



MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS
ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2023/2024 ACADEMIC YEAR

..... YEAR **SECOND** SEMESTER EXAMINATION FOR, BACHELOR OF
SCIENCE IN

EES 308– NUMERICAL METHODS FOR ENGINEERS

DURATION: 2 HOURS

Instructions to candidates:

1. Answer question One and Any Other Two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

- a) Apply the intermediate value theory to show that the function ----- has a root in the interval----- (3marks)
- b) Determine the root of ----- by using the bisection method. Start with $a=0$ and $b=1$, and carry out the first three iterations (5marks)
- c) Solve the following system of equations using the Gauss elimination method. (6marks)
- d) The following data is given

x	1	3	4	6	9	12	14
y	2	4	5	6	7	9	11

Use linear least- squares regression to determine the coefficients of m and b in the function $y=mx+b$ that best fit the data (6marks)

- e) The area of the shaded region shown in the figure can be calculated by -----

Evaluate the integral using the following methods:

- i) Composite Simpson's----- method. Divide the whole interval into four sub intervals (5marks)
- ii) Composite Simpson's ----- method. Divide the whole interval into nine sub intervals. (5marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

- a) Apply the intermediate value theorem to show that the function $f(x) =$ ----- has a root in the interval----- (4marks)
- b) Given the following system of equations ----- determine the unknowns x and y using Cramer's rule. (6marks)
- c) The power generated by a windmill varies with the wind speed. In an experiment, the following five measurements were obtained;

Wind speed(mph)	14	22	30	38	46
Electric power (w)	320	490	540	500	480

Determine the fourth order Newton's interpolating polynomial that passes through the data points. Use the polynomial to calculate the power at a wind speed of 26mph (10marks)

QUESTION THREE (20 MARKS)

- a) Determine the root of $f(x) = \dots$ by using the Newton's method. Start at $x_1=1$ and carry out the first three iterations (3marks)
- b) Solve the following system of equations using the Gauss- Jordan method (8marks)
- c) Given the following data;

x	1.1	1.2	1.3	1.4	1.5
F(x)	0.6133	0.7822	0.9716	1.1814	1.4117

Find the first derivative $f'(x)$ at the point $x=1.3$

- i) Use the three-point forward difference formula
- ii) Use the three-point backward difference formula
- iii) Use the two- point central difference formula (9marks)

QUESTION FOUR (20 MARKS)

- a) The equation \dots has a root between $x=4$ and $x=-5$. Use these values for the initial two points and calculate the next four estimates for the solution using the secant method (5marks)
- b) Apply the power method to find the largest eigenvalue of the matrix from \dots starting with vector \dots (5marks)
- c) The function $f(x)$ is given in the following tabulated form. Compute \dots

x	0	0.3	0.6	0.9	1.2	1.5	1.8
F(x)	0.5	0.6	0.8	1.3	2	3.2	4.8

- i) Use the composite rectangular method (5marks)
- ii) Use the composite trapezoidal method (5marks)