Reg. No. :

Question Paper Code : 73772

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

Fourth Semester

Civil Engineering

MA 2264/MA 41/MA 1251/080280026/10177 MA 401/MA 51/
10144 ECE 15 — NUMERICAL METHODS

(Common to Sixth Semester — Electronics and Communication Engineering, Computer Science and Engineering, Industrial Engineering, Information Technology and Fifth Semester — Polymer Technology, Chemical Engineering, Polymer Technology and Fourth Semester — Aeronautical Engineering, Civil Engineering, Electrical and Electronics Engineering, Mechatronics Engineering)

(Regulations 2008/2010)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Solve the system of equations $2x + y = 3$, $7x - 3y = 4$ by Gauss–Jordan method.

2. Write down the condition for convergence of fixed point iteration method for $f(x) = 0$.

3. State Newton's forward interpolation formula.

4. Show that $[x_0, x_1] = [x_1, x_0]$ in the divided differences.

5. State Simpson's $\frac{1}{3}$ rule.

6. Use two-point Gaussian quadrature formula to solve $\int_{-1}^{1} \frac{dx}{1+x^2}$.

7. Use Euler's method to find $y(0.2)$ and $y(0.4)$ given $y' = xy$, $y(0) = 1$.

8. State Milne's Predictor-Corrector formula.

9. Write any two methods to solve on dimensional heat equation.

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

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Apply Gauss-Seidel method to solve the system of equations $4x + 2y + z = 14$; $x + 5y - z = 10$; $x + y + 8z = 20$. (8)

(ii) Using Newton-Raphson method, find the root of $x^3 = 6x - 4$ lying between 0 and 1 correct to 5 decimal places. (8)

Or

(b) (i) Find the numerically largest eigen value of $\begin{pmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{pmatrix}$ and the corresponding eigen vector. (8)

(ii) Using Gauss–Jordan method find the inverse of the matrix $\begin{pmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{pmatrix}$. (8)

12. (a) Obtain the cubic spline approximation for the function $y = f(x)$ from the following data, given that $y''_0 = y''_3 = 0$. Hence find $y(-0.5)$, $y'(0.5)$ and $y''(1.5)$. (16)

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
$f(x)$:	48	100	294	900	1210

(ii) Using Lagrange's formula find the cubic polynomial which takes the following values. (8)

x :	1	3	4	6
$f(x)$:	0	22	57	205

13. (a) (i) Evaluate $\int_2^3 \frac{dx}{1+x}$ using 3- point Gaussian formula. (8)

(ii) By dividing the range into six equal parts, evaluate $\int_0^6 \frac{dx}{1+x}$ using Simpson's $\frac{3}{8}$ rule. (8)

Or

(b) (i) Evaluate $\int_0^{\frac{\pi}{2}} \int_0^{\frac{\pi}{2}} \sin(x+y)\, dx\, dy$ by Simpson's rule taking $h = k = \frac{\pi}{4}$. Compare with the actual value. (8)

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

14. (a) Given $y''+xy'+y=0$, $y(0)=1$, $y'(0)=0$, find the value of $y(0.1)$ and $y(0.2)$ by using Range–Kutta method. (16)

Or

(b) Determine the value of $y(0.4)$ using Milne's predictor corrector method, given that $y' = xy + y^2, y(0) = 1$. Use Taylor series method to get the values of $y(0.1)$, $y(0.2)$ and $y(0.3)$. (16)

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

(ii) Solve $4u_{xx} - u_{tt}$ given that $u(0,t)=0$, $u(4,t)=0$, $u_t(x,0)=0$ and $u(x,0)=x(4-x)$, taking $h=1$ (for 4 time steps). (8)

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 $u(x,0)=100(x-x^2)$. Compute u for one time step with $h = \frac{1}{4}$. (16)