GALGOTIAS UNIVERSITY

ADMISSION NUMBER

School of Computing Science and Engineering

Bachelor of Technology in Computer Science and Engineering
Semester End Examination - Jun 2024

Duration : 180 Minutes
Max Marks : 100

Sem VI - E2UC512T - Advanced Numerical Methods

General Instructions
Answer to the specific question asked
Draw neat, labelled diagrams wherever necessary
Approved data hand books are allowed subject to verification by the Invigilator

1) Define Power method for finding dominant eigen values and eigen vectors. K1(3)

2) Classify the given partial differential equation $x^2u_{xx} + (1-y^2)u_{yy} = 0$, $-1 \le y \le 1$ K2(4)

3) Reduce the matrix $\begin{bmatrix} 2 & 3 & 1 \\ 3 & 2 & 2 \\ 1 & 2 & 3 \end{bmatrix}$ to tri-diagonal form using Householder's method. K2(6)

4) Using Given's method, reduce the following matrix to the tri-diadonal form: $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$. K3(6)

5) Find a three-parameter solution of the following equation by using Galerkin's method and compare with the exact solution: K3(6)

$$\frac{d^2y}{dx^2} = -cos\pi, \quad 0 \le x \le 1 \quad y(0) = 0, \quad y(1) = 0$$

6) Solve the BVP $y'' + y + 1 = 0, \quad y(0) = y(1) = 0$ By the application of finite difference method. K3(9)

7) Solve the BVP $y'' + xy' + y = 3x^2 + 2, \quad y(0) = 0, y(1) = 1$ by the application of finite difference method. K3(9)

8) By using finite difference method, analyse the solution of given BVP: K4(8)

$$\frac{d^2y}{dx^2} = y, y(0) = 1, y(1) = 1.$$

9) Solve the equation $2\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(x,0) = x(4-x),\ 0 < x < 5,\ u(0,t) = u(4,t), t \geq 0$ $u(x,0) = x(4-x)$, 0< *x* < 5, $u(0,\ t) = u(4,\ t) = 0,\ t \geq 0$ taking h=1 Examine the values of u up to t=5. K4(12)

10) Apply Milne's method to determine a solution of the differential equation $\frac{dy}{dx} = x - y^2 \frac{dy}{dx} = x - y^2$ in the range $0 \leq x \leq 1$ for the boundary conditions $y = 0\ at\ x = 0$ K5(10)

11) Using Jacobi's method, find all the eigen values and the eigen vectors of the matrix $A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$. K5(15)

OR

Evaluate Hermite interpolation polynomial for the following data: K5(15)

X	0	1	2
f(x)	1	3	2
f'(x)	0	3	6

12) Discuss weak formulation of the following differential equation $\frac{d^2T}{dx^2} = 400(T - 30)$ with the condition $T(0) = 300, \frac{dT}{dx}(x = L) = 0.$ K6(12)

OR

Discuss weak formulation of the following differential equation $AE\frac{d^2y}{dx^2} + ax = 0$ with the condition $u(0) = 0, AE\frac{dy}{dx}(x = L) = 0.$ Here, AE=constant. K6(12)