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Question Paper Code : 20755

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Fourth/Fifth/Sixth/Seventh Semester

Civil Engineering

MA 6459 — NUMERICAL METHODS

(Common to Aeronautical Engineering, Agriculture Engineering, Electrical and Electronics Engineering, Electronics and Instrumentation Engineering, Geoinformatics Engineering, Instrumentation and Control Engineering, Manufacturing Engineering, Mechanical and Automation Engineering, Petrochemical Engineering, Production Engineering, Chemical Engineering, Chemical and Electrochemical Engineering, Handloom and Textile Technology, Petrochemical Technology, Plastic Technology, Polymer Technology, Textile Chemistry, Textile Technology)

(Regulations 2013)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Write down the condition for convergence of iteration method.

2. Find an iterative formula to find the number $\frac{1}{N}$.

3. Write down the Newton's backward interpolation formula.

4. When do you apply Newton's divided difference interpolation formula, for a given problem?

5. Write down the first two derivatives of Newton's forward difference formula at the point $x = x_0$.

6. On what type of intervals, Simpson's three – eight rule can be applied.

7. In solving $\frac{dy}{dx} = f(x, y)$, $y(x_0) = y_0$, write down the Taylor's series formula for $y(x_1)$.

8. Write down the Euler's algorithm to solve first order differential equation.

9. Classify the partial differential equation $x\,u_{xx} + y\,u_{yy} = 0$, $x > 0$ & $y > 0$.

10. Write down the explicit formula to solve one dimensional wave equation.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the real positive root of $3x - \cos x - 1 = 0$ by Newton's method correct to 4 decimal process. (8)

(ii) Solve the following system of equations by Gauss elimination method. (8)

$3x + 4y + 5z = 18$, $2x - y + 8z = 13$, $5x - 2y + 7z = 20$.

Or

(b) (i) Solve the following system of equations by Gauss-Seidel method. (8)

$28x + 4y - z = 32$; $x + 3y + 10z = 24$; $2x + 17y + 4z = 35$.

(ii) Find the inverse of the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix}$ by Gauss – Jordan method. (8)

12. (a) (i) Using Newton's divided difference formula, find the equation $y = f(x)$ of least degree and passing through the points $(-1, -21)$, $(1, 15)$, $(2, 12)$, $(3, 3)$. Find also y at $x = 0$. (8)

(ii) Using Lagrange's interpolation formula find $y(9.5)$ for the given data. (8)

x:	7	8	9	10
y:	3	1	1	9

Or

(b) Fit the following four points by the cubic splines.

x:	1	2	3	4
y:	1	5	11	8

Use the end conditions $y_0'' = y_3'' = 0$. Hence compute (i) $y(1.5)$ and (ii) $y'(2.0)$. (16)

13. (a) (i) From the following table find the value of y'' at the point $x = 0.96$. (8)

x:	0.96	0.98	1.00	1.02	1.04
$f(x)$:	0.7825	0.7739	0.7651	0.7563	0.7473

(ii) Evaluate $\int_1^2 \frac{1}{x}\,dx$ using Gauss 3-point formula. (8)

Or

(b) (i) Evaluate $\int_0^1 \frac{x^2}{1+x^3}\,dx$ using Simpson's $\frac{1}{3}$ rule by taking $h = 0.25$. (8)

(ii) Evaluate $\int_1^2 \int_1^2 \frac{1}{x+y}\,dx\,dy$ using the Trapezoidal rule with $h = k = 0.5$. (8)

14. (a) Find the value of $y(1.1)$ using Runge-Kutta method of fourth order given that $\frac{dy}{dx} = y^2 + xy$; $y(1) = 1$. (16)

Or

(b) Given that $\frac{dy}{dx} = \frac{1}{2}(1 + x^2)\,y^2$; $y(0) = 1$, $y(0.1) = 1.06$; $y(0.2) = 1.12$ and $y(0.3) = 1.21$. Evaluate $y(0.4)$ by Milne's predictor – Corrector method. (16)

15. (a) Solve $u_{xx} + u_{yy} = 0$ over the square mesh of side 4 units, satisfying the following boundary conditions (16)

(i) $u(0, y) = 0$ for $0 \le y \le 4$

(ii) $u(4, y) = 12 + y$, for $0 \le y \le 4$

(iii) $u(x, 0) = 3x$, for $0 \le x \le 4$

(iv) $u(x, 4) = x^2$, for $0 \le x \le 4$.

Or

(b) Solve $4u_{xx} = u_{tt}$ with the boundary conditions $u(0, t) = 0$, $u(4, t) = 0$ and the initial conditions $u_t(x, 0) = 0$ and $u(x, 0) = x(4 - x)$ by taking $h = 1$ (for 4 time steps). (16)