MMDSE-1.5

Sl.No. :

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I Semester M.Sc. Degree Examination, May/June - 2026
(SLM Scheme, CBCS)
MATHEMATICS
Course - V : Numerical Analysis

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

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

Q1) a) Derive Newton-Raphson method that solves the non-linear equation $f(x)=0$. Discuss the rate and Condition of Convergence of the same method.

b) A real root of the equation $f(x)=x^3-5x+1=0$ lies in the interval (0.1). Perform four iterations of the secant method and the Regula-Falsi method to obtain this root.

[8+8]

Q2) a) Perform two iterations of the Muller Method to find the smallest positive root of the equation $f(x) = x^3 - \frac{1}{2} = 0;$

$$x_0 = 0;\ x_1 = 1,\ x_2 = \frac{1}{2}.$$

b) Define the rate of convergence of an iterative method. Show that rate of convergence of secant method is 1.618.

[8+8]

Q3) a) Find the root of the equation $2x = \cos x + 3$ correct to four decimal places using the iteration method. Take $x_0 = \frac{\pi}{2}$. Accelerate the convergence rate using Aitkene Δ^2 method.

b) Derive Birge-Vieta method and with the help of this method, find a real root correct to three decimals of the equation $x^5 - x + 1 = 0,\ P = -1.5$.

[8+8]

Q4) a) Find the number of real and complex roots of the polynomial equation $P_3(x) - x^3 - 5x + 1 = 0$ using strum sequences.

b) Apply Gauss-Seidel method to solve the following system of linear equations.

$$8x - y + z = 18$$
$$x + y - 3z = -6$$
$$2x + 5y - 2z = 3$$

[8+8]

Q5) a) Describe Lagrange's interpolation method obtain the truncation error formula.

b) Find the unique polynomial of degree 2 or less, such that *f(0)*=1*; f(1)*=3*; f*(3)=55, Using Newton's Divided difference interpolation.

[8+8]

Q6) a) Derive the Hermite interpolating polynomial.

b) Evaluate the integral $\int_0^1 \frac{dx}{1+x}$ using:

i) Composite Trapezoidal rule

ii) Composite simpson's rule, with 2,4 and 8 equal subintervals.

[8+8]

Q7) a) Solve the difference equation $\Delta^2 y_j + 3\Delta y_j - 4y_j = j^2$ with the initial conditions $y_0=0,\ y_2=2$.

b) Give the data

x	0	1	2	3
$f(x)$	1	2	33	244

fit quadratic splines with M(0) = $f''(0)=0$. Hence, find an estimate of $f(25)$.

[8+8]

Q8) a) Explain non-linear second order differential equations using boundary conditions.

b) Evaluate the integral $I = \int_1^2 \int_1^2 \frac{dx\ dy}{1+x}$ using the trapezoidal rule with $h=k=0.5$ and $h=k=0.25$. Improve the estimate using Romberg integration.

[8+8]