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I Semester M.Sc. Degree Examination, June-2025
(CBCS, SLM Scheme)
MATHEMATICS
Course - V : Numerical Analysis - I

Time : 3 Hours **Max. Marks : 80**

Instructions : ***1) Answer any five full questions.***
2) All questions carry equal marks.

Q1) a) Obtain the Newton - Raphson formula for finding the roots of the equation $f(x) = 0$ and hence find the real root of the equation $3x = \cos x + 1$.

b) Derive the iterative formula of Chebyshev method.

[10+6]

Q2) a) Show that the rate of convergence of secant method is 1.618.

b) Explain Birge - Vieta method to find the roots of the polynomial equation $P_n(x) = 0$.

[8+8]

Q3) a) Find the number of real and complex roots of the polynomial equations $P_3(x) = x^3 - 5x + 1 = 0$ using Sturm sequence.

b) Solve the given system of equation by LU decomposition method

$2x + y + 4z = 12$

$4x + 11y - z = 33$

$8x - 3y + 2z = 20$

[8+8]

Q4) a) Describe Lagrange's interpolation method. Obtain the truncation error formula.

b) Describe and obtain the piecewise cubic interpolation.

[8+8]

Q5) a) Obtain Gregory Newton forward and backward difference interpolation formulas.

b) Prove the following :-

i) $\delta = \nabla(1-\nabla)^{-1/2}$

ii) $\nabla - \Delta = -\Delta\nabla$

[10+6]

Q6) a) Derive the Hermite interpolating polynomial.

b) Derive Newton's Bivariate interpolation for Equispaced points.

[8+8]

Q7) a) Find the least square approximation of second degree for the discrete data :

x	–2	–1	0	1	2
$f(x)$	15	1	1	3	19

b) Derive Newton's bivariate interpolating function. And find $f(0.5, 0.5)$.

y/x	0	1	3
0	1	2	10
1	2	4	14
3	10	14	28

[8+8]

Q8) a) Explain Trapezoidal method and Simpson method based on interpolation, undetermined coefficients.

b) Evaluate the integral $I = \int_{y=1}^{1.5}\int_{x=1}^{2} \frac{dx \cdot dy}{1+x}$.

Using the Simpson's rule with h = 0.5 (along x – axis) and $k = 0.25$ (along y – axis). Compare with exact solution.

[8+8]

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