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

Question Paper Code : 61371

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

Fifth Semester

Electronics and Communication Engineering

MA 1251 — NUMERICAL METHODS

(Common to Information Technology)

(Regulation 2008)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State fixed point theorem.

2. If a real root of the equation $f(x)=0$ lies in (a, b), write down the formula that gives the root approximately, as per Regula Falsi method.

3. Find the divided difference of $f(x)$ which takes the values 8, 11, 78, 123 with arguments 0, 1, 4, 5.

4. Write Lagrange's inverse interpolation formula.

5. State Simpson's 3/8 rule of integration.

6. Evaluate $\int_{-2}^{2} e^{-\frac{x}{2}}\, dx$ using Gaussian two point formula.

7. Given $y' = x + y$, $y(1.2) = 2$ find $y(1.4)$ using Euler's method if $h = 0.2$.

8. What is the error committed in Milne's predictor formula?

9. State the implicit formula to solve the one dimensional heat equation $u_t = \alpha^2 u_{xx}$.

10. For what value of λ, the explicit method of solving the hyperbolic equation $u_{tt} = c^2 u_{xx}$ is stable, where $\lambda = c\frac{\Delta t}{\Delta x}$.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Use Newton-Raphson method to find the root of $x^4 - x - 10 = 0$ lying between 1 and 2 correct to three decimal places. (8)

(ii) Determine the largest eigenvalue and the corresponding eigenvector of the matrix $\begin{pmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{pmatrix}$ with $(1 \quad 0 \quad 0)^T$ as the initial vector using power method. (8)

Or

(b) (i) Find the inverse of the matrix $\begin{pmatrix} -1 & 1 & 1 \\ 0 & -1 & 2 \\ 1 & 1 & 1 \end{pmatrix}$ using Gauss-Jordan method. (8)

(ii) Solve the following equations by Gauss-Seidel method corrected to three decimal places.

$30x - 2y + 3z = 75$, $2x + 2y + 18z = 30$, $x + 17y - 2z = 48$. (8)

12. (a) (i) Find the natural cubic spline curve for the points (1, 1), (2, 5) and (3, 11) given that $y_1'' = y_3'' = 0$. (8)

(ii) Find the cubic polynomial which passes through the points (0, 2), (1, 3), (2, 12) and (5, 147) using Newton's divided difference formula. Find also y at $x = 3$. (8)

Or

(b) (i) The amount A of a substance remaining in a reacting system after an interval of time t in a certain chemical experiment is given below:

t (min)	2	5	8	11
A (gm)	94.8	87.9	81.3	75.1

Obtain the value of A when $t = 9$ min. using Newton's backward difference interpolation formula. (8)

(ii) The following table gives the normal weights of babies during first few months of life :

Age in months	2	5	8	10	12
Weight in kg	4.4	6.2	6.7	7.5	8.7

Estimate, by Lagrange's method, the normal weight of a baby 7 months old. (8)

13. (a) (i) Apply Romberg's method to evaluate $\int_0^{\pi} \log_e x \, dx$ given that (8)

x	4.0	4.2	4.4	4.6	4.8	5.0	5.2
$\log_e x$	1.3863	1.4351	1.4816	1.526	1.5686	1.6094	1.6486

(ii) From the table given below, find $f'(30)$ by Newton's forward difference formula for first derivative : (8)

x	30	31	32	33	34	35	36
$f(x)$	85.90	86.85	87.73	88.64	89.52	90.37	91.1

Or

(b) Evaluate $\int_2^{2.6} \int_4^{4.4} \frac{dx\,dy}{xy}$ using Trapezoidal rule taking $h = 0.2$, $k = 0.3$. (16)

14. (a) (i) Using Taylor series method, obtain the value of y to three significant figures at $x = 0.2, 0.4$ given $y' = x - y^2$ and $y(0) = 1$. (8)

(ii) Given $y' = 2e^x - y$, $y(0) = 2$, $y(0.1) = 2.010$, $y(0.2) = 2.040$, $y(0.3) = 2.090$, use Adam's method to estimate $y(0.4)$. (8)

Or

(b) (i) Solve $y' = 1 + xy$ using Runge-Kutta method of order four for $x = 0.2$ given $y(0) = 2$, taking $h = 0.2$. (8)

(ii) Using Milne's predictor and corrector formulae, find $y(0.4)$ given $y' = y - \frac{2x}{y}$, $y(0) = 1$, $y(0.1) = 1.0959$, $y(0.2) = 1.1841$, $y(0.3) = 1.2662$. (8)

15. (a) (i) Solve $xy'' + y = 0$, $y(1) = 1$, $y(2) = 2$ with $h = 0.25$ by finite difference method. (8)

(ii) Using Schmidt method, find the values $u(x, t)$ satisfying the equation $u_t = 4u_{xx}$ and the boundary conditions $u(0, t) = 0$, $u(8, t) = 0$, $u(x, 0) = \frac{x}{2}(8 - x)$ at the points $x = i$ where $i = 0, 1, 2, \ldots 7$ and $t = \frac{j}{8}$ where $j = 0, 1, 2, 3, 4$. (8)

Or

(b) Applying Leibmann's method, solve the Laplace equation $\nabla^2 u = 0$ for the square region $0 \le x \le 1$, $0 \le y \le 1$ with $h = \frac{1}{3}$ and $u(x, y) = 9x^2y^2$ on the boundary.
