

5. If the derivative $f'(x_0)$ is approximated by

$$f'(x_0) = \frac{-3f(x_0) + 4f(x_1) - f(x_2)}{2h}. \text{ Estimate the value}$$

of $f'(2.0)$ from the following tabulated values for $h=0.01$ and 0.06 . (10)

X	2.0	2.01	2.02	2.06	2.12
f(x)	0.69315	0.69813	0.70310	0.72271	0.75142

6. Evaluate $\int_{-2}^2 \frac{x}{5+2x} dx$ using the (a) trapezoidal rule, (b) Simpson's 1/3 rule, and (c) Gauss-Legendre's 3-point formula. (3+3+4=10)

7. Given the IVP, $\frac{dy}{dx} = x^2 + y^2$; $y(1) = 1.2$, find $y(3)$ using the Euler's method with step sizes $h=0.5$, $h=1.0$. (10)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2894

H

Unique Paper Code : 32223912

Name of the Paper : Numerical Analysis

Name of the Course : B.Sc. Hons. (Physics) SEC

Semester : IV

Duration : 3 Hours

Maximum Marks : 50

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** questions in all.
3. Question no. 1 is compulsory.
4. **All** questions carry equal marks.
5. Non programmable scientific calculator is allowed.

1. Attempt any **four** : (2.5×4=10)

- (i) Find the difference, $D = \sqrt{5.36} - \sqrt{5.35}$ and calculate the relative error in the result.
- (ii) Find the number of real roots of the equation $3^x - 3x - 2 = 0$ and locate them.
- (iii) Use Newton-Raphson method to find a root of the equation $x^3 + x - 1 = 0$; correct upto three decimal places.
- (iv) Prove the relationship between the operators of finite difference, $\mu = \frac{1}{2}\sqrt{4 + \delta^2}$, where μ and δ are the mean and central differential operators.
- (v) Give geometrical interpretation of Trapezoidal rule.
- (vi) Fit the given data (0, -1), (2, 5), (5, 12), (7, 20) to the straight line $Y = a_0 + a_1x$ using the method of least squares and find the approximate values of a_0 and a_1 .

2. (a) Find a root of the equation $x^3 - 5x + 3 = 0$, correct to three decimal places using Newton Raphson's method.

(b) Find a real root of the equation $x^3 = 1 - x^2$ in the interval $[0,1]$ with an accuracy of 10^{-4} using fixed point iteration method. (2×5=10)

3. The values of x in degrees and $\sin x$ are given in following tables

$x(\text{degrees})$	15	20	25	30	35	40
$\sin x$	0.2588190	0.3420201	0.4226183	0.5	0.5735764	0.6427876

Determine the values of $\sin 18^\circ$ and $\sin 38^\circ$. (10)

4. (a) Using the method of least square fitting, find the constants a and b such that the function $y = ae^{bx}$ fits the given data (1.0, 2.473), (3.0, 6.722), (5.0, 18.274), (7.0, 49.673), (9.0, 135.026).

(b) Find the values of a_0 and a_1 so that $Y = a_0 + a_1x$ fits the data given in the table :

x	0	1	2	3	4
y	1.0	2.9	4.8	6.7	8.6

(2×5=10)