Roll No.						

Total No. of Pages: 02

Total No. of Questions: 07

M.Sc. (Mathematics) (Sem. – 4) ADVANCED NUMERICAL METHODS

Subject Code: MSM510-18

M Code: 77880

Date of Examination : 03-01-2023

Time: 3 Hrs.

Max. Marks: 70

INSTRUCTIONS TO CANDIDATES:

- 1. SECTION-A is COMPULSORY consisting of FIVE questions carrying TWO marks each.
- 2. SECTION-B contains THREE questions carrying FIFTEEN marks each and students have to attempt any TWO questions.
- 3. SECTION-C contains THREE questions carrying FIFTEEN marks each and students have to attempt any TWO questions.

SECTION-A

- 1. Write briefly:
 - a) Write the difference between Gauss-Seidal and Jacobi method.
 - b) What is the difference between Conjugate gradient and Bi-conjugate gradient methods?
 - c) Write the implicit scheme of the elliptic partial differential equation.
 - d) State the properties of the Galerkin approximation.
 - e) State FEM for second order problem.

SECTION-B

2. Solve the system of equations by the Gauss-Seidal method:

$$27x + 6y - z = 85$$
, $6x + 15y + 2z = 72$, $x + y + 54z = 110$

3. Solve the equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square with sides x = 0 = y, x = 3 = y with u = 0 on the boundary and mesh length = 1.

4. Given the values of u(x, y) on the boundary of the square in the Figure, evaluate the function u(x, y) satisfying the Laplace equation $\nabla^2 u = 0$ at the pivotal points of this figure by Jacobi method.



SECTION-C

- 5. Using Galerkin method, solve the equation $\frac{d^2y}{dx^2} + x\frac{dy}{dx} 2y = 0$, y'(0) + y(0) = 1 and y(1) = 2.
- 6. Consider the boundary value problem

-u'' + xu = 0, u(0) + u'(0) = 1, u(1) = 1.

Determine the coefficients of the approximate solution function

$$w(x) = 1 + (1 - x)(a_1 + a_2 x)$$

by using Ritz method.

7. Solve by the finite element method $y'' + xy = x^3 - \frac{4}{x^3}$, y(1) = -1, y(2) = 3. Put nodes at x = 1.2, 1.5 and 1.75 as well as at the ends of [1,2]. Compare your solution to the analytical solution given by $= x^2 - \frac{2}{x}$.

NOTE : Disclosure of Identity by writing Mobile No. or Marking of passing request on any paper of Answer Sheet will lead to UMC against the Student.