

- (b) For the following data find the initial acceleration using Newton's Forward Interpolation method.

(7)

Time (sec)	0	5	10	15	20
vel. (m/s)	0	3	14	60	228

5. (a) Find the polynomial $f(x)$ by using Lagrange Interpolation formula and hence find $f(3)$ for the following data

(7)

x	0	1	5
f(x)	2	3	147

- (b) Solve the ordinary differential equation

$$\frac{dy}{dx} = y - x, \quad y(0) = 2$$

using the second-order Runge-Kutta method. Find $y(0.1)$ and $y(0.2)$ correct to four decimal places.

(8)

(200)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5130

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Unique Paper Code : 2224002004

Name of the Paper : Numerical Analysis and Computational Physics

Name of the Course : **B.Sc. Hons. (Physics) NEP UGCF-2022**

Semester : IV / VI (GE Paper)

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **four** questions in all with question no. 1 as compulsory.

1. Attempt **any five** out of the following : (5×3=15)

- (a) Calculate absolute, relative and percentage error, if true value = 3.14159 and approximate value = 3.14.

P.T.O.

- (b) Explain overflow and underflow in floating-point representation.
- (c) What are the main causes of errors in numerical computation?
- (d) Write the formula for Euler's method for solving a first-order ODE. Solve $\frac{dy}{dx} = -y$ where $y(0) = 1$, find the value of $y(0.02)$ with $h=0.01$.
- (e) Discuss the advantages and disadvantages of the bisection method compared to the secant method for solving algebraic and transcendental equations.
- (f) State the Mean value theorem for derivatives.
2. (a) Define interpolation and derive Newton's forward interpolation formula. (7)
- (b) Solve the equation $f(x)=x^3-x-2=0$ using the bisection method over the interval $[1,2]$. Perform five iterations. (8)

3. (a) For the following data, find the value of y at $x = 0.29$ using Newton's backward interpolation formula. (7)

x	0.2	0.22	0.24	0.26	0.28	0.3
y	1.6596	1.6698	1.6804	1.6914	1.7024	1.7139

- (b) Use the least squares method to fit the given data points to a straight line $y = a + b x$. Compute the coefficients a and b . Estimate the error for the point $x=3$. (8)

x	1	2	3	4	5
y	2.5	3.8	5.2	6.0	7.3

4. (a) A velocity function is given by $v(t) = t^2 + 2t$ over the interval $[0,2]$ seconds. Use the Trapezoidal method and Simpson's 1/3 method with $n = 4$ subintervals to estimate the distance travelled, given by

$$\int_0^2 v(t) dt$$

Compute the result and compare with the exact integral value. (8)