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

Question Paper Code : 60776

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016

Fourth Semester

Civil Engineering

MA 2264/MA 41/MA 1251/080280026/10177 MA 401/10144 CSE 21/
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. What is the condition for the convergence of the iteration method for solving $x=\phi(x)$?

2. Find the iterative formula to find $\sqrt{N}$, where N is a positive integer.

3. A third degree polynomial passes through $(0,-1),(1,1),(2,1)$ and $(3,-2)$, find its value at $x=4$.

4. Find the divided differences of $f(x)=x^3+x+2$ for the arguments 1, 3,6, 11.

5. A curve passes through (0, 1), (0.25, 0.9412), (0.5, 0.8), (0.75, 0.64) and (1, 0.5). Find the area between the curve, x - axis, $x=0$ and 1 by Trapeziodal rule.

6. Evaluate $\int_0^1 e^{-x^2}dx$ dividing the range into 4 equal parts by Simpson's one third rule.

7. By Taylor series with first two non-zero terms find $y(1.1)$ given that $y'=x+y, y(1)=0$.

8. Using Euler's method find $y(0.2)$ given that $y' = x + y, y(0) = 1$.

9. Classify the equation : $U_{xx} + 2U_{xy} + 4U_{yy} = 0$.

10. State the explicit scheme to solve one dimensional wave equation.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Solve the system of equations $x + 2y + z = 8$, $2x + 3y + 4z = 20$, $4x + 3y + 2z = 16$ using Gauss elimination method. (8)

(ii) Find all the eigenvalues and eigenvectors of the following matrix (8)

$$A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}.$$

Or

(b) (i) Solve the system of equations by Gauss-Seidel iterative method. (8)

$20x + y - 2z = 17$, $3x + 20y - z = -18$, $2x - 3y + 20z = 25$.

(ii) Find the inverse of $A = \begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix}$ by Gauss-Jordan method. (8)

12. (a) (i) Given :

$\sin 45^\circ = 0.7071, \sin 50^\circ = 0.7660, \sin 55^\circ = 0.8192, \sin 60^\circ = 0.8660$.

Find $\sin 52^\circ$ by Newton's interpolation formula. (8)

(ii) Fit a Cubic spline curve that passes through (0, 1), (1,4), (2, 0) and (3, 2) with the natural end boundary conditions $s''(0) = 0, s''(3) = 0$. (8)

Or

(b) (i) Given the values

x :	5	7	11	13	17
$f(x)$:	150	392	1452	2366	5202

Evaluate $f(9)$ using Lagrange's formula. (8)

(ii) The values of y are consecutive terms of a series of which 23.6 is the 6th term. Find the first and tenth terms of the series : (8)

x :	3	4	5	6	7	8	9
y :	4.8	8.4	14.5	23.6	36.2	52.8	73.9

13. (a) (i) Using Romberg's method, evaluate $I = \int_0^1 \frac{dx}{1+x}$, correct to 3 decimal places. Evaluate $\log_e 2$. (8)

(ii) Evaluate $\int_0^{\pi/2}\int_0^{\pi/2} \sqrt{\sin(x+y)}\, dx\, dy$ by using Trapezoidal rule. (8)

Or

(b) (i) From the following table, obtain the value of $\frac{d^2y}{dx^2}$ at $x = 0.96$. (8)

x:	0.96	0.98	1.00	1.02	1.04
$f(x)$:	0.7825	0.7739	0.7651	0.7563	0.7473

(ii) Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ using Gauss three point formula. (8)

14. (a) Solve $y'' - xy' + y^2 = 0$ using Runge-Kutta method for $x = 0.2$ correct to 4 decimal places. The given conditions are $y(0) = 1; y'(0) = 0$. (16)

Or

(b) Use Taylor's series method to solve $\frac{dy}{dx} = xy + y^2, y(0) = 1$ at $x = 0.1, 0.2$ and 0.3 and continue the solution at $x = 0.4$ by Milne's method. (16)

15. (a) Solve $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square mesh with sides $x = 0, y = 0$ $x = 3, y = 3$ with $u = 0$ on the boundary and mesh length 1 unit. (16)

Or

(b) Using Crank-Nicholson method, solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to $u(x,0) = 0$, $u(0, t) = 0$ and $u(1,t) = t$,

(i) Taking $h = 0.5$ and $k = 1/8$ and

(ii) Taking $h = 0.25$ and $k = 1/8$, for one time step in each case.
