Reg. No. : [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Question Paper Code : 50584

B.E/B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Sixth Semester

Computer Science and Engineering

10144 CSE 21/MA 51/MA 1251/10177 MA 401 — NUMERICAL METHODS

(Common to Information Technology)

(Regulations 2008/2010)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the order of convergence of an iterative method for finding the root of the equation $f(x)=0$?

2. Solve the equations $x+2y=1$ and $3x-2y=7$ by Gauss-Elimination method.

3. State Newton's forward interpolation formula.

4. Using Lagrange's formula, find the polynomial to the given data :

X:	0	1	3
Y:	5	6	50

5. What are the errors in Trapezoidal and Simpson's rules of numerical integration?

6. State the three point Gaussian quadrature formula.

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. Write the diagonal five point formula for solving the two dimensional Laplace equation $\nabla^2 u = 0$.

10. Using finite difference solve $y'' - y = 0$ given $y(0) = 0$, $y(1) = 1$, $n = 2$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Solve the equation $x \log_{10} x = 1.2$ using Newton's method. (8)

(ii) Solve the equations using Gauss-Seidal iterative method : (8)

$4x + 2y + z = 14,$
$x + 5y - z = 10$ and
$x + y + 8z = 20$

Or

(b) (i) Find the inverse of the following matrix Gauss Jordan method : (8)

$$\begin{bmatrix} 2 & 2 & 6 \\ 2 & 6 & -6 \\ 4 & -8 & -8 \end{bmatrix}$$

(ii) Find all the eigen values of $A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$ using power method. (8)

12. (a) (i) Using Newton's divided difference formula, find $f(x)$ from the following data and hence find $f(4)$. (8)

x:	0	1	2	5
$f(x)$:	2	3	12	147

(ii) Find the value of y when $x = 5$ using Newton's interpolation formula from the following table : (8)

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

Or

(b) (i) Use Lagrange's method to find $\log_{10} 656$, given that $\log_{10} 654 = 2.8156$, $\log_{10} 658 = 2.8182$, $\log_{10} 659 = 2.8189$ and $\log_{10} 661 = 2.8202$. (8)

(ii) Obtain the cubic spline for the following data to find $y(0.5)$. (8)

x :	−1	0	1	2
y :	−1	1	3	35

13\. (a) (i) Apply three point Gaussian quadrature formula to evaluate $\int_0^1 \frac{\sin x}{x} dx$ (8)

(ii) Find the first and second order derivatives of $f(x)$ at $x = 1.5$ for the following data : (8)

x :	1.5	2.0	2.5	3.0	3.5	4.0
$f(x)$:	3.375	7.000	13.625	24.000	38.875	59.000

Or

(b) (i) The velocities of a car running on a straight rod at intervals of 2 minutes are given below :

Time (min) :	0	2	4	6	8	10	12
Velocity (km/hr) :	0	22	30	27	18	7	0

Using Simpson's $\frac{1}{3}$-rd rule find the distance covered by the car. (8)

(ii) Evaluate $\int_2^{2.4} \int_4^{4.4} xy \, dx \, dy$ by Trapezoidal rule taking $h = k = 0.1$. (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 $\frac{dy}{dx} = x^2 + y^2$; $y(1) = 2$ 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)
