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

Question Paper Code : 91583

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 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. Write down the condition for convergence of Newton–Rephson method for $f(x)=0$.

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

3. Find the second degree polynomial through the points $(0,2),(2,1),(1,0)$ using Lagrange's formula.

4. State Newton's backward formula for interpolation.

5. State the local error term in Simpson's $\frac{1}{3}$ rule.

6. State Romberg's integration formula to find the value of $I=\int_a^b f(x)dx$ for first two intervals.

7. State the Milne's predictor – corrector formulae.

8. Given $y' = x + y, y(0) = 1$ find $y(0.1)$ by Euler's method.

9. What is the central difference approximation for y''?

10. Write down the standard five-point formula to find the numerical solution of Laplace equation.

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 eigenvalue of $A = \begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$ and the corresponding eigenvector. (8)

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

12. (a) (i) Using Newton's forward interpolation formula, find the cubic polynomial which takes the following values : (8)

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

(ii) Obtain the cubic spline approximation for the function $y = f(x)$ from the following data, given that $y_0'' = y_3'' = 0$. (8)

x	–1	0	1	2
y	–1	1	3	35

Or

(b) (i) By using Newton's divided difference formula find $f(8)$, given (8)

x	4	5	7	10	11	13
$f(x)$	48	100	294	900	1210	2028

(ii) Find the polynomial $f(x)$ by using Lagrange's formula and hence find $f(3)$ for the following values of x and y: (8)

x	0	1	2	5
y	2	3	12	147

13. (a) (i) Evaluate $\int_1^2 \frac{dx}{1+x^3}$ using 3 point Gaussian formula. (8)

(ii) The velocity v of a particle at a distance a from a point on its path is given by the table : (8)

s (ft)	0	10	20	30	40	50	60
v(ft/sec)	47	58	64	65	61	52	38

Estimate the time taken to travel 60 feet by using Simpson's $\frac{1}{3}$ rule. Compare the result with Simpson's $\frac{3}{8}$ rule.

Or

(b) (i) Evaluate $\int_0^1\int_0^1 \frac{1}{1+x+y}\,dx\,dy$ by trapzoidal rule. (8)

(ii) Evaluate $\int_0^1 \frac{dx}{1+x}$ and correct to 3 decimal places using Romberg's method and hence find the value of $\log_e 2$. (8)

14. (a) (i) Using Taylor's series method, find y at $x=0$ if $\frac{dy}{dx} = x^2y-1, y(0)=1$. (6)

(ii) Given $5xy'+y^2=2$, $y(4)=1$, $y(4.1)=1.0049$, $y(4.2)=1.0097$, $y(4.3)=1.0143$. Compute $y(4.4)$ using Milne's method. (10)

Or

(b) (i) Apply modified Euler's method to find $y(0.2)$ and $y(0.4)$ given $y' = x^2+y^2$, $y(0)=1$ by taking $h=0.2$. (6)

(ii) Given $y''+xy'+y=0, y(0)=1, y'(0)=0$ find the value of $y(0.1)$ by Runge-Kutta's method of fourth order. (10)

15. (a) By iteration method, solve the elliptic equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ over a square region of side 4, satisfying the boundary conditions.

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

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

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

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

By dividing the square into 16 square meshes of side 1 and always correcting the computed values to two places of decimals, obtain the values of u at 9 interior pivotal points. (16)

Or

(b) Solve by Crank-Nicolson's method $\frac{\partial^2 u}{\partial x^2}=\frac{\partial u}{\partial t}$ for $0 < x < 1, t > 0$ given that $u(0,t) = 0$, $u(1,t) = 0$ and $u(x,0) = 100x(1-x)$. Compute u for one time step with $h=\frac{1}{4}$ and $K=\frac{1}{64}$. (16)
