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Question Paper Code : 51318

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Fifth/Sixth Semester

Computer Science and Engineering

080230029/080320009 — NUMERICAL METHODS

(Common to Chemical Engineering)

(Regulation 2008)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the condition for convergence of Newton — Raphson method.

2. Solve the following system of equations by Gauss Elimination method $2x + y = 3; 7x - 3y = 4$.

3. What is mean by Cubic spline?

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

5. Write down the trapezoidal rule to evaluate $\int_1^6 f(x)\,dx$ with h = 0.5.

6. Use two point quadrature formula to solve $\int_{-1}^{1} \frac{dx}{1+x^2}$.

7. Find y(0.1) by Euler's method given that $\frac{dy}{dx} = x + y, y(0) = 1$.

8. Write the Adam — Bashforth predictor and corrector formula.

9. Write the finite difference approximations for the differential equation $y'' = x + y$ with $y(0) = y(1) = 0$.

10. State the Schmidt explicit formula for one dimentional heat equation.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Find the real root of the equation $x = \frac{1}{2} + \sin x$ by iteration method. (8)

(ii) Using Gauss-Jordan method, find the inverse of the matrix $\begin{pmatrix} 2 & 4 & 3 \\ 0 & 1 & 1 \\ 2 & 2 & -1 \end{pmatrix}$. (8)

Or

(b) (i) Solve the system of equations by Gauss-Seidel method correct to three decimal places. (8)

$$x + y + 54z = 110$$
$$27x + 6y - z = 85$$
$$6x + 15y + 2z = 72$$

(ii) Using power method, find the dominant eigenvalue and eigenvector of the matrix $\begin{pmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{pmatrix}$. (8)

12. (a) (i) Using Lagrange's formula, construct the polynomial which takes the values $f(0) = -12, f(1) = 0, f(3) = 6$ and $f(4) = 12$. Hence, find $f(2)$. (8)

(ii) Find y for $x = 9$ by Newton's interpolation formula from the following data : (8)

x :	4	6	8	10
y :	1	3	8	16

Or

(b) (i) For the following values, construct a cubic polynomial (8)

x :	0	1	2	3
$f(x)$:	1	2	1	10

(ii) Find $f(8)$, Using Newton's divided difference from the following : (8)

x :	3	7	9	10
$f(x)$:	168	120	72	63

13. (a) (i) Find $\frac{dy}{dx}$ at $x = 51$ from the following table : (8)

x :	50	60	70	80	90
y :	19.96	36.65	58.81	77.21	94.61

(ii) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using trapezoidal rule with $h = 0.02$. Hence determine the value of π. (8)

Or

(b) (i) Using Simpson's $\frac{1}{3}$ – rule evaluate $\int_0^1\int_0^1 \frac{1}{1+x+y}\,dx\,dy$ taking h = k = 0.5. (8)

(ii) Using three — point Gaussian Quadrature formula ,evaluate $\int_{-1}^{1} \frac{dx}{1+x^2}$. (8)

14. (a) (i) Using Taylor series method, compute the value of $y(0.1), y(0.2), y(0.3), y(0.4)$ correct to three decimal places from $\frac{dy}{dx} = 1 - 2xy$ given that y(0) = 0. (8)

(ii) Given $\frac{dy}{dx} = \frac{1}{2}(1+x^2)y^2$ and $y(0) = 1, y(0.1) = 1.06, y(0.2) = 1.12$, $y(0.3) = 1.21$. Evaluate $y(0.4)$ by Milne's predictor – corrector method. (8)

Or

(b) (i) Solve $\frac{d^2y}{dx^2} - x\left(\frac{dy}{dx}\right)^2 + y^2 = 0$ using Runge-kutta method for $x = 0.2$ correct to four decimal places, given that $y(0) = 1, y'(0) = 0$. (8)

(ii) Using modified Euler's method, find y at $x = 0.1$ and $x = 0.2$ given $\frac{dy}{dx} = 1 + xy, y(0) = 2$. (8)

15. (a) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, 0 \le x \le 1$, $t \ge 0$ with $u(x,0) = x(1-x), 0 < x < 1$ and $u(0,t) = u(1,t) = 0 \; \forall t > 0$ using explicit method with $\Delta x = 0.2$ for 3 time steps. (16)

Or

(b) Solve $4u_{xx} = u_{tt}$ with $u(0,t) = 0 = u(4,t)$, $\frac{\partial u}{\partial t}(x,0) = 0$ and $u(0,t) = x(4-x)$ taking $h = 1$. Compute u upto 5 time steps. (16)