Mahindra University

Mahindra University Hyderabad
École Centrale School of Engineering
Minor-I

Program: B. Tech.   Branch: AI, CAM, CE, CSE, ECE, NT   Year: II   Semester: II
Subject: Numerical Methods (MA2208)

Date: 09/03/2023
Time Duration: 1.5 Hours

Start Time: 10:00 AM
Max. Marks: 30

Instructions:

1) Each question carries 6 marks.

2) All questions are compulsory.

3) Use of scientific calculator is allowed.

4) It is strictly prohibited to share calculators during exams.

Question 1 (6 marks)

Find the IEEE 754 single-precision binary representation of the decimal number 14.5.

Question 2 (6 marks)

For the following system of equations perform three iterations of the Gauss-Jacobi iteration method taking initial approximation as $x_1 = 0.5$, $x_2 = -0.5$, $x_3 = -0.5$.

$$4x_1 + x_2 + x_3 = 2$$
$$x_1 + 5x_2 + 2x_3 = -6$$
$$x_1 + 2x_2 + 3x_3 = -4$$

Question 3 (6 marks)

Solve the following system of linear equations using Doolittle's LU decomposition

$$\begin{bmatrix} 1 & 1 & 1 \\ 3 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 6 \\ 4 \end{bmatrix}.$$

Question 4 (6 marks)

Solve the equation $x^3 - 5x + 3 = 0$ by secant method upto two iterations starting from $x_0 = 0.5$ and $x_1 = 2.0$.

Question 5 (6 marks)

Consider a variation of Newton's method in which only one derivative is needed; that is,

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_0)}, \quad n = 0, 1, 2, \ldots$$

Find c and p such that

$$\epsilon_{n+1} = c\epsilon_n^p,$$

where $\epsilon_n := x_n - \alpha$ with α is the simple root of f. Note that, the higher power of ϵ_n can be ignored.