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NEPNY—52—2023

FACULTY OF SCIENCE

M.Sc. (NEP) (First Semester) EXAMINATION

NOVEMBER/DECEMBER, 2023

PHYSICS

SPHYC–403

(Numerical Techniques and C-Programming)

(Tuesday, 26-12-2023) **Time : 10.00 a.m. to 1.00 p.m.**

Time—3 *Hours* *Maximum Marks*—80

N.B. :— (*i*) *All* questions carry equal marks.

(*ii*) Q. No. **1** is compulsory.

(*iii*) Solve any *three* of the remaining five questions (Q. No. **2** to Q. No. **6**).

(*iv*) Figures to the right indicate full marks.

(*v*) Use of scientific calculator is allowed.

1. Solve the following questions (**5** marks each) : 20

(*a*) Derive an expression for Newton Forward interpolation formula.

(*b*) Evaluate :

$\int_0^1 \frac{dx}{1+x^2}$ using Simpson's $\frac{1^{rd}}{3}$ rule.

(*c*) Discuss Gauss elimination method for the solution of simultaneous equations.

(*d*) Executable and non-executable statements in C-programming.

P.T.O.

2. (*a*) Derive Newton's forward difference interpolation formula and for the data construct the forward difference formula, hence, find $f(0.5)$. 10

x	–2	–1	0	1	2	3
$f(x)$	15	5	1	3	11	25

(*b*) Find the approximate value of I, $I = \int_0^1 \frac{dx}{1+x}$, using the trapezium rule with 2, 4 and 8 equal subintervals. Using the exact solution, find the absolute error. 10

3. (*a*) Solve the system of equations 10

$$x_1 + 10x_2 - x_3 = 3$$

$$2x_1 + 3x_2 + 20x_3 = 7$$

$$10x_1 - x_2 + 2x_3 = 4$$

using the Gauss elimination method.

(*b*) Discuss Built in and user defined functions in detail. 10

4. (*a*) Discuss Bisection method and find a real root of equation $x^3 - 2x - 5 = 0$ using Bisection method. 10

(*b*) Find inverse of the matrix 10

$$A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$$ using Gauss–Jordan method.

5. (*a*) Derive Newton-Cotes formula for the numerical integration. 10

(*b*) Write a C-programme for the addition of two 3 × 3 matrix. 10

6. Solve the following questions (**5** marks each) : 20

(*a*) Linear interpolation

(*b*) What are random numbers ? How random numbers are generated in C-programming ?

(*c*) Euler method

(*d*) Solution of elliptic equation using finite difference method.