KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR
FIRST YEAR, FIRST SEMESTER EXAMINATION
FOR THE DEGREE IN ECONOMICS AND FINANCE

Date: 7th August, 2024
Time: 11.30am –1.30pm

KEC 2101 ECONOMISTS MATHEMATICS I

INSTRUCTIONS TO CANDIDATES

ANSWER **QUESTION ONE (COMPULSORY)** AND **ANY OTHER TWO** QUESTIONS
QUESTION ONE (30 MARKS)

a) Consider the universal set T and its subsets A, B and C below;
   T= $\{a, b, c, d, e, f\}$, A= $\{a, d\}$, B= $\{b, c, f\}$ and C= $\{a, c, e, f\}$.
   Find;

   i) $A \cup B$ (2 marks)

   ii) $B \cap C$ (2 marks)

b) Solve the given quadratic equation, $2x^2 + 3x + 1$ using

i) completing square method   (3 marks)

ii) quadratic formula   (2 marks)

c) Given the arithmetic progression series 5, 11, 17, … find

i) the 12th term   (3 marks)

ii) the sum of the first 12 terms   (3 marks)

d) The demand component of a market model is given by the following quadratic function,

   $p = -Q^2 - 6Q + 7$ and the supply component is also given as $p = Q^2 + 3Q + 2$.

i) Find the equilibrium price   (2 marks)

ii) Find the equilibrium quantity   (2 marks)

e) If $f(x) = x^2 + x - 1 \; and \; g(x) = x^2 - x$.

   Find

   i) $gof(x)$ (2 marks)

   ii) $fog(x)$ (2 marks)

f) If $y = u^2$ and $u = x^2 - 4x + 3$, find $\frac{dy}{dx}$ (2 marks)

g) Given $f'(x) = \sqrt{x}$, find $f(x)$ (1 mark)

h) Evaluate $\int 5x^2 \, dx$ (2 marks)

i) Find the area under the curve $y = x^2 \text{ from } x = 0 \text{ to } x = 1$ (2 marks)

QUESTION TWO (20 MARKS)

a) The demand component of a market model is given by the following quadratic function $P = Q^2 - 6Q + 7$ and the supply component is also given as $P = Q^2 + 3Q + 2$.
Find;

   i) The equilibrium price in the market (2 marks)

   ii) The equilibrium quantity in the market (2 marks)

b) Find the derivatives of z with respect to U given the following functions: $z = x^2y^3 - y^2$;
$x = u - u^3$ (6 marks)

c) Find the intersection of the following sets:

   i) $A = \{4,1,7,0,3,6\}$ $B = \{4,3,0\}$ (2 marks)

   ii) $A = \{2,3,1,8\}$ $B = \{4\}$ (2 marks)

d) Compute the following logarithms function

   i) $\log_5 (25)^{\frac{1}{2}}$ (2 marks)

   ii) $\log_5 (\sqrt{5^{10}})(5^{-2})$ (2 marks)

e) Evaluate $\lim\limits_{x \to 1} \frac{x-1}{x^3-1}$ (2 marks)

QUESTION THREE (20 MARKS)

a) Consider the following national income model for an economy with no external trade.

$Y = C + I + G$ $G = 40$
$C = 120 + 0.8Y$
$I = 70$

   i) Find equilibrium income (4 marks)

   ii) Find equilibrium consumption. (4 marks)

b) Find the nature of the turning points on $y = x^3 - 3x^2 + 2$, hence sketch the curve (7 marks)

c) A particle moves from point A so that after t seconds it is S meters from A.

   where $S = 8t - t^2$.   Find the velocity when $t = 0, t = 4 \text{ and } t = 5$ (5 marks)

QUESTION FOUR (20 MARKS)

a) Given that $f(x) = 2^x, \quad g(x) = x + 3 \quad and \quad h(x) = x^2$, obtain

    i) $fog(x)$ (2 marks)

    ii) $(goh(x))^{-1}$ (3 marks)

    iii) $(goh(7))^{-1}$ (2 marks)

b) Given;

    i) $f'(x) = \frac{x^4 - x^2 + 1}{x^2}$. Find $f(x)$ (3 marks)

    ii) $f'(x) = 6x^2 + 6x - 4 \ and \ f(1) = 3. \ Find \ f(x)$ (3 marks)

c) Integrate $\int (3s + 4)ds$ (2 marks)

d) The second term of the geometric progression series is 6 and the sum of 5th term is 48.

    i) Find the geometric progression   (3 marks)

    ii) Find the sum of 10 terms   (2 marks)

QUESTION FIVE (20 MARKS)

Find the sum of the series $0.3 + 0.6 + 0.9 + \ldots + 3.3$ (3 marks)

a) Find the sum to infinity of the series $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{16} + \cdots$ (4 marks)

b) The $1^{st}, 3^{rd}, and \ 5^{th}$ terms of a GP form the 1st 3 consecutive term of an AP. Obtain the 10th term of the AP given that the 1st term of the AP is 3   (5 marks)

c) Given $y = x^3 - 12x^2 + 36x + 8$

    i)   determine the critical value for the function   (3 marks)

    ii) find out whether the critical value constitutes a maximum   (5 marks)