

M.Sc. 1st Semester Examination-2022-23**MATHEMATICS****Course ID : 12155 Course Code : MATH/105C(IA)****Course Title : Internal Assignment (Numerical Analysis)****Time : 1 Hour****Full Marks : 16**

The figures in the right hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable. Notations and symbols have their usual meaning.

Answer any two questions :**8×2=16****1. Consider a linear system $Mx = N$, with**

$$M = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix} \quad N = \begin{bmatrix} -1 \\ 7 \\ 7 \end{bmatrix}.$$

- (a) Verify that for the SOR method with value $\theta = 1.15$ for the relaxation parameter can be used to find the solution of the system.

(Turn Over)

- (b) Compute the first iteration using SOR method starting at $x^0 = [0, 0, 0]^T$ 3+5

2. Apply the power method on

$$A = \begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix}, \text{ with } X_0 = \begin{bmatrix} 1 \\ 1 \end{bmatrix} \text{ and } X_1 = \begin{bmatrix} 1 \\ -1 \end{bmatrix}.$$

Explain the results. 3+3+2

3. (a) By using the Runge-Kutta method of order four, solve the ODE

$$\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2} \text{ with } y(0) = 1 \text{ to find the value of } y \text{ at } x = 0.4$$

Take $h = 0.2$. 4

- (b) Use the implicit Euler's method for the same problem to find $y(0.2)$. 4