

Reg. No.																			
----------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code	13909
---------------------	-------

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Seventh Semester

**Computer Science and Engineering
20MAOE910 - NUMERICAL METHODS**

Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

	Marks	K- Level	CO
1. The Condition for convergence of the iteration process is (a) $ \phi'(x) > 1$ (b) $ \phi'(x) < 1$ (c) $ \phi'(x) = 1$ (d) $ \phi'(x) = 0$	1	K1	CO1
2. Which of the following is not an iterative method? (a) Gauss-Jordan (b) Fixed point (c) Gauss-Seidel (d) Gauss-Jacobi	1	K1	CO1
3. Which interpolation method is suitable for both equal and unequal intervals? (a) Newton's forward method (b) Lagrange's interpolation method (c) Newton's divided difference method (d) Both b and c	1	K1	CO2
4. The Lagrange interpolation polynomial passes through (a) The first and last points only (b) All the given data points (c) The midpoint of the date range (d) Only the first three points.	1	K1	CO2
5. Simpson's one third rule formula for $\int_a^b f(x)dx$ is (a) $\frac{h}{3} [(y_0+y_n) - 4(y_1 + y_3 + y_5 \dots + y_{n-1}) + 2(y_2 + y_4 \dots + y_{n-2})]$ (b) $\frac{h}{3} [(y_0+y_n) + 4(y_1 + y_3 + y_5 \dots + y_{n-1}) - 2(y_2 + y_4 \dots + y_{n-1})]$ (c) $\frac{h}{3} [(y_0+y_n) - 4(y_1 + y_3 + y_5 \dots + y_{n-1}) + (y_2 + y_4 \dots + y_{n-2})]$ (d) $\frac{h}{3} [(y_0+y_n) + 4(y_1 + y_3 + y_5 \dots + y_{n-1}) + 2(y_2 + y_4 \dots + y_{n-2})]$	1	K1	CO3
6. The first derivative of a function can be approximated using: (a) Newton's interpolation polynomial Method (b) Trapezoidal rule (c) Simpson's rule (d) Gauss-Seidel method	1	K1	CO3
7. The predictor-corrector method is a combination of (a) midpoint and trapezoidal rules (b) backward euler method and trapezoidal rule (c) implicit and explicit methods (d) forward and backward euler methods	1	K1	CO4
8. How many prior values are required to predict the next value in Adam's method? (a) One (b) Two (c) Three (d) Four	1	K1	CO4
9. Crank-Nicholson scheme is of order: (a) first (b) second (c) third (d) fourth	1	K1	CO5
10. The explicit formula for solving the parabolic equation $u_{i,j+1} = \lambda u_{i+1,j} + (1 - 2\lambda)u_{i,j} + \lambda u_{i-1,j}$ vanishes if (a) $\lambda = 0$ (b) $\lambda = 1$ (c) $\lambda = \frac{1}{2}$ (d) $\lambda = 2$	1	K2	CO5

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11. Write the advantages of Newton Raphson method.	2	K1	CO1
12. Compare Gauss elimination with Gauss seidel method.	2	K2	CO1
13. Prove that the relation $\Delta=E-1$ and $\nabla=1-E^{-1}$.	2	K2	CO2
14. Define cubic spline.	2	K1	CO2

15. Write down the expression for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = x_0$ by Newton's forward difference formula. 2 K1 CO3
16. Use two – point Gaussian quadrature formula to solve $\int_{-1}^1 \frac{dx}{1+x^2}$. 2 K2 CO3
17. Find $y(0.1)$ if $y' = 1 + y$, $y(0) = 1$, using Taylor's series method. 2 K2 CO4
18. Given $y' = x + y$, $y(0) = 1$. Find $y(0.1)$ by Euler's method. 2 K2 CO4
19. Classify the PDE $u_{xx} - u_{yy} = 0$. 2 K2 CO5
20. Write the diagonal five - point formula to solve the Laplace's equation. 2 K1 CO5

$$u_{xx} + u_{yy} = 0.$$
21. Write down Adam's – Bashforth predictor and corrector formula. 2 K1 CO4
22. State Euler modified formula. 2 K1 CO4

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23. a) Solve the following equations by Gauss-Seidel method. 11 K3 CO1
 $27x + 6y - z = 85, x + y + 54z = 110, 6x + 15y + 2z = 72.$

OR

- b) Find the dominant Eigen value and the Eigen vector of $A = \begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$. 11 K3 CO1

24. a) Find the polynomial $f(x)$ and hence find $f(10)$ by using Lagrange's formula for 11 K3 CO2

x	5	6	9	11
f(x)	12	13	14	16

OR

- b) The following data are taken from the steam table: 11 K3 CO2

Temp. °C	140	150	160	170	180
Pressure kgf/cm ²	3.685	4.854	6.302	8.076	10.225

Find the pressure at temperature $t = 142^\circ$ and $t = 175^\circ$.

25. a) Evaluate $\int_0^6 \frac{1}{1+x^2} dx$ by (i) Trapezoidal rule (ii) Simpon's rule. 11 K3 CO3

OR

- b) Find first and second derivative of $f(x)$ at $x = 1.5$ if 11 K3 CO3

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

26. a) Apply Runge-Kutta method of fourth order to solve the equation 11 K3 CO4
 $y' = x + y^2, 0 \leq x \leq 1, y(0) = 1$ find $y(0.1), y(0.2)$.

OR

- b) Given $5xy' + y^2 = 2, y(4) = 1, y(4.1) = 1.0049, y(4.2) = 1.0097,$
 $y(4.3) = 1.0143$. Compute $y(4.4)$ using Milne's method. 11 K3 CO4

27. a) Obtain the difference scheme to solve the Laplace equation. Solve, $\nabla^2 u = 0$ at the pivotal points in the square shown fitted with square mesh. Use Liebmann's iteration procedure. (5 iteration only). 11 K3 CO5

1000		1000	1000	1000
2000		u_1	u_2	500
2000		u_3	u_4	0
1000				0
		500	0	0

OR

- b) Solve the Poisson equation $u_{xx} + u_{yy} = 8x^2y^2$ for the square mesh of the given figure with $u(x, y) = 0$ on the boundary and mesh length = 1. 11 K3 CO5

0	0	0	0	0	
0		u_1	u_2	u_1	0
0		u_2	u_3	u_2	0
0		u_1	u_2	u_1	0
0					0
0	0	0	0	0	

28. a) (i) Find by Newton's method, the real root of the equation $3x = \cos x + 1$ correct to 4 decimals. 6 K3 CO1
(ii) Using Gauss elimination method, solve 5 K3 CO1
 $x + 2y - z = -5$; $x + y - 6z = -12$ And $2x + 17y + 4z = 35$.

OR

- b) Apply Gauss – Jordan method to solve the following system of equations 11 K3 CO1
 $x + y + z = 9$; $2x - 3y + 4z = 13$; $3x + 4y + 5z = 40$.