SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2021

(CUCSS - PG)

(Regular/Supplementary/Improvement)

CC19P PHY2 C08 - COMPUTATIONAL PHYSICS

(Physics)

(2019 Admission onwards)

Time: Three Hours   Maximum: 30 Weightage

Section A

Answer *all* questions. Each question carries 1 weightage.

1. Write a note on operators in python programming.

2. What is the difference in file manipulation with or without pickle?

3. Distinguish between 'polyval(p,x)' and 'poy(s)' in polynomial class.

4. Briefly explain shooting method?

5. Show that any value of y can be expressed in terms of y_n and its backward differences.

6. What are sub-plots? How sub-plots are created using Python?

7. Briefly explain the concept of fast Fourier transform.

8. Write a note on the condition for stability of attractor in logistic map.

(8 × 1 = 8 Weightage)

Section B

Answer any *two* questions. Each question carries 5 weightage.

9. i) What is meant by a loop in a program?

   ii) Explain with examples, the different loop statements in Python.

   iii) What is the use of 'break' and 'continue' statements?

10. Derive Runge-Kutta fourth order formula and solve the simultaneous equations $\frac{dx}{dt} = 2x + y$, $\frac{dy}{dt} = x - 3y$ with the initial conditions x=0,y=0.5 when t=0. Compute the first six lines of a tabular solution.

11. i) Derive Lagrange's interpolation formula.

    ii) Find Lagrange's interpolation polynomial fitting the points y(1)=-3, y(3)=0, y(4)=30, y(6)=132. Hence find y(5).

12. Explain various functions used in matplotlib for visualization in Python.

(2 × 5 = 10 Weightage)

Section C

Answer any *four* questions. Each question carries 3 weightage.

13. Explain the important *ndarray* object attributes.

14. Write down a program to draw a 'rhodonea' for $r = \sin(n\theta)$

15. Determine the constants a and b by the method of least squares such that $y=ae^{bx}$ fits following data:

X	2.5	5.0	7.5	10.0	12.5	15.0
y	76	52	35	24	16	11

16. Find the real root of the equation $x^3-x-1=0$ using bisection method.

17. Write a programme to plot the graph of simple harmonic oscillator.

18. Fit a cubic spline curve that passes through (0,1), (1,4), (2,0), (3,2) with natural end boundary conditions $S''(0) = S''(3)=0.0$

19. Find the approximate value of $y = \int_0^\pi \sin x\, dx$ using (i) trapezoidal rule and

(ii) Simpson's 1/3 rule by dividing the range of integration into six equal parts.

(4 × 3 = 12 Weightage)

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