17P214 (Pages: 2) Name……………………….

Reg. No……………………..

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, MAY 2018

(CUCSS - PG)

(Physics)

CC17P PHY2 C07 - COMPUTATIONAL PHYSICS

(2017 Admissions: Regular)

Time: Three Hours Maximum: 36 Weightage

Section A

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

1. What is a high level language? What are its features?
2. Using which functions can inputs be read in python? What distinguishes those functions?
3. How can data be written into and read from files, preserving their datatypes?
4. How can we perform vector operations like scalar and vector products using arrays?
5. How do you obtain multiple plots in a same graph in python?
6. Write a python code to plot a sine function in the interval $(0, 4\pi)$ using python.
7. What is curve fitting? How is it different from interpolation?
8. Obtain Lagrange's interpolation polynomial of degree two, and then generalize it to that of n^{th} degree.
9. Give the computational steps to obtain the solution of nonlinear or transcendental equations using *regula-falsi* method.
10. Given $\frac{dy}{dx}$ and $y(x_0)$, how do we solve it using Euler's first order method?
11. What is *Fast Fourier transform* (FFT)? How is it advantageous over *Discrete Fourier Transform* (DFT)?
12. Explain the stability of an attractor for a logistic map. When is chaos onset?

(12 x 1 = 12 Weightage)

Section B

Answer any ***two*** questions. Each question carries 2 weightage.

13. Discuss functions and modules in python with suitable examples.
14. (a) How do we save and restore arrays in python?

    (b) How can we solve simultaneous equations using matrices in python?
15. Explain Monte Carlo method of simple integration. Using the method, how do we find the area of a circle of unit radius centered at the origin?

16. Discuss shooting method to solve ordinary differential equations. Apply the method to solve the boundary value problem $y'' = y(x),\ y(0) = 0$ and $y(1) = 1$.

(2 x 6 = 12 Weightage)

Section C

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

17. Write a program to find the factorial of a number using recursive function.

18. Write a python program to obtain a bar chart between the data given:

Year	1995	2000	2005	2010	2015
Yield (arb. unit)	74.2	77.6	87.5	92.0	94.3

19. Measurements from a radioactive decay are tabulated below. Use least squares method to fit the data.

Time (s)	0	0.05	0.1	0.15	0.2	0.25
Count	100	61	37	22	14	8

20. Show that Simpson's rule yields more accurate results than trapezoidal rule by comparing the integral $\int_0^1 \frac{1}{1+x}\,dx$ with the exact value of 0.6931. Consider step sizes of 0.5 and 0.25.

21. The angular displacement θ of a simple pendulum is given by the equation

$$\frac{d^2\theta}{dt^2} + \frac{g}{l} sin\theta = 0$$

where, l = 0.98 cm and g = 9.8 m/sec^2. If $\theta = 0$ and $d\theta/dt$ = 4.472 at t = 0, use Runge-Kutta method to find θ and $d\theta/dt$ when t = 0.2 sec.

22. Write a python program to solve an ideal simple harmonic oscillator using Euler method.

(4 x 3 = 12 Weightage)

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