PG – 115

IV Semester M.Sc. Degree Examination, June 2015
(RNS)
MATHEMATICS
M-402 : Numerical Analysis and Matlab/Scilab Programming – II

Time : 3 Hours Max. Marks : 60

Instructions : *Answer **any five full** questions. Choosing **atleast one** from **each** Part.*

PART – A

1. a) Solve :

$$\frac{dy}{dx} = x - 2;\ y(0) = 2,$$

$$\frac{dz}{dx} = x - y^2;\ z(0) = 1$$

Obtain y (0.05) and z (0.05) using four terms of the Taylor series. 6

b) Solve :

$$\frac{dy}{dx} = y - z;\ y(0) = 1$$

$$\frac{dz}{dx} = z - y,\ z(0) = 0$$

by the classical, 2^{nd} order, explicit Runge-Kutta method. 6

2. a) Solve :

$$\frac{dy}{dx} = x + y^2,\ y(0) = 1$$

by Adam's predictor-corrector method of 2^{nd} order. Assuming h = 0.05 obtain the solution at x = 0.2. Use any single step method to obtain unknown values. 6

b) Using finite difference method to solve the two point BVP :

$$\frac{d^2y}{dx^2} = xy;\ y(0) - \frac{dy_{(0)}}{dx} = 1,\ y(1) = 1$$

Choose $\Delta x = \frac{1}{3}$. Use any iterative method to solve the system of linear algebraic equations. 6

P.T.O.

3. a) Obtain the five point central difference formula for solving the Laplace's equation in a rectangular region. Hence obtain the diagonal five point formula. 6

b) Solve using finite difference method the Laplace's equation

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0,$$

where

$u(x, 0) = x;\ 0 \le x \le 1,$

$u(0, y) = 0;\ 0 \le y \le 1,$

$u(x, 1) = 0;\ 0 \le x \le 1,$

$u(1, y) = 1;\ 0 \le y \le 1,$

choose $\Delta x = \Delta y = \frac{1}{3}$. 6

PART – B

4. a) Solve by Schmidt explicit method the following IBVP :

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} \quad 0 < x < 1;\ t \ge 0,$$

$u(x, 0) = \sin(\pi x) \quad 0 \le x \le 1,$

$$\left.\begin{array}{l} u(0, t) = 0 \\ u(1, t) = 0 \end{array}\right\} t \ge 0$$

Choose $\Delta x = \frac{1}{4}$ and $\Delta t = \frac{1}{64}$. Obtain the solution at the 2nd time level. 6

b) Explain the ADI method of solving two-dimensional heat equation. 6

5. The explicit finite difference method of solving the one-dimensional wave equation is unconditionally stable. Prove or disprove the statement. Using stability consideration of the above method solve.

$$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}; \quad 0 < x < 1,\ t \ge 0,$$

Subject to

$$\left.\begin{aligned} u(0, t) &= 0 \\ u(1, t) &= 0 \end{aligned}\right\} t \geq 0$$

Choose $\Delta x = \frac{1}{4}$. Obtain the solution at the second time level. 12

PART – C

6. a) Illustrate user-defined function in Matlab/Scilab with an example. 6

   b) Using an example in Matlab/Scilab explain the use of one and two-dimensional arrays. 6

7. Write a Scilab/Matlab program to find solution of the IVP.

   $$\frac{dy}{dx} = x + y^2, \; y(0) = 1$$

   by using Adam's predictor-corrector method of 2nd order or 4th order. 12

8. a) Write a program to solve the Poisson equation by using finite-difference method.

   Employ Gauss-Seidal iterative scheme for the solution of linear algebraic equations. 6

   b) Write a Matlab/Scilab program to find the solution of a linear/non linear ODE (IVP) using shooting method. 6
