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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY UNIVERSITY EXAMINATIONS, 2024/2025 ACADEMIC YEAR FIRST YEAR, SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN MATHEMATICS

KMA 2110: MATHEMATICS FOR INFROMATION TECHNOLOGY DATE: DECEMBER 2024 Time:

<u>INSTRUCTIONS TO CANDIDATES</u> ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE: COMPULSORY (30 MARKS)

- a) Given the following sets $A = \{4,5,7,8\}$ and $B = \{4,5,9\}$ and $C = \{1,4,6,9\}$. Verify that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ (3 Marks)
- b) Consider the graph given below.



	i.	Describe G formally.	(3 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.	$y = (6x^3 - 4x)^3$	(3 Marks)
	ii.	$y = \frac{e^{2x}}{\tan x}$	(3 Marks)
	iii.	$y = (3x + 4)\cos 8x$	(3 Marks)
d)	Find the	output of the following network:	(3 Marks)
e)	Draw the	graph G represented by the adjacency matrix is $A = \begin{bmatrix} 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$.	(4 Marks)

f) A computer company must hire 20 programmers to handle programming jobs and 30 programmers for applications programming. Of these hired, 5 are expected to perform jobs of both types. How many programmers must be hired? (4 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.
 - Draw a Venn diagram to represent this information (4 marks) i.
 - ii. Determine the number of students who did not play any of the three games. (2 marks)
 - Determine the number of students who played exactly one of the three games. (2 marks) iii.
 - Determine the number of students who played exactly one of the three games. (2 marks) iv.
- b) Let G be the graph given below.



i.	Subgraph H generated by $\{B, C, E, F\}$.	(2 Marks)
ii.	All bridges in graph G.	(2 Marks)
iii.	All cut points in graph G	(2 Marks)
iv.	Diam (G), the diameter of G.	(2 Marks)
v.	Distance from A to C	(2 Marks)

v. Distance from A to C

QUESTION THREE: (20 MARKS)

a. Draw the graphs having the following matrices as its adjacency matrices.

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

b. Let G be the graph given below.



Find:

- i. Find two simple paths from A to F (2 Marks) ii. All cycles in graph G. (3 Marks) Subgraph H generated by $\{A, E, F\}$. iii.
- iv. Are there any sources or sinks of graph G?

- (2 Marks)
- (3 Marks)

QUESTION FOUR: (20 MARKS)

a) Use truth table to prove that (A + B). (A + C) = A + (B, C). (4 Marks) b) Find the output of the following networks: A٠ в i. (2 Marks) С В Q ii. (4 Marks) c) Create the truth table for the following logic gate diagram. А в С (3 Marks)

d) Find the derivatives of the following function:

 $f(x) = e^{2x}(6x + 1)$ $y = (x^2 - 9) \sin 3x$ i. (2 Marks) ii. (3 Marks) $y = \frac{x^4 - 3x + 6}{2 + 3x^3}$ iii. (2 Marks)

QUESTION FIVE: (20 MARKS)

a) Evaluate the following integrals

i.
$$\int \frac{6x^5 - 1}{(x^6 - x + 1)} dx$$
 (3 Marks)
ii. $\int (x^3 - 6x)(2x + 2) dx$ (3 Marks)

iii
$$\int (x^2 - 6x)(2x + 5)ux$$
 (5 Marks)
iii $\int (3x^2 e^{x^3 - 8} dx)$ (3 Marks)

iv.
$$\int x^2 (2x^3 + 4)^3 dx$$
 (3 Marks)

$$\frac{1}{\sqrt{2x}} \int \frac{2x \cos x^2}{x^2} dx$$
 (3 Marks)

b) Obtain the adjacency matrix representing the graph given below.



(5 Marks)