UGANDA INSTITUTE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

END OF SEMESTER ONE EXAMINATIONS

ACADEMIC YEAR 2025/2026

DEPARTMENT:	**ICT**
YEAR OF STUDY:	**ONE**
PROGRAMME:	**DIPLOMA IN SOFTWARE ENGINEERING (DSWE)**
COURSE:	**APPLIED MATHEMATICS FOR SOFTWARE ENGINEERING**
COURSE CODE:	**CMT1102**
DATE:	**THURSDAY 11TH DECEMBER, 2025**
TIME:	**09:00 AM – 12:00 NOON**
DURATION:	**3 HOURS**

INSTRUCTIONS:

(a) **This paper consists of two sections A and B**

(b) **Section A carry 40 marks and is compulsory**

(c) **Attempt any THREE questions from section B**

(d) **Any number in section B carry equal marks**

(e) **Credit will be given for use of relevant examples and illustrations**

(f) **Begin each number on a new page of the answer sheet**

SECTION A [40 MARKS]
Attempt ALL the Questions in this section.
Question 1

(a) Convert :

(i) FA5 hexadecimal to binary **(4 marks)**

(ii) 672355 octal to hexadecimal **(4 marks)**

(iii) 1011.011 binary to decimal **(4 marks)**

(b) Using the 2's complement method, perform the binary subtraction:

1011001 – 010110 **(4 marks)**

(c) With reference to graph theory, define the following terms:

(i) Simple Graph **(2 marks)**

(ii) Path **(2 marks)**

(iii) Empty Graph **(2 marks)**

(d) A graphics designer wants to scale an image of a triangle by a factor of 3, and then rotate it by 90 degrees counter-clockwise. The original coordinates of the vertices of the triangle are given by the following vectors: A: (3, 2), B: (4, 5) and C: (2, 5)

(i) What is the composite matrix to perform this transformation? **(6 marks)**

(ii) What are the new coordinates of the triangle's vertices after the transformations? **(4 marks)**

(e) Universal set $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$,

$A = \{x/x\ is\ an\ odd\ number, 0 < x < 10\}$

$B = \{x/x\ is\ a\ prime\ number, 0 < x < 10\}$

Find A – B. **(4 marks)**

(f) Given $f(x) = 3x - 4$ and $g(x) = x^2 - 3$. Find $g(f(x))$. **(4 marks)**

SECTION B [60 MARKS]
Attempt Only Three Questions in this section.

Question 2

(a) What is meant by "**contradiction",** with reference to propositional logic? **(2 marks)**

(b) Show whether the propositions **(¬ p ∨ q) ∧ (p ∧ (p ∧ q))** and **(p ∧ q)** are logically equivalent. **(6 marks)**

(c) Given two variables, p and q, draw truth table for:

(i) p **AND** q **(4 marks)**

(ii) p **EXCLUSIVE** q **(4 marks)**

(iii) **IF** p **THEN** q **(4 marks)**

Question 3

Given matrix A = $\begin{bmatrix} 2 & 0 & 1 \\ -1 & 4 & -1 \\ -1 & 2 & 0 \end{bmatrix}$. Find the:

(a) Eigen-Values for matrix A **(10 marks)**

(b) Eigen-Vectors for matrix A **(10 marks)**

Question 4

(a) Universal set $U = \{1, 2, 3, 4, 5, 6, 7, 8\}$; $T = \{2, 5\}$ and $V = \{1, 2, 3, 7, 8\}$.
Find and write out the set corresponding to $(V \cap T^c)^c$ **(5 marks)**

(b) Universal set $U = \{1, 2, 3, 4, 5, 6, 7\}$; $S = \{2, 4, 5\}, T = \{3, 5, 7\}$,
$V = \{2, 3, 4, 5, 7\}$ and $W = \{1, 2, 3, 4, 6\}$.
Find and write out the set corresponding to $(S \cap V)^c \cup (W^c \cup T)$ **(5 marks)**

(c) 50 students were asked whether they liked football (F), volleyball (V) or basketball (B). 8 students liked football and volleyball, 11 students liked basketball and volleyball, 19 students liked football and basketball, 6 students liked basketball only, 7 students liked football only and 8 students liked volleyball only. If 3 students did not like any of these sports:

(i) How many students liked all 3 sports? **(5 marks)**

(ii) Represent this information in a Venn diagram **(5 marks)**

Question 5

Given the following vertex set V = {a, b, c, d} and edge set E = {ab, ac, bd, cb, cd} for undirected graph:

(a) Construct the corresponding adjacency matrix for this graph. **(4 marks)**

(b) Using the above adjacency matrix,

(i) Find the degree of each vertex in this graph **(4 marks)**

(ii) How many walks of length 2 exist from Edge a to Edge c **(6 marks)**

(iii) How many walks of length 2 exist from Edge a to Edge d **(6 marks)**

Question 6

(a) A theater has 25 rows of seats; the first row closest to the stage has 28 seats. Each subsequent row has 3 more seats than the row in front of it.

(i) How many seats are in the last row - the 25th row? **(4 marks)**

(ii) What is the total seating capacity of the theater? **(4 marks)**

(b) Given the following simultaneous equations:

$x + 2y + 2z = 5$

$3x – 2y + z = - 6$

$2x + y – z = - 1$

(i) Write these equations in the form $Ax = b$ **(2 marks)**

(ii) Find the inverse of matrix A obtained above **(6 marks)**

(iii) Find the values of x, y and z that satisfy these equations **(4 marks)**

END