

[This Question paper contains 2 printed pages.]

Sr. No. of question paper :

Your roll no.....

Unique Paper code : 2224002004

Name of the Paper : Numerical Analysis and Computational Physics
(GE paper)

Name of the Course : B.Sc. (Hons.) NEP

Semester : III

Duration : 2 Hours

Maximum Marks : 60 Marks

Instruction for candidates

1. Write your Roll no. on the top immediately on receipt of this question paper.
2. Question no. 1 is compulsory.
3. Attempt any four questions.
4. Use of non-programmable scientific calculator is allowed.

Q1. Attempt any five questions

5x3=15

- a. If $\Delta x = 0.005$, $\Delta y = 0.001$ be the absolute errors in $x = 2.11$ and $y = 4.15$, find the relative error in the computation of $x + y$.
- b. Find the least square line $y = ax + b$ for the data

x	-2	-1	0	1	2
y	1	2	3	3	4

- c. Why Newton Raphson method is faster than Bisection method?
- d. Show graphically how Secant method converges to the root.
- e. Discuss the condition on number of intervals/subinterval in Simpson's 1/3 integration method.
- f. Integration is defined as area under the function/polynomial. Explain what is the order of polynomial to find the integration by Trapezoidal method?

2. a) Solve the equation $x^3 - 9x + 1 = 0$ for the root lying between 2 and 3, correct to three significant figures by using bisection method.

b) Starting from two initial guess $[a, b]$ in which a function is continuous, discuss the graphical representation of Secant method for convergence to root for the function. Also derive the expression for approximate root of the method. (7+8)

3. a) Use Newton's forward interpolation formula and find the value of $\sin 52^\circ$ from the following data. Estimate the error.

x	45°	50°	55°	60°
$y = \sin x$	0.7071	0.7660	0.8192	0.6660

b) Using Lagrange's interpolation formula find a polynomial $y = f(x)$ which passes the points (0,-12), (1,0), (3,6) and (4,12). Find the value of $f(2)$. (8+7)

4. a) A rod is rotating in a plane about one of its ends. If the following table gives the angle θ radians through which the rod turned for different values of time t seconds, find its angular velocity and angular acceleration.

t (Seconds)	0.0	0.2	0.4	0.6	0.8	1.0
θ (Radians)	0.00	0.12	0.48	1.10	2.00	3.20

b) Find the value of $\int_0^1 \frac{dx}{1+x^2}$, taking 5 subinterval by Trapezoidal rule, correct to five significant figures. Also compare it with its exact value. (7+8)

5. a) Determine the value of y when $x=0.1$ and 0.2 given that $y(0)=1$ and $\frac{dy}{dx} = x^2 - y$

b) Given $\frac{dy}{dx} = x^2 + y^2$, with $x=0, y=1$. Find $y(0.1)$ by forth order Runge-Kutta method.

(7+8)