

ADVANCED NUMERICAL ANALYSIS
 (MS-561)

Instructions: Attempt any **SEVEN** questions, all questions carry equal marks.

Q-1 Compute smallest eigen value, λ of the equation,

$$\frac{\partial^2 U}{\partial x^2} + \frac{\partial^2 U}{\partial y^2} + \lambda U = 0$$

The value of the function U on the sides of the square with vertices $(0,0)$, $(1,0)$, $(1,1)$ and $(0,1)$ is 'ZERO' except on the side along y -axis, where $\frac{\partial U}{\partial x} = 0$, choosing $h = \frac{1}{2}$ and $h = \frac{1}{3}$. Also extrapolate the value of λ for $h = 0$.

Q-2 Given $\frac{dy}{dx} = xy$ with $y(1) = 5$

Find the solution using Runge-Kutta fourth order method for $x = 1(0.1)1.3$

Q-3 A river is 80 feet wide. Depth d in feet at a distance of x feet from one bank is given by the following table:

x	0	10	20	30	40	50	60	70	80
d	0	4	7	9	12	15	14	8	3

Find approximately the area of the cross-section.

Q-4 Estimate the maximum value of y from the following data

x	1.0	1.2	1.4	1.6	1.8
y	1.125	1.464	1.644	1.664	1.525

Q-5 The equation $\cos x - 3x + 1 = 0$ has a solution lying between 0 and 1;

Verify this statement by finding the solution correct to three decimal places using simple iteration method.

Q-6 Fit a polynomial to the following data using Newton's divided difference

x	-4	-1	0	2	5
y	1245	33	5	9	1335

Q-7 Find Eigen values and corresponding Eigen-vectors for the following matrix.

$$\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$

Q-8 Solve the following system of linear equations by Jacobi iteration method, correct to THREE decimal places

$$3x + 4y + 15z = 54.8$$

$$x + 12y + 3z = 39.66$$

$$10x + y - 2z = 7.74$$

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