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DMI-ST. EUGENE UNIVERSITY
ZAMBIA

DEGREE EXAMINATION – DECEMBER 2023

Semester: VIII

760EE05 NUMERICAL METHODS

Time: 3:00 Hours

Max. Marks: 100

Answer any FIVE Questions (5 x 20 = 100 Marks)

1. a) Evaluate $\Delta \left[\frac{5x+12}{x^2+5x+6} \right]$ by taking '1' as the interval of differencing. (10 Marks)
b) Given $y_3 = 2, y_4 = -6, y_5 = 8, y_6 = 9$ and $y_7 = 17$. Calculate $\Delta^4 y_3$. (10 Marks)

2. a) Using Langrange's formula, fit a polynomial to the data

x	0	1	3	4
y	-12	0	6	12

Also find y at $x = 2$.

(10 Marks)

- b) Give and prove Newton's divided difference interpolation formula for unequal intervals.

(10 Marks)

3. a) Solve the following system of linear equations, by Gaussian elimination method :

$$4x + 3y + 6z = 25$$

$$x + 5y + 7z = 13$$

$$2x + 9y + z = 1.$$

10 Marks)

- b) The upward speed $v(t)$ of a rocket at time t is approximated by $v(t) = at^2 + bt + c, 0 \leq t \leq 100$ where $a, b,$ and c are constants. It has been found that the speed at times $t = 3, t = 6,$ and $t = 9$ seconds are respectively, 64, 133, and 208 miles per second respectively. Find the speed at time $t = 15$ seconds. (Use Gaussian elimination method.)

(10 Marks)

4. a) Find the first, second and third derivatives of the function tabulated below at the point $x = 1.5$.

x	1.5	2.0	2.5	3.0	3.5	4.0
$f(x)$	3.375	7.0	13.625	24.0	38.875	59.0

(10 Marks)

b) Obtain the value of $f'(0.04)$ using an approximate formula for the given data.

x :	0.01	0.02	0.03	0.04	0.05	0.06
$f(x)$:	0.1023	0.1047	0.1071	0.1096	0.1122	0.1148

(10 Marks)

5. a) Find a real root of equation $x \log_{10} x = 1.2$ which lies between 2 and 3 by using Bi-section method. (10 Marks)

b) Find a real root of the equation $x^3 - 2x - 5 = 0$ by the method of false position correct to three decimal places. (10 Marks)

6. a) Find a positive root of equation $x^3 - 4x - 9 = 0$ by using Bi-section method in four stages. (10 Marks)

b) Find a real root of the equation $x \log_{10} x = 1.2$ by Regula - Falsi method correct to 4 decimals. (10 Marks)

7. a) An amount of K65,000 is invested in three bonds at the rates of 6%, 8% and 10% per annum respectively. The total annual income is K4,800. The income from the third bond is K600 more than that from the second bond. Determine the price of each bond. (Use Gaussian elimination method.). (10 Marks)

b) Solve the following system of equations, using matrix inversion method:

$$2x_1 + 3x_2 + 3x_3 = 5,$$

$$x_1 - 2x_2 + x_3 = -4,$$

$$3x_1 - x_2 - 2x_3 = 3.$$

(10 Marks)