

Roll No.

Total No. of Questions : 09]

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Paper ID [ME309]

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B.Tech. (Sem. - 5th)

NUMERICAL METHODS IN ENGINEERING (ME - 309)

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1)

(10 × 2 = 20)

- a) Distinguish between absolute error, relative error and percentage errors.
- b) Find the number of terms of the logarithmic series such that the value of $\log 1.02$ is correct up to 3 decimals.
- c) What are the sufficient conditions for the convergence of iterative method.
- d) Using Iterative interpolation method, give the second approximation for the Newton's forward interpolation formula.
- e) Give working procedure for fitting a parabola.
- f) Derive Newton Cotes formula for numerical integration.
- g) Give Euler's Maclaurin's formula.
- h) Find eigen values of the following matrix
$$\begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix}$$
- i) Give the formula of Modified Euler's method. Give its order of error also.
- j) Give the SOR method for the solution of partial differential equations.

Section - B

(4 × 5 = 20)

Q2) Using Newton-Raphson's method, find $\sqrt[5]{50}$, correct to four decimals.

Q3) The pressure P of wind corresponding to velocity V is given by the following data. Find the value of P when V = 25.

V	10	20	30	40	50
P	1.1	2.0	4.4	7.6	10.8

Q4) The velocity of a car at intervals of 2 min. are given below:

Time (min.)	0	2	4	6	8	10	12
Velocity (km/Hr.)	0	22	30	27	18	7	0

Apply Simpson 1/3rd rule to find the distance covered by the car in 12 minutes.

Q5) Solve the system of equations $2x + y + z = 10$, $3x + 2y + 9z = 18$, $x + 4y + 9z = 16$ by matrix inversion method.

Q6) Using Taylor's series method find the solution of $dy/dx = 3x + y^2$ where $y(0) = 1$. Find the value of y for $x = 0.01$ correct to 4 decimal places.

Section - C

(2 × 10 = 20)

Q7) Fit a cubic spline to the following data and evaluate $y(1.5)$ and $y'(3.0)$.

x	1	2	3	4
y	1	2	5	11

Q8) The deflection of a beam is governed by the equation $\frac{d^4 y}{dx^4} + 81y = \phi(x)$, where $\phi(x)$ is given by the table

x	1/3	2/3	1
$\phi(x)$	81	162	243

and boundary condition is given by $y(0) = y'(0) = y''(1) = y'''(1) = 0$. Evaluate the deflection at the pivotal points of the beam using three subintervals.

Q9) Solve the equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square with sides $x = 0$, $y = 0$, $x = 3$, $y = 3$ with $u = 0$ on the boundary and mesh length = 1.

