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

Question Paper Code : 41298

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

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 Regular Falsi method.

3. What is the Lagrange's interpolation formula to find equation of the curve which passes through the points $(x_0, y_0), (x_1, y_1)$ and (x_2, y_2)?

4. Fit a polynomial from the following data, using Newton's forward difference interpolation formula :

x:	0	2	4	6
y:	–1	–1	7	23

5. State the trapezoidal rule to evaluate $\int_a^b f(x)\,dx$.

6. State three point Gaussian quadrature formula.

7. Compare Milne's method and Runge – Kutta fourth order method of solving an ordinary differential equation.

8. Write down a second order initial value problem and convert it into a first order coupled system.

9. State finite difference scheme of $u_{xx} + u_{yy} = 0$.

10. Define Standard Five Point formula.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Use Regula – Falsi method to obtain- a real root, of the equation $\log x = \cos x$ correct to four decimals. (8)

(ii) Solve the following system of equations by Gauss elimination method : $2x + y + z = 10$; $3x + 2y + 3z = 18$; $x + 4y + 9z = 16$. (8)

Or

(b) Solve the following system of equations by Gauss-Jacobi and Gauss – Seidel methods (five iterations) : $2x + 8y - z = 11$; $5x - y + z = 10$; $-x + y + 4z = 3$, with initial approximate solution $X^{(0)} = (0, 0, 0)^T$.

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) Given the following data, find $y'(6)$. (8)

x:	0	2	3	4	7	9
y:	4	26	58	112	466	922

(ii) Using three point Gaussian quadrature formula, evaluate $I = \int_1^2 \frac{dx}{1+x^3}$. (8)

Or

(b) Evaluate numerically $\int_0^1 \int_1^2 \frac{2xy\,dx\,dy}{(1+x^2)(1+y^2)}$ by taking $\Delta x = \Delta y = 0.25$, using Simpson's 1/3 rule.

14. (a) (i) Evaluate the values of $y(0.1)$ and $y(0.2)$ given $y'' - (xy')^2 + y^2 = 0$; $y(0) = 1$, $y'(0) = 0$ by using Taylor series method. (8)

(ii) Using Milne's method, find $y(0.8)$ if $y(x)$ is the solution of $\frac{dy}{dx} = x^3 + y$ given $y(0) = 2$, $y(0.2) = 2.073$, $y(0.4) = 2.452$, $y(0.6) = 3.023$ taking $h = 0.2$. (8)

Or

(b) (i) Using Runge – Kutta method of order four solve $\frac{dy}{dx} = x + y^2$ with $y(0) = 1$ at $x = 0.1$, $x = 0.2$ with $h = 0.1$. (8)

(ii) Using Adams – Bashforth method find $y(4,4)$ given $5x\frac{dy}{dx} + y^2 = 2$ given that $y(4) = 1$, $y(4.1) = 1.0049$, $y(4.2) = 1.0097$, $y(4.3) = 1.0143$. (8)

15. (a) Solve the Laplace's equation over the square mesh of side 4 units satisfying the boundary condition

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

$u(x,0) = 3x, 0 \le x \le 4$; $u(x,y) = x^2, 0 \le x \le 4$.

Or

(b) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial t^2}$ in $0, x > 5; t > 0$ given that $u(x,0) = 20$, $u(0,t) = 0$, $u(5,t) = 100$. Compute u for one time step with $h = 1$ by Crank – Nicholson method.