THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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MAIN EXAMINATION

AUGUST – DECEMBER 2018 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

REGULAR PROGRAMME

DMAT 100: BASIC MATHEMATICS

Date: DECEMBER 2018	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and any other TWO Questions	

Q1. a) Find the values of x for which the expression $\frac{2x+5}{x-x-6}$ does not exist. **(4 marks)**

b) Given that A is the set of odd numbers less than 20, and B is the set of prime numbers less than 20, list the members of A, B, A∩B, A∪B. **(4 marks)**

c) Convert the following numbers:

i) 11011110_2 into decimal **(2 marks)**
ii) 76_{10} into binary **(2 marks)**
iii) 45_8 into binary **(2 marks)**
iv) 3580_{10} into hexadecimal **(2 marks)**

d) Given that f(x) =10x and g(x)= x+3, find:

i) fg(x) **(2 marks)**
ii) $(fg)^{-1}(x)$ **(3 marks)**

e) How many even numbers, greater than 2000, can be formed with the digits 1,2,4,8, if each digit may be used only once in each number? **(3 marks)**

f) Find the values of:

i) $(27/8)^{-2/3}$ **(3 marks)**
ii) $\text{Log}_2 7$ **(3 marks)**

Q2. a) Prove the irrationality of $\sqrt{2}$ **(5 marks)**

b) Are the following statements true or false? **(4 marks)**

i) All prime numbers are odd numbers.
ii) Any natural number can be expressed as a rational number.
iii) The square root of a natural number is an irrational number.
iv) π= 22/7, so π is a rational number.

c) If f(x) =x^2, express as simply as possible $\frac{f(a+h)-f(a)}{h}$, h≠0 **(5 marks)**

d) i) Subtract 001_2 from 110_2 **(2 marks)**
ii) Divide 11001_2 by 101_2 **(2 marks)**
iii) Multiply 1101_2 by 1010_2 **(2 marks)**

Q3. a) Solve x^2-bx+13=0, where x∈ ℂ **(5 marks)**

b) Find by completing the square, the greatest value of the function f(x) = 1-6x-x^2 **(5 marks)**

c) Solve the equations:
i) $x^2 + 64 = 0$ **(2 marks)**
ii) $4x^2 + 9 = 0$ **(2 marks)**

d) Express in surd form and rationalize the denominators. **(6 marks)**
i) $\frac{1}{1+\cos 45°}$ ii) $\frac{2}{1-\cos 30°}$ iii) $\frac{1+\tan 60°}{1-\tan 60°}$

Q4. a) Solve the equation cos 2θ=0.6428, for values of θ between -180° and +180°. **(5 marks)**

b) Solve the equation 2sin$^2\theta$= sinθ, for values of θ from 0° to 360° inclusive. **(7 marks)**

c) Find, without using tables or calculator, the value of $\sin(120° + 45°)$. **(5 marks)**

d) Solve the equation $\sin\theta = -1/2$ for values ofθ from 0° to 360° inclusive. **(3 marks)**

Q5. a) In how many ways can 8 people sit at a round table? **(3 marks)**

b) A mixed hockey team containing 5 men and 6 women is to be chosen from 7 men and 9 women. In how many ways can this be done? **(4 marks)**

c) Expand (2x +3y)^3 in descending powers of x. **(5 marks)**

d) Use Pascal's triangle to obtain the value $(1.002)^5$, correct to six places of decimals. **(4 marks)**

e) Find the coefficient of x^{10} in the expansion of $(2x - 3)^{14}$. **(4 marks)**

END