KARATINA UNIVERSITY

UNIVERSITY EXAMINATIONS

2024/2025 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER REGULAR

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: 18th DECEMBER, 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 $(2745)_{10}$. **[3 Marks]**

(b) Evaluate $\sqrt{42}$ correct to 5 dp using Newton-Raphson formula **[6 Marks]**

(c) 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

[6 Marks]

(d) 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]

(e) 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

[3 Marks]

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

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

[6 Marks]

Answer **any TWO** questions from this section

QUESTION TWO (20 MARKS)

(a) Obtain the missing entry in the following table

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

.   [5 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) 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

[7 Marks]

QUESTION THREE (20 MARKS)

(a) Given

$$\sqrt{15500} = 124.4990, \quad \sqrt{15510} = 124.5392, \quad \sqrt{15520} = 124.5793$$

and $\sqrt{15530} = 124.6194.$ Find the value of $\sqrt{15516}$ [9 Marks]

(b) Compute and interpret the condition number for

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

[5 marks]

(c) 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

x	0.00	0.25	0.50	0.75	1.00
y	1.0000	0.9896	0.9589	0.9089	0.8415

Using Simpson's third rule, determine the volume of a solid of revolution formed by rotating a curve about x-axis. **[6 marks]**

QUESTION FOUR (20 MARKS)

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

$$15x + 3y - 2z = 85$$
$$2x + 10y + z = 51$$
$$x - 2y + 8z = 5$$

[10 Marks]

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

$$8x + 2y - 2z = 8$$
$$x - 8y + 3z = -4$$
$$2x + y + 9z = 12$$

[10 marks]

QUESTION FIVE (20 MARKS)

(a) Compute the root of the equation

$$x^3 - 4x - 8.95 = 0$$

accurate to 3 decimal places using Bisection method $\qquad$ **[7 Marks]**

(b) The following is a table of values of a polynomial. 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

[5 Marks]

(c) 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

$$P_5(x) = 1 + x^2 + \frac{x^4}{2!} + \frac{x^6}{3!} + \frac{x^8}{4!}$$

[8 Marks]