S.No. 259

17 PMAE01

(For the candidates admitted from 2017 – 2018 onwards)

M.Sc. DEGREE EXAMINATION, NOVEMBER-2020.

First Semester

Mathematics

Elective — NUMERICAL ANALYSIS

Time : Three hours   Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Define the Power series solution.

2. Write the formula for Milne's Predictor-Corrector method.

3. Write Modified Euler's formula.

4. Find the first approximation of $\frac{dy}{dx} = x^2 + y^2, y(0) = 1$ by Picard's method.

5. Define the Fourth order Runge-Kutta method for simultaneous equations.

6. Define Fourth order Runge-Kutta method.

7. Define Lattice points.

8. State Standard Five point formula.

9. Write the Bender-Schmidt recurrence equation.

10. Write the residuals at u_0 and u_1 in relaxation method.

PART B — ($5 \times 5 = 25$ marks)

Answer ALL the questions.

11. (a) Solve $y' = y^2 + x$, $y(0)=1$ using Taylor's series method to compute $y(0.1)$ and $y(0.2)$.

Or

(b) Given $y' = \frac{1}{x+y}, y(0)=2, y(0.2)=2.0933,$ $y(0.4)=2.1755, y(0.6)=2.2493$, find $y(0.8)$ by Milne's predictor - corrector method.

12. (a) Solve $\frac{dy}{dx} = 1-y$, $y(0)=0$ in the range $0 \le x \le 0.2$ using improved Euler's method.

Or

(b) Use Picard's method to approximate the value of y when $x=0.1, 0.2, 0.3, 0.4$ and 0.5, given that $y=1$ at $x=0$ and $y=1+xy$, correct to three decimal places.

13. (a) Find $y(1.2)$ by Runge-Kutta method of fourth order given $y' = x^2 + y^2; y(1) = 1.5$.

Or

(b) Given $y' = x^2 - y, y(0) = 1$, find $y(0.1)$, $y(0,2)$ using Runge - Kutta method of second order. $y' = f(x, y) = x^2 - y, x_0 = 0, y_0 = 1, f(x_0, y_0) = -1$.

14. (a) Classify the following partial differential equation $(x+1)u_{xx} - 2(x+2)u_{xy} + (x+3)u_{yy} = 0$.

Or

(b) Explain the Liebmann's iteration process.

15. (a) Derive Bender-Schmidt recurrence equation.

Or

(b) Derive the Crank-Nicholson difference scheme.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Find $y(0.1)$, $y(0.2)$, $y(0.3)$, from $y' = x^2 - y; y(0) = 1$ using Taylor's series method and hence obtain $y(0.4)$ using Adams-Bashforth method.

17. Solve $y' = -y$; $y(0) = 1$ for $y(0.04)$ by (i) Euler's method and (ii) Modified Euler's method.

18. Solve $\frac{dy}{dx} = yz + x; \frac{dz}{dx} = xz + y$ given that $y(0) = 1; z(0) = -1$ for $y(0.2), z(0.2)$.

19. Solve $u_{xx} + u_{yy} = 0$ over the square mesh of side 4 units satisfying the following boundary conditions:

(a) $u(0, y) = 0$ for $0 \leq y \leq 4$

(b) $u(4, y) = 12 + y$ for $0 \leq y \leq 4$

(c) $u(x, 0) = 3x$ for $0 \leq y \leq 4$

(d) $u(x, 4) = x^2$ for $0 \leq y \leq 4$.

20. Solve $\nabla^2 u = 8x^2 + y^2$ for square mesh given $u = 0$ on the four boundaries dividing the square into 16 sub-squares of length 1 units.
