KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR
FIRST YEAR, FIRST SEMESTER EXAMINATION
FOR THE BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY
KMA 2110 MATHEMATICS FOR INFORMATION TECHNOLOGY

Date: 14TH AUGUST 2024

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Time: 8:30AM – 10:30AM
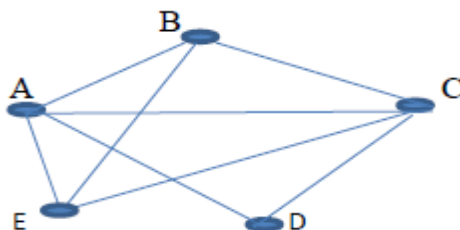
INSTRUCTIONS TO CANDIDATES
ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS
QUESTION ONE (30 MARKS)

a) Given the following sets $A = \{1,2,3,4, 9\}$ and B = $\{3, 4, 5, 6, 7\}$ and C=$\{2, 3, 8, 9\}$. Find

i.	$A \cup B$		**(1 Mark)**
ii.	$A \cap C$		**(1 Mark)**
iii.	$A - B$		**(1 Mark)**
iv.	$C - B$		**(1 Mark)**

b) Consider the graph given below.
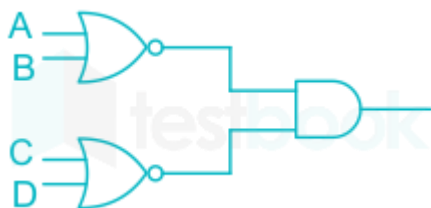

i)	Describe G formally.	**(2 Marks)**
ii)	Find the degree of each edge.	**(2 Marks)**
iii)	State and verify the Handshaking Lemma for this graph.	**(2 Marks)**

c) Find the derivative of the following functions:

i)	$y = e^{\cos 3x}$	**(2 Marks)**
ii)	$y = \frac{2x+1}{x^2+1}$	**(2 Marks)**
iii)	$y = \sin 2x^2$	**(2 Marks)**

d) Write the algebraic expression for the following logic gate diagram

(2 Marks)

e) Draw the graph corresponding to the adjacency matrix is $A = \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 0 & 2 & 1 \\ 0 & 2 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix}$. **(3 Marks)**

f) In a group of 50 people, two tests were conducted, one for diabetes and one for blood pressure. 30 people were diagonised with diabetes and 40 were diagonised with high blood pressure. What is the number of people who were having diabetes and high blood pressure.

(4 Marks)

g) Evaluate the following integrals:

    i) $\int (2x^3 + 6x - 4)dx$ **(2 Marks)**

    ii) $\int_{-1}^{2}(5x^4 + 2)dx$ **(3 Marks)**

QUESTION TWO (20 MARKS)

a) Among a group of 120 students, 50 played cricket, 50 played hockey and 40 played volley ball. 15 played both cricket and hockey, 20 played both hockey and volley ball, 15 played cricket and volley ball and 10 played all three.

    i)   Draw a Venn diagram to represent this information   **(4 Marks)**

    ii)   Determine the number of students who did not play any of the three games.   **(2 Marks)**

    iii) Determine the number of students who played exactly one of the three games.   **(2 Marks)**

    iv) Determine the number of students who played exactly two of the three games.   **(2 Marks)**

b) Find the derivatives of the following functions:

    i) $y = e^x(2x^2 + 1)$ **(2 Marks)**

    ii) $y = \ln(x^2 + 2)$ **(2 Marks)**

    iii) $y = 5x^3 \sin x$ **(2 Marks)**

c) Using a Venn diagram, shade the region represented by the following sets;

    i) $A^c \cap (B \cup C)$ **(2 Marks)**

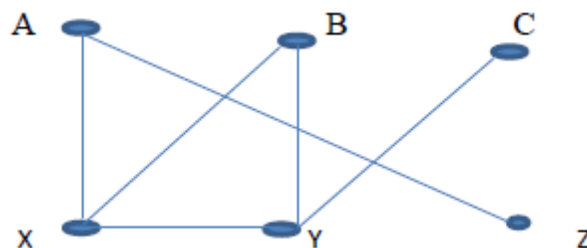   ii) $A - (B \cup C)$ and comment on the result with (i).   **(3 Marks)**

QUESTION THREE (20 MARKS)

a) Draw the graphs having the following matrices as its adjacency matrices:

    i) $A = \begin{bmatrix} 0 & 0 & 3 & 0 \\ 5 & 0 & 1 & 7 \\ 2 & 0 & 0 & 4 \\ 0 & 6 & 8 & 0 \end{bmatrix}.$ **(4 Marks)**

    ii) $A = \begin{bmatrix} 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}.$ **(4 Marks)**

b) Let G be the graph given below.

Find:

    i)   All simple paths from vertex A to C.   **(2 Marks)**

    ii)   All cycles in graph G.   **(2 Marks)**

    iii) Subgraph H generated by {B, C , X, Y}.   **(2 Marks)**

iv)   G-Y   (2 Marks)
v)   All bridges in graph G.   (2 Marks)
vi)   All cut points in graph G   (2 Marks)
vii) Diam (G), the diameter of G.   (2 Marks)
viii) Distance from A to C   (2 Marks)

QUESTION FOUR (20 MARKS)

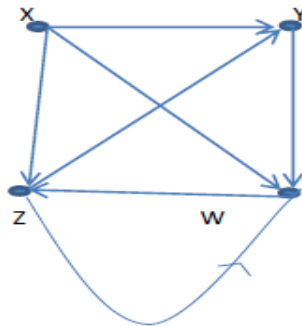a)   Find the derivatives of the following function:
     i. $f(x) = e^{2x} \sin 3x$ (2 Marks)
     ii. $y = (x^3 + 1)(x^2 + 2x - 3)$ (2 Marks)
     iii. $y = \dfrac{\sin x + 4}{1 + \cos x}$ (3 Marks)

b)   Let G be the directed graph shown below.

    i)   Describe G formally.   (2 Marks)
    ii)   All simple paths from X to Z.   (2 Marks)
    iii) All cycles in graph G.   (2 Marks)
    iv)   Subgraph H generated by {,X, Y, Z}.   (2 Marks)
    v)   The in-degree and out-degree of each vertex of G.   (2 Marks)
    vi)   Are there any sources or sinks in graph G?   (2 Marks)

QUESTION FIVE (20 MARKS)

a)   Evaluate the following integrals
    i) $\int \dfrac{5x^4 - 1}{(x^5 - x + 1)} dx$ (3 Marks)
    ii) $\int (x^3 - 6x + 4) dx$ (2 Marks)
    iii) $\int x e^{x^2 - 5} dx$ (3 Marks)
    iv) $\int (3x + 1)^3 dx$ (3 Marks)
    v) $\int \cos 5x \ dx$ (3 Marks)

b)   (i). Create a logic gate for the following algebraic expression
$$\sim (A \wedge B) \vee \sim C.$$ (3 Marks)

   (ii). hence create its truth table.   (3 Marks)