QP CODE: 25022306

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Reg No : ....

Name : ....

M.Sc DEGREE (CSS) SPECIAL REAPPEARANCE EXAMINATION, APRIL 2025

Third Semester

M.Sc PHYSICS(MATERIAL SCIENCE)

CORE - PH020302 - NUMERICAL METHODS IN PHYSICS

2019 ADMISSION ONWARDS

A4121F19

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. Explain Newton's difference table and explain the terms.
2. Write down Lagrange's interpolation formula.
3. State and explain the limitations of numerical differentiation.
4. State the Romberg’s integration formula with h1 and h2 .Further, obtain the formula when h1= h and h2 = h/2.
5. Explain briefly the method of Gaussian integration.
6. Explain the Euler's method of solving ordinary differential equation and comment on the error on it.
7. State the principle behind Gauss-seidel iteration method.
8. Explain Jacobi's method for solving eigen values of a matrix.
9. What is meant by Dirichlet problem?
10. State the condition for convergence of Gauss -Siedal method.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. The table below gives the values of $tanx$ for $0.10 \leq x \leq 0.30$. Find the values of $tan0.12$ and $tan0.40$

x	0.10	0.15	0.20	0.25	0.30
y	0.1003	0.1511	0.2027	0.2553	0.3093

12. Find the Lagrange interpolating polynomial ditting the following data:

x	1	3	4	6
y	-3	0	30	132

Hence find y(5)

13. Evaluate $\int_0^{\frac{\pi}{2}} \int_0^{\frac{\pi}{2}} \sqrt{\sin(x+y)}\,dxdy$

by numerical double integration.

14. Discuss Newton Cotes integration in detail

15. Solve the differential equation $(1+x)\frac{dy}{dx}+y=0$ with y(0)=2 for x=1.5 to x= 2.5.Obtain the starting value by using the fourth order Runge-Kutta method with h=0.5

16. Use the Gauss-Jordan method to solve the system $4x_1+3x_2-x_3=6$

$$3x_1+5x_2+3x_3=4$$
$$x_1+x_2+x_3=1$$

17. Write down the finite difference analogue of the parabolic equation $U_t=U_{xx}$. Given that $U=1$, when $t=0$ and $U=0$ at $x=0$ and $x=1$. Compute the solution of the above equation at $x=0.1$ and $t=0.1$ using Gauss - Seidel method.

18. Solve the equation $U_{tt}=U_{xx}$ subject to following boundary conditions $U(0,t)=U(1,t)=0$ for $t>0$ and $U_t(x,0)=0$ and $U(x,o)=sin^3\pi x$ for all x in $0\le x\le 1$

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. Obtain Gauss's forward and backward interpolation formula. Explain Stirling's formula.

20. Derive the general formula for numerical integration and from this obtain the Trapezoidal rule. Give its geometrical significance and estimate the total error in this formula.

21. Explain the predictor-corrector method to solve ordinary differential equations.

22. Explain the concept of finite difference approximation to partial derivatives in details. Obain the solution of Lapalace equation using finite difference approximation.

(2×5=10 weightage)