Math-2.4

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II Semester M.Sc. Degree Examination, May - 2025
(Non - CBCS, SLM Scheme)
MATHEMATICS
Numerical Analysis

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 $f(x) = 0$. Discuss the rate and condition of convergence of the same method.

b) Using Chebyshev method find the root of the equation $x^3 - 5x + 1 = 0$. Perform two iterations by using the initial approximation $x_0 = 0.5$.

[10+6]

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

b) Find the root of the equation $2x = \cos x + 3$ correct to four decimal places using the iteration method. Take $x_0 = \pi/2$. Accelerate the convergence rate using Aitkene Δ^2 method.

[8+8]

Q3) a) Explain Birge-Vieta method to find the roots of the polynomial equation $P_n(x) = 0$.

b) Find the number of real and complex roots of the polynomial equation $P_3(x) = x^3 - 5x + 1 = 0$, using sturm sequence.

[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) Derive Newton's bivariate interpolation for equispaced points.

b) Obtain the least squares polynomial for degree one and two for $f(x) = x^{1/2}$ on $[0, 1]$

[8+8]

Q6) a) Define a numerical differentiation method of order 'P' obtain numerical differentiation methods based on finite difference operators.

b) Derive the trapezoidal method using the method of undetermined co-efficients obtain the truncation error.

[8+8]

Q7) a) Evaluate the integral $I = \int_{y=1}^{1.5} \int_{x=1}^{2} \frac{dx \cdot dy}{1+x}$ using Simpson's rule with $h = 0.5$ (along x-axis) and $k = 0.25$ (along y-axis)

b) Using Adam - Bashforth third order method solve the initial value problem $u' = -2tu^2$, $u(0) = 1$ on $[0, 1]$ with $n = 0.2$. **[8+8]**

Q8) a) Illustrate $P(EC)^ME$ method for the equation $u' = \lambda u$ and the P-C set.

b) Explain shooting method to solve the boundary value problem.

[8+8]

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