Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 51576

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

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)

(Regulation 2008/2010)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Evaluate $\sqrt{15}$ using Newton–Raphon's formula.

2. Using Gauss elimination method solve : $5x + 4y = 15, 3x + 7y = 12$.

3. Find the second divided difference with arguments *a, b, c* if $f(x) = \frac{1}{x}$.

4. Define cubic spline.

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. State the advantages and disadvantages of the Taylor's series method.

8. State the Milne's predictor and corrector formulae.

9. Obtain the finite difference scheme for the differential equation $2y''(x) + y(x) = 5$.

10. State whether the Crank Nicholson's scheme is an explicit or implicit scheme. Justify.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the numerically largest eigens value of $A = \begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$ and its corresponding eigen vector by power method, taking the initial eigen vector as $(1\ 0\ 0)^T$ (upto three decimal places). (8)

(ii) Using Gauss–Jordan method, find the inverse of $\begin{bmatrix} 2 & 2 & 6 \\ 2 & 6 & -6 \\ 4 & -8 & 8 \end{bmatrix}$. (8)

Or

(b) (i) Solve the system of equations by Gauss–Jordan method : $5x_1 - x_2 = 9; -x_1 + 5x_2 - x_3 = 4; -x_2 + 5x_3 = -6$. (8)

(ii) Using Gauss–Seidel method, solve the following system of linear equations $4x + 2y + z = 14;\ x + 5y - z = 10;\ x + y + 8z = 20$. (8)

12. (a) (i) Find $f(3)$ by Newton's divided difference formula for the following data : (8)

x :	–4	–1	0	2	5
y :	1245	33	5	9	1335

(ii) Using Lagrange's interpolation formula, find $y(2)$ from the following data :

$y(0) = 0;\ y(1) = 1;\ y(3) = 81;\ y(4) = 256;\ y(5) = 625$. (8)

Or

(b) Fit the cubic splines for the following data : (16)

x :	1	2	3	4	5
y :	1	0	1	0	1

13. (a) (i) For the given data, find the first two derivatives at $x = 1.1$ (8)

x	1.0	1.1	1.2	1.3	1.4	1.5	1.6
y	7.989	8.403	8.781	9.129	9.451	9.750	10.031

(ii) Evaluate $\int_0^{\frac{1}{2}} \frac{x}{\sin x} dx$ correct to three decimal places using Romberg's method. (8)

Or

(b) (i) Taking $h = 0.05$, evaluate $\int_1^{1.3} \sqrt{x}\, dx$ using Trapezoidal rule and Simpson's three-eighth rule. (8)

(ii) Taking $h = k = \frac{1}{4}$, evaluate $\int_0^{\frac{1}{2}}\int_0^{\frac{1}{2}} \frac{\sin(xy)}{1+xy} dx\, dy$ using Simpson's rule. (8)

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 $\frac{dy}{dx} = x^2 + y^2; y(1) = 2$. Carryout 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) (i) Using Bender–Schmidt's method solve $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ given $u(0,t) = 0, u(1,t) = 0, u(x,0) = \sin \pi x, 0 < x < 1$ and $h = 0.2$. Find the value of u upto $t = 0.1$. (8)

(ii) Solve $y'' - y = x$, $x \in (0,1)$ given $y(0) = y(1) = 0$ using finite differences by dividing the interval into four equal parts. (8)

Or

(b) (i) Solve the Poisson equation $\nabla^2 u = -10(x^2 + y^2 + 10), 0 \le x \le 3$, $0 \le y \le 3$, $u = 0$ on the boundary. (8)

(ii) Solve the wave equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}, 0 < x < 1,\ t > 0$,

$$u(0,t) = u(1,t) = 0, t > 0,\ u(x,0) = \begin{cases} 1, & 0 \le x \le 0.5 \\ -1, & 0.5 \le x \le 1 \end{cases} \text{ and } \frac{\partial u}{\partial t}(x,0) = 0,$$

using $h = k = 0.1$, find u for three time steps. (8)
