



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

MAIN EXAMINATION

MAY – JULY 2018 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

REGULAR PROGRAMME

MAT 100: BASIC MATHEMATICS

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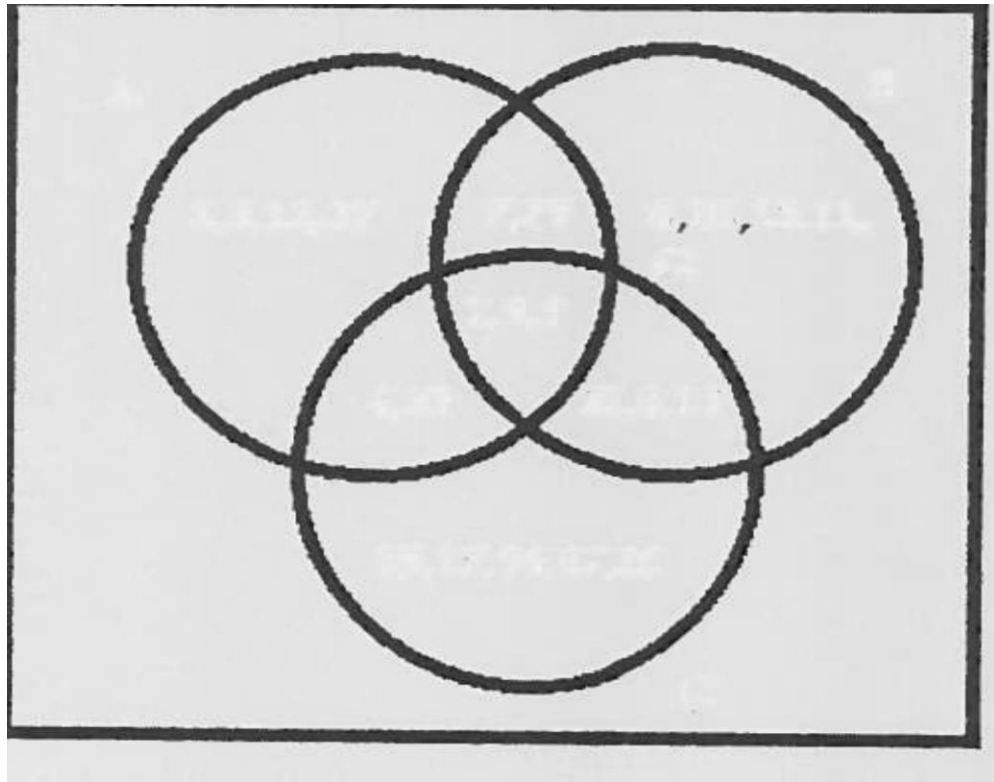
Date: JULY 2018 **Duration: 2 Hours**

INSTRUCTIONS: Answer Question ONE and any other TWO Questions

- Q1. a) Given that $f(x) = 2 - 3x$ and $g(x) = 5x^2 + x$ Find
- i) $(f \circ g)(2)$ **(2 marks)**
 - ii) $(g \circ f^{-1})(x)$ **(3 marks)**
- b) Simplify $\frac{(x^2\sqrt{y})(\sqrt{x^3y})}{(x^5y^3)^{1/2}}$ **(2marks)**
- c) Evaluate $\cos 105^\circ$ using surd angles on 60° and 45° **(3marks)**
- d) Evaluate the series $x_1 = 2, x_2 = -1, x_3 = -3$ and $x_4 = -5$ for $\sum_{i=1}^4 \frac{x_i+3}{2x_i-3}$ **(4 marks)**
- e) Given the universal set $U = (1,2,3,4,5,6,7,8)$ and the subsets $A = (1,2,4,8)$ $B = (1,3,5,7)$ and $C = (2,4,6,8)$ list the elements C' and $(A \cup B) \cap C$ **(3marks)**
- f) Find the number of permutations of the letters of the word GOOGLE **(1 mark)**
- g) Write $\log\left(\frac{8 \times 125}{729}\right)$ in term of $\log 2, \log 3$ and $\log 5$ **(2 marks)**
- h) Evaluate $\frac{(3+i)(2+4i)}{(1-i)}$ **(3 marks)**
- i) By using the remainder theorem, determine the remainder when $3x^3 - x^2 - 20x + 5$ is divided by $(x + 4)$ **(3marks)**

