QP CODE: 22000733

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Reg No : .....

Name : .....

M Sc DEGREE (CSS) EXAMINATION, APRIL 2022

Third Semester

Faculty of Science

CORE - PH010302 - COMPUTATIONAL PHYSICS

M Sc PHYSICS, M Sc SPACE SCIENCE

2019 ADMISSION ONWARDS

CED2409C

Time: 3 Hours Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. Using the method of least squares, find an equation of the form $y = mx + c$ that fits the following data:

x	0	1	2	3	4
y	1.1	4.3	7.5	10.5	13.7

2. Explain the procedure for fitting a curve of the form $y = ax^b$ using the method least squares.

3. Define a cubic spline. What are the advantages of cubic spline fitting?

4. Evaluate $\int_{-2}^{2} x^4 dx$ by using the Trapezoidal rule.

5. Write the algorithm to find the integral of a function using Simpson's 3/8 rule.

6. Briefly explain the application of Euler's method.

7. Explain the convergence and stability considerations while solving differential equations.

8. State the condition of convergence of the Gauss-Seidel method.

9. What is meant by implicit method?

10. Why do we need random numbers?

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Calculate the missing term in the following table

X	1	2	3	4	5
Y	9	…..	15	23	39

12. Find F(1) by using divided difference interpolation from the following data

X	-4	-1	0	2	5
F(x)	1245	33	5	9	1335

13. Find the first and second derivatives of the function tabulated below at the point x = 1.5.

x	1.5	2	2.5	3	3.5	4
y	3.375	7.0	13.625	24.0	38.875	59.0

14. A cubic function y= f(x) satisfies the following data; Determine f(x) and hence find f(3) and f ''(3) from the data.

x	0	1	2	4
f (x)	1	5	40	80

15. Solve the initial value problem $\frac{dy}{dx} = log(x+y)$, y(0) =1 using modified Euler method and hence find y(0.2).

16. Apply Gauss – Jordan elimination method to find the solution of the following system of equations:
    x+2y +z = 8
    2x + 3y +4z =20
    4x + 3y +2z =16

17. Express $(\frac{\partial^2 T}{\partial x\, \partial y})_{1,j}$ in terms of central difference approximation.

18. Using the Schmidt method, solve the differential equation $\frac{\partial T}{\partial t} = \frac{\partial^2 T}{\partial x^2}$ $0 \leq x \leq \frac{1}{2}$, with boundary conditions, $\frac{\partial T}{\partial t} = 0$ at x=0 and $\frac{\partial T}{\partial t} = 1$ at $x = \frac{1}{2}$ for t > 0 taking $\Delta x = 0.1\ and\ \Delta t = 0.001$. Give a solution for the one time step.

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. Explain the method of curve fitting by the method of least squares. How can you fit a straight line and an exponential function to the given data points? Explain using examples.

20. Derive the general formula for numerical integration and arrive at simpsons 1/3 rule for Numerical integration. Also write the algorithm for this method

21. Using R-K method of fourth order, solve $y'' = xy' + y^2$. Given that y(0) =1 , y'(0) =2. Take h =0.2 and find y(0.2) and y'(0.2).

22. Discuss weighted average implicit method and hence reduce the Schmidt and Crank Nicolson formula

(2×5=10 weightage)