

MSc DEGREE END SEMESTER EXAMINATION - OCTOBER 2022**SEMESTER 3 : PHYSICS****COURSE : 16P3PHYT10 : COMPUTATIONAL PHYSICS***(For Supplementary - 2016/2017/2018/2019/2020 Admissions)*

Time : Three Hours

Max. Marks: 75

PART A**Answer All (1 mark each)**

1. Using Newton's forward interpolation formula obtain the value of $y(1.6)$ if

x:	1	1.4	1.8	2.2
y:	3.49	4.82	5.96	6.5

 a) 5.54 b) 5.45 c) 5.35 d) None of the above
2. For operators E and μ
 a) $E^2 \mu = 1/\mu$ b) $E\mu = 1/E$ c) $E\mu = \mu E$ d) $E\mu = 1$
3. Trapezoidal and Simpson's rules can be used to evaluate
 (a) Double integrals (b) Differentiation
 (c) Multiple Integrals (d) Divided difference
4. Single step methods are
 (a) Euler, Adam, Milne (b) Euler RK method, Milne
 (c) Euler, Modified Euler, RK method, Taylor (d) Euler, Milne, Taylor
5. An example of hyperbolic PDE is
 (a) Laplace equation (b) heat equation (c) wave equation (d) none of these
 (1 x 5 = 5)

PART B**Answer any 7 (2 marks each)**

6. What's the difference between truncation and rounding off errors.
7. Show that the following relation for operators holds good:
 $\mu \equiv \sqrt{1 + \delta^2/4}$
8. Graphically explain trapezoidal rule of integration
9. Write a short note on Simpson's 3/8 rule of integration.
10. How does Monte Carlo integration work?
11. Discuss Adaptive step size R.K method.
12. Graphically explain what happens in modified Euler method way of solving ODE.
13. Discuss the type of stability conditions involved in implicit way of solving PDE
14. Write down the diffusion equation and represent the same in a finite difference representation.
15. Write down a linear second order PDE of the general form and mention the case when it reduces to an elliptical equation.

(2 x 7 = 14)

PART C

Answer any 4 (5 marks each)

16. Using Newton's forward difference formula find the sum $S_n = 1^3 + 2^3 + 3^3 + \dots + n^3$
17. Determine the constants A and B by the least squares method such that $y = A \exp(Bx)$ fits the following data:
- x : 1.0 1.2 1.4 1.6
y : 40.170 73.196 133.372 243.02
18. From the following table find the value of dy/dx at the point $x=1.0$
- | | | | | | | |
|---|--------|--------|--------|--------|--------|--------|
| X | 1 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 |
| Y | 5.4680 | 5.6665 | 5.9264 | 6.2551 | 6.6601 | 7.1488 |
19. From the Taylor's Series for $y(x)$, find $y(0.1)$ correct to four decimal places if $y(x)$ satisfies: $dy/dx = x - y^2$ and $y(0) = 1$.
20. Discuss explicit method of solving a PDE and the concept of stability.
21. Arrive at the nine point formula for Laplace equation.

(5 x 4 = 20)

PART D

Answer any 3 (12 marks each)

- 22.1. Discuss Cubic Spline Interpolation and also state the conditions it has to satisfy.
OR
2. Discuss Simpson's 1/3 method and error associated with it.
- 23.1. Discuss the steps involved in obtaining the maxima and minima of a tabulated function.
OR
2. Discuss Euler and modified Euler methods estimate its leading error term.
- 24.1. Discuss Gauss Seidel Iteration method, write an algorithm for the same.
OR
2. Discuss finite differences approximations of derivatives in solving Diffusion equation of one state variable.

(12 x 3 = 36)