

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, 2nd 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 2nd 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

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

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

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

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

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

6

PART – B

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

$$\frac{\partial u}{\partial t} - \frac{\partial^2 u}{\partial x^2} \quad 0 < x < 1, t \geq 0,$$

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

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

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.

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



Subject to

$$u(0, t) = 0,$$

$$u(1, t) = 0, \quad x, t > 0$$

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

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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