks)

Question two 20 marks

a) Show that $\rceil(p \vee q)$ and $\rceil p \wedge \rceil q$ are logically equivalent (5 marks)
b) Construct the truth table for the disjunction of two proposition (4 marks)
c) let $Q(x, y, z)$ denote the statement $z = x + y + 1$ .what are the true value of $Q(1,3,5)$ and $Q(6,4,0)$ (3 marks)
d) Give an example of tautology and contradiction (4 marks)
e) Construct the truth table for the bi conditional of two proposition (4marks)

Question three 20 marks

a) A committee of 6 people is to be selected from 5 women and 6 men. In how may ways:
   i) Can the committee be selected if at least three women must be in the committee? (4 marks)
   ii) Can the committee be selected if three men must be in the committee?
   . (3 marks)
b) Let 1,2,3,4 be four letters. In how many ways can you arrange two of them? (3 marks)
c) Four men and their wives sit on the bench. In how many ways can they be arranged if
   i) There is no restriction (2 marks)
   ii) Each man must sit next to his wife. (3 marks)
d) In how many ways can 9 people sit at a round table (2 marks)
e) Simplify $\frac{16!}{9!7!} + \frac{16!}{10!6!} + \frac{16!}{11!5!}$ (3 marks)

Question four 20 marks

a) Let $U = \{1,2,3,4,5,6,7,8,9,10,11,12\}$, $A = \{1,3,5,7,9,11\}$ $B = \{2,3,5,7,11\}$ $C = \{2,3,6,12\}$ and $D = \{2,4,8\}$
   Determine the set
   i) $A \cup B$
   ii) $A \cap C$
   iii) $(A \cup B) \cap C^c$
   iv) $(C \cap A) \cup D$ (8 marks)
b) A market researcher investigating consumer preference for three brands of soda namely, coke, fanta and sprite in a certain town gathered the following information; from a sample of 800 consumers 230 took coke 245 took fanta and 325 took sprite. 30 took all the three brands of soda, 70 took coke and sprite, 110 took coke only, 185 took sprite only. Required
   i) Present the above information in a venn diagram (4 marks)
   ii) Determine the number of customers who took fanta only (2 marks)
   iii) Determine the number of customers who took coke and fanta only (2 marks)
   iv) Determine the number of customers who took fanta and sprite only (2 marks)

v) Determine the number of customers who took none of the brands of soda. (2 marks)

Question five 20 marks

a) If $Z = -2\sqrt{3} - 2i$, find $|z|$ and the argument of Z (4 marks)

b) Solve $Z^3 - 1 = 0$, obtaining its three roots. If w is a root not equal to 1, show that the other root may be denoted by w^2 and prove that $1 + w + w^2 = 0$ (10 marks)

c) Use De Moivres theorem to simplify $\left(1 + i\sqrt{3}\right)^4$ (2 marks)

d) Find all the cube roots of $-\sqrt{2} + i\sqrt{2}$ (4 marks)