

Roll Number:

Name:

Thapar Institute of Engineering & Technology, Patiala
Department of Mathematics

B.E.(Sem. IV) MST

UMA011: Numerical Analysis

March 22, 2024

Instructors: Dr. Paramjeet Singh and Dr. Vivek Sangwan

Time: 2 Hrs.; M. Marks: 30

Note:

(a) Attempt all parts of a question at one place.

(b) All questions are compulsory.

Q.1 (a) Use nesting with 3-digit chopping to evaluate $f(x) = x^3 - 3x^2 + 3x - 1$ at $x = 1.25$.

[Marks: 3, (CLO1, L3)]

(b) Show that the fixed-point method converges linearly for the simple root of $x = g(x)$, where $g(x)$ is continuously differentiable function satisfying $|g'(x)| < 1$ near the root.

[Marks: 3, (CLO1, L4)]

Q.2 (a) Perform three iterations of the bisection method to approximate the value of $\sqrt{5}$.

[Marks: 4, (CLO1, L3)]

(b) Find the root of the equation $3x - e^x = 0$ using Newton-Raphson (Newton's) method accurate within 0.005 by taking initial guess $x_0 = 2$.

[Marks: 4, (CLO1, L2)]

Q.3 (a) Using LU decomposition method with Gauss elimination, solve the following system of equations:

[Marks: 4, (CLO2,

L3)]

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

$$4x_1 + 4x_2 - 3x_3 = 3,$$

$$-2x_1 + 3x_2 - x_3 = 1.$$

(b) Use power method to find the largest eigen value in magnitude of the matrix $A = \begin{bmatrix} 2 & -1 & 0 \\ 2 & 6 & 1 \\ 0 & 2 & 2 \end{bmatrix}$.

Take initial eigen vector as $[-0.1989, 1.0000, 0.4624]'$ and use stopping criteria as $|\lambda_k - \lambda_{k-1}| < 0.03$, where λ_k is the dominant eigen value at the $k - th$ iterate. **[Marks: 4, (CLO2, L3)]**

Q.4 (a) Check whether the Gauss Seidel method will converge for the following system of linear equations or not:

[Marks: 4, (CLO2, L4)]

$$x_1 - x_3 = 0.2$$

$$-0.5x_1 + x_2 - 0.25x_3 = 2$$

$$x_1 - 0.5x_2 + x_3 = 1.$$

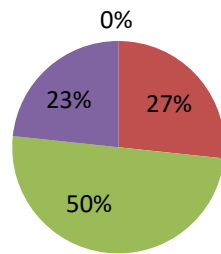
(b) Find the condition number in max norm (infinity norm) of the matrix $A = \begin{bmatrix} 1 & 0 & 0 \\ 3 & 2 & 0 \\ -1 & 6 & 1 \end{bmatrix}$.

[Marks: 4, (CLO2, L2)]

Marks Distribution

Bloom's Level wise Marks Distribution

■ Level 1 ■ Level 2 ■ Level 3 ■ Level 4



Course Outcome wise Marks Distribution

