PG – 624

IV Semester M.Sc. Examination, June 2017
(RNS) (Repeaters) (2011 – 12 and Onwards)
MATHEMATICS
M 402 : Numerical Analysis and Matlab/Scilab Programming – II

Time : 3 Hours Max. Marks : 60

Instructions : *1)* ***All*** *questions have* ***equal*** *marks.*
2) Answer ***any five*** *questions choosing atleast* ***one*** *from* ***each*** *Part.*

PART – A

1. a) Derive the Runge-Kutta fourth order method for the solution of

$\frac{dy}{dx} = f(x,y),\ y(x_0) = y_0.$

b) Find an approximate solution of $\frac{dy}{dx} = x + y^2,\ y(0) = 1$ using the Picard's method with h = 0.1. Obtain the solution at y (0.3). **(6+6)**

2. a) Derive the Adam-Bashforth method for the solution of

$\frac{dy}{dx} = f(x,y),\ y(x_0) = y_0.$

b) Solve the boundary value problem $y'' - xy' + 12y = 0$ with $y(0) + y'(0) = 1$, $y(1) = 1$ using the finite difference method with $h = \frac{1}{3}$. **(6+6)**

PART – B

3. a) Solve the Laplace equation

$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0,\ 0 \le x, y \le 1$ subjected to the conditions

$u(x, 0) = 2x,\ u(x, 1) = 2x - 1,\ u(0, u) = u(1, u) = z - y$ with $\Delta x = \Delta y = \frac{1}{3}$ using the finite difference method. **6**

b) Solve the boundary value problem $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = \sin \pi x \sin \pi y,\ 0 \le x, y \le 1$ with $u = 0$ on the boundary and $\Delta x = \Delta y = \frac{1}{3}$ using the finite difference method. **6**

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4. a) Solve the initial boundary value problem $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, $0 \le x \le 1$, $t \ge 0$ with

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

   $u(0, t) = 0 = u(1, t)$

   $\Delta x = \frac{1}{4}$, $\Delta t = \frac{1}{64}$ using the implicit finite difference scheme. Obtain the solution at second-time level. **6**

   b) Discuss the stability criteria for the Schmidt explicit method. **6**

5. Derive the alternating direction implicit finite difference method for the solution of $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$, $0 \le x, y \le 0$, $t \ge 0$ and hence discuss its stability. **12**

PART – C

6. a) Explain the looping structures with suitable examples.

   b) Write a program to find the solution of an IVP using the Runge-Kutta method of order four. **(6+6)**

7. a) Explain with suitable examples about the decision making statements.

   b) Implement the Schmidt method for solving the one-dimensional parabolic partial differential equation. **(6+6)**

8. a) Explain with suitable examples about built-in and user-defined functions.

   b) Write a program to solve the Poisson's equation using the finite-difference scheme. **(6+6)**

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