3rd Year B.S. (Honors) 2019
Math Lab Assignment 03
Course: AMTH 350 (Math Lab III)
Department of Applied Mathematics
University of Dhaka

Name: **Roll No:**

Write MATLAB program to solve the following problems using Script file.

No:	Problems
1	Consider the following linear system of equations: $$10x_1 - x_2 + 2x_3 = 6$$ $$-x_1 + 11x_2 - x_3 + 3x_4 = 25$$ $$2x_1 - x_2 + 10x_3 - x_4 = -11$$ $$3x_2 - x_3 + 8x_4 = 15$$ Solve the above system, correct up to 5 decimal places, with initial guess $\boldsymbol{x_0} = (0,0,0,0)$ using: (i) Jacobi iterative method. (ii) Gauss-Seidel iterative method. (iii) SOR iterative method with $\omega = 1.1$.
2	Consider the system of equations given below $$2x_1 - 3x_2 + 2x_3 = 5$$ $$-4x_1 + 2x_2 - 6x_3 = 14$$ $$2x_1 + 2x_2 + 4x_3 = 8$$ (a) Solve the system using Gaussian elimination method. (b) Solve the system using Gaussian-Jordan elimination method.
3	Use the Power method to approximate the dominant eigenvalue of the matrix $$A = \begin{pmatrix} -4 & 14 & 0 \\ -5 & 13 & 0 \\ -1 & 0 & 2 \end{pmatrix}$$ Let $x^0 = (1,1,1)^T$

4	Solve the following initial value problem over the interval [0,2]. Display all your results graphically. $\frac{dy}{dt} = yt^3 - 1.5y,\ y(0) = 1$ (a) ode solver. (b) Using Euler's method with h =0.5 and 0.25. (c) Using the midpoint method with h =0.5. (d) Using Heun's method with h=0.5. (e) Using the fourth-order RK method with h =0.5.
5(a)	Solve the following system of ODEs $$\frac{dx}{dt} = ax - bxy$$ $$\frac{dy}{dt} = -cy + dxy$$ $$x(0) = 2, \qquad y(0) = 1$$ Taking $a = 1.2,\ b = 0.6, c = 0.8, and\ \ d = 0.3.$
5(b)	The van der Pol equation is a second order ODE $\frac{d^2y}{dx^2} - \mu(1 - y^2)\frac{dy}{dx} + y = 0,\ y(0) = 2,\ y'(0) = 0$ where $\mu > 0$ is a scalar parameter. Solve the above equation using shooting method (ode45 solver) and then show the result graphically.
6	Consider the heat conduction equation $$\rho c_p \frac{\partial u}{\partial t} = k\frac{\partial^2 u}{\partial x^2},\ \ u(x,0) = 100, u(0,t) = 0, u(10,t) = 0,$$ $$0 \le x \le 10, t > 0$$ Solve the above equation using finite difference method and the show the result graphically.(In particular case let $\rho = 1, c_p = 1\ and\ k = 1$)