U.G. 1st Semester Examination - 2021

PHYSICS

[HONOURS]

Course Code : PHY-H-CC-P-01

(Mathematical Physics-I)

[PRACTICAL]

Full Marks : 20 Time : 2 Hours

Use any of the programming languages python/ Fortran/Matlab/C/C++ to solve the following physical problems.

Answer any **four** questions: 5×4=20

1. Given some data: 87, 91, 85, 75. 28, 122, 66 and 56. Find the (arithmetic) mean and r.m.s. (root mean square) value of the variable.

2. Write a computer program to compute n!, where n=10.

3. Find the value of π from the infinite series: up to the 6th decimal of accuracy.

$$\frac{\pi}{4}=1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\frac{1}{9}+\ldots$$

4. Starting with $u_1=1, u_2=1$, generate 20 Fibonacci numbers with the sequence $u_{n+1}=u_n+u_{n-1}$ and then calculate the following series sum: $S=\sum_{n=1}^{20}\frac{1}{u_n^2}$.

5. Using the bisection method find a root of the following equation $x\sin x-1=0$ in the interval [0, 2].

6. You have a set of data points given in the tabular form in the following:

x	5	10	15	20	25	30
y	45	105	174	259	364	496

Find out the value of y for x = 18 using Newton's forward difference formula.

7. Write a computer program to find the trace, Tr(A) of the following matrix:

$$A=\begin{pmatrix}3 & 4 & 8\\ 5 & 9 & 2\\ 1 & 6 & 0\end{pmatrix}$$

8. Compute the value of π from the formula:

$$\frac{\pi}{4}=\int_0^1\frac{dx}{1+x^2}$$

Use composite Simpson's 1/3 rule to evaluate with an accuracy of the order of 10^{-5}.

9. Write a program to solve the differential equation for the damped harmonic motion: (code may be written following Euler/Runge-Kutta 2nd order/Runge-Kutta 4th Order method)

$$\frac{d^2y}{dx^2} + 2.\frac{dy}{dx} + y = 0 \text{, with } y(0) = 0, x(0) = 0, y'(0) = 1.0$$

10. The temperature of a well-stirred liquid by the isothermal heating coil is given by the equation:

$$\frac{d\theta}{dt} = K(100 - \theta)$$, where K is a constant of the system.

Write a computer program to solve the equation by any suitable method to find θ at t = 1.0 sec for K=2.5. Initial condition: θ = 25°C at t = 0 sec.

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