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Question Paper Code : 51776

B.E/B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Sixth Semester

Computer Science and Engineering

MA 2264/MA 41/MA 51/MA 1251/080280026/10177 MA 401/10144 CSE 21/10144 ECE 15 – NUMERICAL METHODS

(Common to Sixth Semester – Electronics and Communication Engineering, Industrial Engineering and Information Technology, Fifth Semester – Polymer Technology, Chemical Engineering and Polymer Technology, Fourth Semester – Aeronautical Engineering, Civil Engineering, Electrical and Electronics Engineering and Mechatronics Engineering)

(Regulations 2008/2010)

Time : Three Hours **Maximum : 100 Marks**

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Write down the condition for convergence of Newton-Raphson method for f(x).

2. Find the inverse of $A = \begin{pmatrix} 1 & 3 \\ 2 & 7 \end{pmatrix}$ by Gauss-Jordan method.

3. State Newton's forward difference formula for equal intervals.

4. Find the divided differences of $f(x) = x^3 - x^2 + 3x + 8$ for the arguments 0, 1, 4, 5.

5. Write down the expression for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = x_n$ by Newton's backward difference formula.

6. Taking h = 0.5, evaluate $\int_1^2 \frac{dx}{1+x^2}$ using Trapezoidal rule.

7. Find y(0.1) if $\frac{dy}{dx} = 1 + y$, y(0) = 1 using Taylor series method.

8. State the fourth order Runge-Kutta algorithm.

9. Obtain the finite difference scheme for the differential equation 2y" + y = 5.

10. Write Liebmann's iteration process.

PART – B (5 × 16 = 80 Marks)

11. (a) (i) Apply Gauss-Seidal method to solve the system of equations

$20x + y - 2z = 17$; $3x + 20y - z = -18$; $2x - 3y + 20z = 25$ **(8)**

(ii) Find by Newton-Raphson method a positive root of the equation

$3x - \cos x - 1 = 0$. **(8)**

OR

(b) (i) Find the numerically largest eigen value of $A = \begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$ and the corresponding eigen vector. **(8)**

(ii) Using Gauss-Jordan method to solve $2x - y + 3z = 8$; $-x + 2y + z = 4$; $3x + y - 4z = 0$. **(8)**

12. (a) Find the natural cubic spline to fit the data :

x :	0	1	2
f(x) :	–1	3	29

Hence find f(0.5) and f(1.5). **(16)**

OR

(b) (i) The following table gives the values of density of saturated water for various temperatures of saturated steam. **(8)**

Temperature °C :	100	150	200	250	300
Density hg/m^3 :	958	917	865	799	712

Find by interpolation, the density when the temperature is 275 °C.

(ii) Use Lagrange's formula to find the value of y at $x = 6$ from the following data : **(8)**

x :	3	7	9	10
y :	168	120	72	63

13. (a) (i) Find $f'(x)$ at $x = 1.5$ and $x = 4.0$ from the following data using Newton's formulae for differentiation. **(8)**

x :	1.5	2.0	2.5	3.0	3.5	4.0
y = f(x) :	3.375	7.0	13.625	24.0	38.875	59.0

(ii) Compute $\int_0^{\pi/2} \sin x \, dx$ using Simpson's 3/8 rule. **(8)**

OR

(b) Evaluate $\int_0^2 \int_0^1 4xy \, dx \, dy$ using Simpson's rule by taking $h = \frac{1}{4}$ and $k = \frac{1}{2}$. **(16)**

14. (a) (i) Using Adam's Bashforth method, find y(4.4) given that $5xy' + y^2 = 2$, y(4) = 1, y(4.1) = 1.0049, y(4.2) = 1.0097 and y(4.3) = 1.0143. **(8)**

(ii) Using Taylor's series method, find y at $x = 1.1$ by solving the equation $\frac{dy}{dx} = x^2 + y^2$; y(1) = 2 Carry out the computations upto fourth order derivative. **(8)**

OR

(b) Using Runge-Kutta method of fourth order, find the value of y at $x = 0.2, 0.4, 0.6$ given $\frac{dy}{dx} = x^3 + y$, $y(0) = 2$. Also find the value of y at $x = 0.8$ using Milne's predictor and corrector method. **(16)**

15. (a) Solve $\nabla^2 u = 8x^2y^2$ over the square $x = -2, x = 2, y = -2, y = 2$ with $u = 0$ on the boundary and mesh length = 1. **(16)**

OR

(b) (i) Solve $u_{xx} = 32u_t$, $h = 0.25$ for $t \geq 0$, $0 < x < 1$, $u(0, t) = 0$, $u(x, 0) = 0$, $u(1, t) = t$. **(8)**

(ii) Solve $4u_{tt} = u_{xx}$, $u(0, t) = 0$, $u(4, t) = 0$, $u(x, 0) = x(4 - x)$, $u_t(x, 0) = 0$, $h = 1$ upto $t = 4$. **(8)**