Reg. No ..... Name .....

M Sc DEGREE END SEMESTER EXAMINATION - OCTOBER 2019

SEMESTER 3 : PHYSICS

COURSE : **16P3PHYT10 : COMPUTATIONAL PHYSICS**

(For Regular - 2018 Admission and Supplementary - 2016/2017 Admissions)

Time : Three Hours Max. Marks: 75

Section A
Answer any 5 (1 marks each)

1. In Newton's forward difference formula,
   a)$\Delta y_{n-1} = y_n - y_{n-1}$ b) $\Delta y_n = y_n - y_{n-1}$
   c)$\Delta y_n = y_n - y_0$ d) $\Delta y_{n+1} = y_n - y_{n-1}$
2. Newton's backward difference formula is mainly used for finding the function values
   a. Near the beginning of a set of tabular values
   b. Near the end of a set of tabular values
   c. All values backward from the initial value
   d. From a set of unequally spaced tabular values.
3. By Romberg method the value of I_T for the set if f(0)=0.25, f(1)=0.20 and f(2)=0.125 is
   (a) 0.3875 (b) 0.3650 (c) 0.3950 (d) 0.4000
4. Various types of RK Method are classified according to their
   (a) Degree (b) Order (c) Rank (d) Both (a) and (b)
5. The partial equation $xu_{xx} + u_{yy}$ =0 is a parabolic if x is
   (a) > 0 (b) < 0
   (c) $= 0$ (d) none of the above

(1 x 5 = 5)

Section B
Answer any 7 (2 marks each)

6. Discuss least square method for fitting a power curve.
7. What is ψ^2 test ? Explain.
8. What are the advantages of Monte Carlo integration over the other usual Numerical integration schemes.
9. Discuss how one try to obtain the Maxima and Minima of a given set of tabulated function using the concept of Newton's forward difference formula.
10. How does one evaluate the weights and abscissae in Gaussian Integration.
11. What's partial pivoting?
12. How can one numerically obtain the largest eigen value of a matrix and its corresponding eigen vector.
13. Write down a linear second order PDE of the general form and mention the case when it reduces to an hyperbolic equation
14. Discuss the type of stability conditions involved in explicit way of solving PDE
15. Write a note on weighted average implicit method.

(2 x 7 = 14)

Section C
Answer any 4 (5 marks each)

16. From the following table of values of x and f(x), determine f(0.23)

x	0.20	0.22	0.24	0.26	0.28	0.30
f(x)	1.6596	1.6698	1.6804	1.6912	1.7024	1.7139

17. Applying Lagrange's Interpolation Formula, find a cubic polynomial which approximates the following data.

x	-2	-1	2	3
f(x)	-12	-8	3	5

18. Evaluate double integral of the function $\exp(x+y)$ within the limits 0 to 1 using Simpsons/Trapezoidal rules. Also find its error

19. Write an algorithm to solve ODE using modified Euler method.

20. Write down the finite difference analogue of the Laplace equation in 2 dimension and arrive at the standard five point formula.

21. Use Schmidt's method to solve the heat equation $u_t = 5u_{xx}$ with the boundary conditions u(0,t)=0, u(5,t)=60, and u(x,0)= 20x ($0 \leq x \leq 3$) and 60 ($3 < x \leq 5$). Give your answer in three time steps with h=1

(5 x 4 = 20)

Section D
Answer any 3 (12 marks each)

22.1. Derive Newton's divided difference formula. Write down the expression for the leading error term observed in this formula.

OR

2. Integrate the function f(x)= 1/x using Romberg's method starting with trapezoidal rule taking h=1,0.5,0.25 and 0.125. Take limits of integration 1 and 2.

23.1. Discuss Hit or miss method associated with Monte Carlo method to evaluate an Integral and write an algorithm to evaluate the value of Pi using the same method.

OR

2. Discuss power method and write an algorithm for the same.

24.1. Discuss Gauss Elimination method and write an algorithm for the same.

OR

2. Obtain the leading error term involved with diagonal five point formula in solving Laplace equation.

(12 x 3 = 36)