Your Roll No.....

Sr. No. Of Question Paper : 2980

Unique Paper Code : 2223512003

Name of the Paper : Introduction to Numerical Methods Name of the

Course : **B. Sc (Prog.) Physical Sciences**

(NEP: UGCF-2022)

Semester : IV

Duration : 2 hours Maximum Marks : 60

Instructions to candidates

Write your Roll No. on the the top immediately on receipt of the question paper.

Question No. 1 is compulsory.

Answer any three of the remaining four questions.

Q.1. (a) Find the absolute error and relative error in the quotient u/v, given that $u = 34.56 \pm 0.002$ and $v = 8.3 \pm 0.02$. (4)

(b) Find the real root of the equation $f(x) = x^3 - 2x - 5 = 0$. (5)

(c) Prove any three of the following: (6)

(i) $\Delta - \nabla = \delta^2$

(ii) $(1 + \Delta)(1 - \nabla) = 1$

(iii) $\Delta\nabla = \Delta - \nabla$

(iv) $\Delta^2 = (1 + \Delta)\delta^2$

Q.2. (a)Find $f(1.15)$ and $f(1.85)$ from the following table: (10)

x	1	1.2	1.4	1.6	1.8	2.0
$f(x)$	2.718	3.320	4.055	4.953	6.050	7.389

(b) Using **Gauss's forward formula,** find the value of y at $x = 3.75$ from the following table: (5)

x	2.5	3.0	3.5	4.0	4.5	5.0
y	24.145	22.043	20.025	18.644	17.262	16.047

Q. 3. (a) Evaluate the integral $I = \int_0^1 \frac{1dx}{1+x^2}$ by both the trapezoidal and Simpson's (1/3) rule using 6 sub intervals. (7)

(b) Determine the unique cubic polynomial that fits the following data:

x	0	1	2	3
$f(x)$	1	2	1	10

Hence calculate the first and second derivatives $f'(1.5)$ and $f''(1.5)$. (8)

Q.4. Using Euler's modified method, solve the following problems:

(a) Find $y(0.1)$ and $y(0.2)$ given the differential equation $dy/dx = x + y$ with initial condition $y(0) = 1$ and step size $h = 0.1$. (7)

(b) Given that $\frac{dy}{dx}=x+y^2$, $y(0) = 1$, Find $y(0.2)$,where $h = 0.1$ using Runge-kutta fourth order. (8)

Q.5.(a) Find the missing terms in the following:

x	1	2	3	4	5
y	2	5	---	14	22

(10)

(b) Find the Lagrange interpolating polynomial of degree 2 approximating the function $y = ln\, x$ defined by the following tables of values. Hence determine the value of ln 2.7.

x	$y = \ln x$
2	0.69315
2.5	0.91629
3.0	1.09861

(5)

(5)