



KARATINA UNIVERSITY

UNIVERSITY EXAMINATIONS

2023/2024 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER

SUPPLEMENTARY/SPECIAL EXAMINATIONS

FOR THE DEGREE OF:

BACHELOR OF SCIENCE (P102,P103,P106,P107)

AND BACHELOR OF EDUCATION (E101)

COURSE CODE: MAT 317

COURSE TITLE: NUMERICAL ANALYSIS I

DATE: 17th JULY, 2024

TIME: 9:00AM -11:00 AM

Instructions: See Inside

Answer **all** questions in section **A** and any other **two** from section **B**.

SECTION A

Answer **all** questions from this section

QUESTION ONE (30 MARKS)

- (a) Compute the hexadecimal equivalent of the decimal number $(2655)_{10}$. [4 Marks]
- (b) A slider in a machine moves along a fixed straight line. its distance is x metres along the rod are given in the following table for the various values of time t in seconds

t(seconds)	1	2	3	4	5	6
x(metres)	0.0201	0.0844	0.3444	1.0100	2.3660	4.7719

Compute its velocity and acceleration

[8 Marks]

- (c) Determine the maximum relative error for the function

$$F = 3x^2y^2 + 5y^2z^2 - 7x^2z^2 + 38$$

for

$$x = y = z = 1, \quad \delta x = -0.05, \quad \Delta y = 0.001 \quad \Delta z = 0.02$$

[6 Marks]

- (d) Construct the forward difference table for the set of data given

x	1	2	3	4	5
y=f(x)	4	6	9	12	17

[6 Marks]

- (e) Using the method of Regula falsi, find the real roots of the equation

$$x^4 - 11x + 8 = 0 \quad \text{accurate to 4dp}$$

[6 Marks]

SECTION B

Answer **any TWO** questions from this section

QUESTION TWO (20 MARKS)

- (a) Using Gauss Seidel iterative method with $x = y = z = 0$ as the initial values solve

$$8x + 2y - 2z = 8$$

$$x - 8y + 3z = -4$$

$$2x + y + 9z = 12$$

[5 Marks]

- (b) Obtain the missing entry in the following table

x	0	1	2	3	4	5
y	1	3	11	-	189	491

[5 Marks]

- (c) Compute and interpret the condition number for

$$f(x) = \sin x \quad \text{for } a = 0.51\pi$$

[5 Marks]

- (d) Evaluate $\sqrt{29}$ correct to 5 d.p. near **5.3** using Newton-Raphson formula

[5 Marks]

QUESTION THREE (20 MARKS)

- (a) From the following table, find the area bounded by the curve $y = f(x)$ and the x-axis from $x = 7.47$ to $x = 7.52$ using trapezoidal rule taking $h = 0.001$

x	7.47	7.48	7.49	7.50	7.51	7.52
y	1.93	1.93	1.98	2.01	2.03	2.06

[5 Marks]

- (b) Given that

$$\int_0^{\frac{1}{2}} e^{x^2} dx = 0.544987104184$$

Determine the accuracy of the approximation obtained by replacing the integrand

$$f(x) = e^{x^2} = 1 + x^2 + \frac{x^4}{2!} + \frac{x^6}{3!} + \frac{x^8}{4!} \cdots \frac{x^{2n}}{n!}$$

with a truncated Taylor series correct to 7 decimal places

[7 marks]

- (c) Determine the volume of a solid of revolution is formed by rotating a curve about x-axis. The area between the x-axis and the line $x = 0$ and $x = 1$ and a curve passes through the points with the following coordinates

[8 Marks]

QUESTION FOUR (20 MARKS)

- (a) Use Lagrange interpolation formula determine $f(10)$ from the given table

x	5	6	9	11
f(x)	12	13	14	16

[10 Marks]

- (b) Using Newton's divided difference formula, determine $f'(6)$

x	0	2	3	4	7	9
y=f(x)	4	26	58	112	466	922

[10 marks]

QUESTION FIVE (20 MARKS)

- (a) Solve the following system of linear equation using Gauss Jacobi's Iteration Method

$$15x + 3y - 2z = 85$$

$$2x + 10y + z = 51$$

$$x - 2y + 8z = 5$$

[8 Marks]

- (b) By Newton's forward interpolation formula, find the value of $\cos 51^\circ$ and estimate the error from the following set of data

x	45°	50°	55°	60°
$f(x)=\cos x$	0.7071	0.6428	0.5736	0.5000

[6 Marks]

- (c) The following is a table of values of a polynomial degree. If it is given that $f(3)$ is in error, correct the error

x	0	1	2	3	4	5	6
f(x)	1	2	33	254	1054	3126	7777

[6 Marks]