- j) The third fourth and fifth term of G.P is given by $(x + 4)$, $(4x - 5)$, and $(2x + 1)$ respectively, show that one of the possible value of x is $\frac{1}{2}$, find the other possible value and common ration **(4marks)**

- Q2. a) Prove that $(\cot \theta + \csc \theta)^2 = \frac{1+\cos \theta}{1-\cos \theta}$ **(4marks)**
- b) **Given** $f(x) = 2x - 1$, $g(x) = x^2 + 2$ **and** $h(x) = 3x + 1$; find $(f \circ g \circ h)(2)$ **(3 marks)**
- c) Evaluate $\frac{\log 25 - \log 125 + \frac{1}{2} \log 625}{3 \log 5}$ **(3 marks)**
- d) If $\tan \theta = \frac{3}{4}$ find the value of $\cos 2\theta$ **(2 marks)**
- e) Solve $2^x = 7$ **(1marks)**
- f) If $A=(1,2,3)$ $B=(2,3,4)$ and $U=(1,2,3,4,5,6)$, verify that:
 $(A \cup B)' = A' \cap B'$ **(3marks)**
- g) Show whether the functions below are even, odd or neither:
 i) $f(x) = -3x^2 + 4$ **(2 marks)**
 ii) $g(x) = 2x^3 - 4x$ **(2marks)**
- Q3. a) Solve $2\sin^2 \theta + 3 \cos \theta - 3 = 0$ for $0^\circ \leq \theta \leq 360^\circ$ **(6marks)**
- b) Given that $g(x) = \frac{4x+5}{7x-6}$ find $g^{-1}(x)$ hence show $(g \circ g^{-1}) = x$ **(6 marks)**
- c) Study the diagram below and attempt the question that follows **(4 marks)**
- i) $A \cap B$
 ii) $(A \cup C) \cap B'$
 iii) $(A \cap B)'$
 iv) $n(A \cap B \cap C)'$



d) Evaluate $(3 + i)(2 + 4i)$ and hence write your answer in polar form. **(4marks)**

Q4. a) Solve for x , $\log_9 x + 4 \log_3 x^2 = 5$ **(5marks)**

b) Evaluate **(2 marks)**

$$\frac{2}{\sqrt{5} + \sqrt{3}}$$

c) In a G.P the sum of the 2nd and 3rd terms is 6 and sum of 3rd and 4th terms is -12 find the first term, common ratio and the 10th term **(6 marks)**

d) Find the modulus and the argument of $\frac{7-i}{3-4i}$ **(4 marks)**

e) UCC class of 42 students, 30 students play football while 25 students play volleyball. Use Venn diagrams to determine the number of students who play both games. **(3marks)**

Q5. a) A survey was carried out in a local open air market. It was noted that 41 people ate Mango, 38 ate an Orange and 44 ate Apple. 19 people ate Mango and an Orange 16 ate an Orange and an Apple and 17 ate an Mango and an Apple suppose 81 people took part in the survey
 i) Draw a Venn diagram to illustrate the above information **(4 marks)**

- ii) Determine how many ate all the three types of fruits **(6marks)**
- b) Find the value of a and b if $\frac{x^5+4x^3+ax+b}{x^2-1}$ the remainder is $2x + 3$ **(4 marks)**
- c) Consider the series 0.3232323232..... Hence determine the; **(6 marks)**
- i) 20th term
 - ii) Sum to infinity
 - iii) Sum of the first 10 terms

END