Kasarani Campus
Off Thika Road
Tel. 2042692 / 3
P. O. Box 49274, 00100
NAIROBI
Westlands Campus
Pamstech House
Woodvale Grove
Tel. 4442212
Fax: 4444175

KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2022/2023 ACADEMIC YEAR
FOURTH YEAR, FIRST SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF BUSINESS INFORMATION TECHNOLOGY

Date: 20th April, 2022
Time: 11.30am – 1.00pm

KMA 2406 - NUMERICAL METHODS

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

a) Construct an algorithm making use of the Newton Raphson method to find the square root of a positive number N. Hence find $\sqrt{12}$ correct to three decimal places.

(3 Marks)

b) Prove the following results:

(i) $\Delta = \frac{\delta^2}{2} + \delta\sqrt{1+\frac{\delta^2}{4}}$ (3 Marks)

(ii) $\mu\sigma = \frac{\Delta E^{-1}}{2} + \frac{\Delta}{2}$

(3 Marks)

c) Use false position method to find the smallest positive root to the equation $x^3 + 2x - 4 = 0$ correct to 4 decimal places. (3 Marks)

d) Given the following data, evaluate f(4) using Lagrange's interpolating polynomial

x	-1	0	2	3
f(x)	-8	3	1	12

(4 Marks)

e) Find the solution to the following systems of equations using row reduction method.

$$4x - y - z = 3$$
$$-2x + 6y + z = 9$$
$$-x + y + 7z = -6$$

(3 Marks)

f) Find the first and derivative of f(x) at x=1.5 if

x	1	1.2	1.4	1.6	1.8	2
f(x)	0	0.128	0.544	1.296	2.432	4

(3 Marks)

g) The sales for company A for the last five years are given in the table below. Estimate the sales for the year 1979.

Year	1974	1976	1978	1980	1982
Sales (in $)	40	43	48	52	57

(4 Marks)

h)

x	1.5	2.0	2.5	3.0	3.5	4.0
f(x)	3.375	7	13.625	24	38.875	59

Use trapezoidal rule to evaluate $\int_1^2 \frac{1}{x^2}\, dx$ when $n = 5$. (4 marks)

QUESTION TWO (20 MARKS)

a) Find the Newton-Gregory backward difference interpolating polynomial for the following data:

x	1.0	1.2	1.4	1.6	1.8	2.0
f(x)	0	0.128	0.544	1.296	2.432	4

(8 marks)

b) Find the solution to the following systems of equations using Gauss Seidel method up to the fourth iteration.

$$4x - y - z = 3$$
$$-2x + 6y + z = 9$$
$$-x + y + 7z = -6$$

(12 marks)

QUESTION THREE (20 MARKS)

a) Evaluate f(3.2) given the following table of values:

(7 Marks)

b) For what values of x,y is maximum from the following data:

x	-1	0	1	2
f(x)	5	1	1	11

(8 Marks)

Use false position method to find the smallest positive root to the equation $x^2 - 2x - 1 = 0$ correct to four decimal places.

(5 Marks)

QUESTION FOUR (20 MARKS)

a) A rod is rotating in a plane. The following table gives the angle θ (in radians) through which the rod has turned for various values of t (seconds). Calculate the angular velocity of the rod at t=0.7 seconds.

t	0	0.2	0.4	0.6	0.8	1.0
θ	0	0.12	0.49	1.12	2.02	3.20

(8 Marks)

b) Find and correct a single error in y in the following table

X	0	1	2	3	4	5	6	7
f(x)	0	0	1	6	24	60	120	210

(6 Marks)

c) A missile is launched from the ground station. The acceleration during the first 80 seconds of flight is recorded as given below.

t(s)	0	10	20	30	40	50	60	70	80

a(m/s^2)	30	33.63	34.34	35.47	37.75	39.33	43.25	46.69	51.67

Compute the velocity of the missile using Simpson's $\frac{1}{3} - rule$.

(6 Marks)

QUESTION FIVE (20 MARKS)

a) Express in the form LU the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 2 & -1 & 3 \\ 3 & 1 & -1 \end{bmatrix}$ where L is lower triangular with unit elements on its diagonal and U is upper triangular. Use this to solve the simultaneous equations

$$x + y + z = 3$$
$$2x - y + 3z = 16$$
$$3x + y - z = -3$$

(12 Marks)

b) i) Write down the Lagrange polynomial which fits the points $(3, 168),\ (7,\ 120),\ (9,\ 72),\ \ (10,\ 63)$.

(6 Marks)

ii) Use it to interpolate the values of y at $x = 8$.

(2 Marks)