ALUPE UNIVERSITY

OFFICE OF THE DEPUTY VICE CHANCELLOR

ACADEMICS, RESEARCH AND STUDENTS AFFAIRS

UNIVERSITY EXAMINATIONS

2024/2025 ACADEMIC YEAR,

SECOND SEMESTER THIRD YEAR MAIN EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: MAT 317
COURSE TITLE: NUMERICAL ANALYSIS

DATE: TUESDAY, 8TH APRIL, 2025 TIME:2-5 PM

Instruction to the candidates:

Answer all questions in section ***A (COMPULSORY)*** *and any other* ***THREE*** *questions section B*

Do not write on this question paper

Time: 3 hours

This paper consists of 4 printed pages. Please turn over.

SECTION A: Answer ALL the questions in this section

QUESTION ONE - 16 MARKS

(a) Solve the following system of equations using the Gaussian elimination method **[5 marks]**

$$\begin{aligned} x_1 + 2x_2 + x_3 &= 0 \\ 2x_1 + 2x_2 + 3x_3 &= 3 \\ -x_1 - 3x_2 &= 0 \end{aligned} \tag{1}$$

(b) Solve the given system of linear equations by the LU decomposition method **[5 marks]**

$$\begin{aligned} 4x + 3y &= 1 \\ 6x + 3y &= 2 \end{aligned} \tag{2}$$

(c) Using the Lagrange's formula, find f(0.4) for the table below

x	0.3	0.5	0.6
f(x)	0.01	0.69	0.72

[3 marks]

(d) Compute $\int_0^4 x^3 - 2x + 1dx$ using the Simpson's one third rule taking h=1 **[3 marks]**

QUESTION TWO - 15 MARKS

(a) Prove that $\Delta\{\frac{f(x)}{g(x)}\} = \frac{g(x)\Delta f(x) - f(x)\Delta g(x}{g(x)g(x+h)}$ **[5 marks]**

(b) Using the fixed point iteration method, find the approximate root of the $x^2 - 2x - 3$ upto x_4 with 6dp upto x_4 **[5 marks]**

(c) Find the 7th term of the sequence 2,9,28,66,126,217. Find also the 7th term. **[5 marks]**

SECTION B: Answer any THREE questions from this section

QUESTION THREE - 13 MARKS

(a) Compute the values of $y'(0), y''(0), y'(0.02), y''(0.02)$ for the function $y = f(x)$ given the following tabular values **[8 marks**

x	0.0	0.05	0.10	0.15	0.20	0.25
y	0.00000	0.10017	0.20134	0.30452	0.41075	0.52110

[3 marks]

(b) Solve the following system of equations by the triangularization method

$$\begin{aligned} 1x + 5y + z &= 14 \\ 2x + y + 3z &= 13 \\ 3x + y + 4z &= 17 \end{aligned} \tag{3}$$

[5 marks]

QUESTION FOUR - 13 MARKS

(a) Evaluate the following integral $\int_0^1 (4x - 3x^2)dx$ by taking n=10 using

i trapezoidal rule

ii simspson's one third rule also compare them with the exact value and find the error in each case **[7 marks]**

(b) Given the table of values y=f(x) form the diagonal difference table and hence find the values of $\Delta f(5)$, $\Delta^2 f(3), \Delta^3 f(1)$

x	1	3	5	7	9
f(x)	8	12	21	36	62

[6 marks]

QUESTION FIVE - 13 MARKS

(a) Solve the following system of equations using the Gauss siedel iteration method upto three significant figures. Let $x_1 = 1.5, x_2 = 2, x_3 = 3$

$$\begin{aligned} 20x_1 + 2x_2 + x_3 &= 30 \\ x_1 - 40x_2 + 3x_3 &= -75 \\ 2x_1 - x_2 + 10x_3 &= 30 \end{aligned} \tag{4}$$

[6 marks]

(b) Solve the following equation using the Newton-Raphson Method, $2x^3 - 3x - 6 = 0$, $x_0 = 2$ upto x_4 **[7 marks]**

QUESTION SIX - 13 MARKS

(a) Using the following table, estimate the number of students whose weight lies between 45 and 50. (Hint; use the cumulative frequency)

weight in Kg	35-45	45-55	55-65	65-75	75-85
students	20	45	35	12	10

[6 marks]

(b) Find the unique polynomial P(x) of degree 2 such that P(1)=1, P(3)=27, P(4)=64, using the Lagrange's method of interpolation **[4 marks]**

(c) Convert 0.59375_{10} to a binary number via octal **[3 marks]**

QUESTION SEVEN - 13 MARKS

a Determine the interpolating polynomial of degree three for the table given below

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

[6 marks]

b Use the method of least square approximation to fit a straight line to the following observed data

x_i	60	61	62	63	64
y_i	40	42	48	52	55

[7 marks]