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

KMA 301 NUMERICAL ANALYSIS I

Date: 12TH AUGUST, 2024 Time: 2:30 PM – 4:30 PM

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

QUESTION ONE: COMPULSORY (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 (4 Marks)

Х	-1	0	2	3
f(x)	-8	3	1	12

e) Find the solution to the following systems of equations using row reduction method. (3 Marks)

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

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				()			
f(x) 0 0.128 0.544 1.296 2.432 4	Х	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.(4 Marks)

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

h) 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:

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

(8 Marks)

(7 Marks)

b)Find the solution to the following systems of equations using Gauss Seidel method up to the fourth iteration. (12 Marks)



QUESTION THREE: (20 MARKS)

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

	, .	. 0	0					
	Х	1.5	2.0	2.5	3.0	3.5	4.0	
	f(x)	3.375	7	13.625	24	38.875	59	
ł) For what val	(8)	Marks)					

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

Х	-1	0	1	2
f(x)	5	1	1	11

c) 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. (8 Marks)

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

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

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

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 $\frac{1}{2}$ - rule.

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 (12 Marks)

$$x + y + z = 3$$

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

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

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

> (6 Marks) (2 Marks)

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

(6 Marks)

(6 Marks)