KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2023/2024 ACADEMIC YEAR
THIRD YEAR, FIRST SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE
(MATHEMATICS)

Date: 13th December, 2023
Time: 8.30am – 10.30am

KMA 301 - NUMERICAL ANALYSIS 1

INSTRUCTIONS TO CANDIDATES

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

QUESTION ONE (30 MARKS)

a)   Construct a forward difference table for the following data

x	5	10	15	20	25	30
f(x)	9962	9848	9659	9397	9063	8660

(2 Marks)

b)   Evaluate $\sqrt{12}$ using Newton Raphson method correct to 4 decimal places.

(3 Marks)

c)   Prove the following results:

i) $\left(E^{\frac{1}{2}} + E^{\frac{-1}{2}}\right)(1 + \Delta)^{\frac{1}{2}} = 2 + \Delta$ (3 Marks)

ii) $E\nabla = \nabla E = \Delta$

(2 Marks)

iii) $\Delta = E - 1$

(2 Marks)

d)   Find the root of the equation $x^3 - x - 1 = 0$ correct to 3 decimal places using bisection method

(3 Marks)

e)   Solve the following systems of equations using Gauss elimination method

$$2x + 3y - z = 5$$
$$4x + 4y - 3z = 3$$
$$2x - 3y + 2z = 2$$

(3 Marks)

f)   The table given below shows the velocity v of a body during the time t. Find its acceleration at t=1.1.

t	1.0	1.1	1.2	1.3	1.4
v	43.1	47.7	52.1	56.4	60.8

(4 Marks)

g)   Construct a divided difference table for the following data

x	1	2	4	7	12
f(x)	22	30	82	106	216

x	1	3	4
y	1	27	64

(2 Marks)

h)   Use trapezoidal rule to evaluate $\int_0^1 \frac{1}{1+x}\, dx$ given h= 0.125.

(3 Marks)

i)   Applying Lagrange's formula to obtain the unique polynomial for the following data

(3 Marks)

QUESTION TWO (20 MARKS)

a)   Use Newton divided fifference interpolation formula to evaluate f(6) from the given data

x	1	2	7	8
f(x)	1	5	5	4

(6 Marks)

b)   Obtain the first four iterations solutions of the following systems of equations using Jacobi 's method.

$$10x + y - 2z = 7.74$$
$$x + 12y + 3 = 39.66$$
$$3x + 4y + 15z = 54.8$$

(8 Marks)

c)   Find the real root of the equation $x^2 - 5x + 2 = 0$ using Newton Raphson method correct to three decimal places.   (6 Marks)

QUESTION THREE (20 MARKS)

a)   Locate and correct the error in the following
        $1, 2, 4, 8, 16, 26, 42, 64, 93$

(6 Marks)

b)   Use Simpson's rule to evaluate $\int_0^6 \frac{dx}{(1+x)^2}$ given the spacing of the values of x is 1

(6 Marks)

c)   Using Newton's backward difference interpolation formula, find the population for the year 2012.

Year	1972	1982	1992	2002
Population (in millions)	12	15	20	27

(8 Marks)

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QUESTION FOUR (20 MARKS)

a)   Locate and correct the error in the following data

x	1	2	3	4	5	6	7
y	2	5	10	18	26	37	50

(6 Marks)

b)   Applying Newton's divided difference formula to find the value of f(8) given the following data:

x	1	3	6	10	11
y	3	31	223	1011	1343

(6 Marks)

c)   Find $\dfrac{dy}{dx}$ and $\dfrac{d^2y}{dx^2}$ at x=50 from the following data

x	50	51	52	53	54	55	56
y	3.6840	3.7084	3.7325	3.7563	3.7798	3.8030	3.8259

(8 Marks)

QUESTION FIVE (20 MARKS)

a)   Use Newton's forward difference formula to obtain the polynomial satisfying the following data:

x	0	1	2	3
y	1	0	1	10

(7 Marks)

b)   Find the real root of the equation $x^3 - 2x - 5 = 0$ using Regula falsi method.

(6 Marks)

c)   In an examination, the number of candidates who obtained Marks between certain limits are as follows;

Marks	0-40	40-45	45-50	50-55	55-60	60-65
No. of Candidates	210	43	54	74	32	79

Find the number of candidates who secured more than 45 but less than 48 Marks.

(7 Marks)