THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

MAIN EXAMINATION

MAY – JULY 2019 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

REGULAR PROGRAMME

MAT 100: BASIC MATHEMATICS

Date: JULY 2019	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and any other TWO Questions	

Q1.　　a)　　Calculate all the angles in triangle whose lengths are 5.5cm, 4.2 cm and 3.8cm. **(4marks)**

b)　　If $f(x)=2-3x \wedge g(x)=5x^2+x$ find: $(g \circ f^{-1})(x)$

(4marks)

c)　　solve for x in $8^{(x+1)}=27^{(2x-5)}$　　(**3 marks**)

d)　　Without fully expanding determine the sixteenth term given by

$(3p+\dfrac{q}{3})^{25}$　　**(3 marks)**

e)　　Use the factor theorem to determine the factors of
$3x^3-21x^2+42x-24=0$
and hence solve the cubic equation $3x^3-21x^2+42x-24=0$

(3marks)

f)　　The sum of first 8 terms of AP is 236 and the sum of the first 6 terms of the same series is 147. Find the sum of the first 12 terms of the series. **(3marks)**

g) A vertical aerial stands on a horizontal ground. a surveyor positioned due east of the aerial measures the elevation of the top as 48^0. He moves due south 30 m and measures the elevation as44^0. Determine the height of the aerial.

(4marks)

h) Express$\dfrac{(6+i)(2-i)}{(4+3i)(1-2i)}$ *in the form a + ib*

(2 marks)

i) A committee of six is to be constituted from nine women and three men. In how many ways can this be done so as to include at least one man? **(4 marks)**

Q2. a) Solve the trigonometric equation $2-4\cos^2 A ¿ 0\, for\, 0^0 \le A \le 360^0$

(4marks)

b) Find the value of a and b if $\dfrac{x^5+4x^3+ax+b}{x^2-1}$ the remainder is $2x+3$

(4 marks)

c) Truck A and B can ferry goods between two towns which are 3120 km apart, Truck A travels at 5 km/h faster than Truck B and Truck B takes 4 hours more than Truck A to cover the distance. Form quadratic equation from the above information and calculate the speed of Truck A.

(5marks)

d) In a stadium, the cost per seat during a match is Ksh 200. The stadium is built in such a way that the first row has twenty seats and each other row has five seats more than the previous one and there are thirty one rows. If during the match between Tunisia and Kenya the stadium was 75% full, how much money was collected if every fan payed? **(7marks)**

Q3. a) 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. **(4marks)**

b) Solve for x in the following equation $3^{x+1} +3^{x-2} -\dfrac{15}{3^{x-1}} = \dfrac{247}{3^{x-2}}$

(4marks)

c) if ksh 10,000 is invested at compound interest of 8% per annum, determine
   i) the value after 10years
   ii) The time, correct to the nearest year, it will take to reach more than Ksh 30,000. **8**

d) If $\tan\theta=\dfrac{7}{24}\wedge\theta$ is reflex, without using tables or calculators find the values of $\sec\theta\wedge\sin\theta$

(4 marks)

Q4.   a) A nail factory starts producing nails at the rate of 10000 per hour. This rate of production decreases by 20% every hour.
   i) Find the number of nails produced during the third hour
(3marks)
   ii) Calculate the total number of nails produced in the four hours.   **(4marks)**

(b) The resistance R of an electrical conductor at temperature $\theta^0 c$ is given by $R=Ro\,e^{\alpha\theta}$, where α is a constant and $Ro=5000\,ohms$. determine the value of α, correct to 4 significant figure, when $R=6000\,ohms\wedge\theta=1500^0 c$. Also, find the temperature, correct to the nearest degree, when the resistance R is 5400 ohms.

(8marks)

(c) Solve the equation $\log_3 x-4\log_x 3+3=0$

(5marks)

Q5.   a) Evaluate the following using DeMoivre's theorem
¿¿¿

(5marks)

b) Fifteen books of three different sizes are to be arranged on a shelf five of each size. In how many ways can this be done if books of the size must not be kept together?   **(7marks)**

c) The angle of the depression of a ship viewed at a particular instant from the top of a 225 m vertical cliff is 30^0. Find the distance of the ship from the base of the cliff at this instant. The ship is sailing away from the cliff at a constant speed and 1 minute later, its angle of depression from the top of the cliff is 20^0. Determine the speed of the ship in km/h.   **(8marks)**

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