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(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

UNIVERSITY EXAMINATIONS 2022/2023 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE MATHEMATICS WITH IT

COURSE CODE: MAT 324

COURSE TITLE: NUMERICAL ANALYSIS II

DATE:20TH APRIL, 2023 **TIME: 8.00-10.00 AM**

INSTRUCTIONS TO CANDIDATES

Answer question ONE (COMPULSORY) and any other TWO questions

This Paper Consists of 5 Printed Pages. Please Turn Over.

QUESTION ONE (30 MARKS)

a) Determine whether the following system is diagonally dominant

$$\begin{aligned} x+y+54z &= 110 \\ 27x+6y-z &= 85 \\ 6x+15y+2z &= 72 \end{aligned}$$

(3 Marks)

b) Using the Cramer's rule, solve

$$\begin{aligned} x_1+3x_2 &= 5 \\ 2x_1+2x_2 &= 6 \end{aligned}$$

(4 Marks)

c) Find a positive root of $x^3-x-1=0$ that lies between 1 and 2 by bisection method (5 Marks)

d) Find an iterative formula to find a reciprocal of a given number N and hence find the value of $\frac{1}{19}$ (5 Marks)

e) Find the double root of $x^3-5.4x^2+9.24x-5.096=0$ given that its nearer to 1.5 (4 Marks)

f) Solve $e^x-3x=0$ by method of iteration (4 Marks)

g) Apply Gauss Jordan method to find the solution of the following system

$$\begin{aligned} 10x+y+z &= 12 \\ 2x+10y+z &= 13 \\ x+y+5z &= 7 \end{aligned}$$

(5 Marks)

QUESTION TWO (20 MARKS)

a) Find an iteration formula to find $\sqrt{N}$ (where N is a positive number), hence find $\sqrt{5}$ (5 Marks)

b) By the method of triangularization, solve the following system

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

(5 Marks)

c) Find the inverse of $A=\begin{pmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{pmatrix}$ by Crout's method (5 Marks)

d) Solve by relation method the system (5 Marks)

$$9x-y+2z=9$$
$$x+10y-2z=15$$
$$2x-2y-13z=-17$$

QUESTION THREE (20 MARKS)

a) Solve, by Gauss Seidel method, the following system (5 Marks)

$$28x+4y-z=32$$
$$x+3y+10z=24$$
$$2x+17y+4z=35$$

b) Find an approximate root between 2 and 5, given that $x\log_{10}x-1.2=0$ by false position method (5 Marks)

c) Using Newton's method, find the root of $x=\cos x$ that lies between 0 and 1 (5 Marks)

d) Assuming that a root of $x^3-9x+1=0$ that lies in the interval (2,4), find its root by bisection method (5 Marks)

QUESTION FOUR (20 MARKS)

a) Derive the Newton-Raphson iteration formula (5 Marks)

$$x_{n+1}=x_n-\frac{f(x_n)}{f'(x_n)}$$

b) Show that the Newton-Raphson method in (a) above has quadratic convergence. (5 Marks)

c) By iteration method, find a positive root that lies in (0,1) of (5 Marks)

$$3x-\sqrt{1+\sin x}=0$$

d) Solve the following system by Gauss Jordan method (5 Marks)

$$5x_1 + x_2 + x_3 + x_4 = 4$$
$$x_1 + x_2 + 6x_3 + x_4 = -5$$
$$x_1 + 7x_2 + x_3 + x_4 = 12$$
$$x_1 + x_2 + x_3 + 4x_4 = -6$$

QUESTION FIVE (20 MARKS)

a) Derive the Secant iteration formula $x_{n+1} = x_n + \frac{(x_n - x_{n-1})f(x_n)}{f(x_{n-1}) - f(x_n)}$ (5 Marks)

b) By Newton Raphson method, find the positive root of

$f(x) = 2x^3 - 3x - 6 = 0$ between 1 and 2 correct to five decimal places

(5 Marks)

c) Solve by relaxation method the system (5 Marks)

$$9x - y + 2z = 9$$
$$x + 10y - 2z = 15$$
$$2x - 2y - 13z = -17$$

d) Solve by Gauss Seidel method the following system (5 Marks)

$$28x + 4y - z = 32$$
$$x + 3y + 10z = 24$$
$$2x + 17y + 4z = 35$$