

KAMARAJ COLLEGE (Autonomous)

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(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

THOOTHUKUDI – 628 003

(6 Pages)

Reg. No:

Question Code No : 250003303

Course Code : 24PMPH33

PG Degree - End Semester Examinations, November 2025

Third Semester

M.Sc. PHYSICS

Numerical Methods and Programming in C++

(For those who joined in July 2024 onwards)

Time : 3 Hours

Maximum : 75 Marks

PART – A (10 × 1 = 10 Marks)

Answer ALL Questions

Choose the correct answer:

1. If the curve is constant by the Newton Raphson method, then $f'(x)$ is
(a) Zero (b) One
(c) Infinite (d) Negative
2. Gauss-Jacobi's method is a _____ method.
(a) Algebraic (b) Non-iteration

- (c) Iteration (d) Infinite
3. The process of estimating the value of dependent variable at an intermediate value called _____.
- (a) Estimation (b) Interpolation
(c) Extrapolation (d) Dependency
4. Newton forward interpolation formula is used in _____ intervals.
- (a) Open (b) Closed
(c) Equal (d) Unequal
5. Which method is direct method for finding eigenvalues?
- (a) Cramer's rule (b) Jacobi's method
(c) Relaxation method (d) Power method
6. Trapezoidal rule gives exact value of the integral when the integrand function is
- (a) Linear (b) Quadratic
(c) Cubic (d) Polynomial
7. A differential equation together with initial condition is called
- (a) Initial value (b) Problem
(c) Conditioned problem (d) Initial value problem
8. How many stages are involved in the calculation using the fourth-order Runge-Kutta method?

- (a) One (b) Two
(c) Three (d) Four
9. C++ is an _____ programming language.
(a) Object oriented (b) Procedural
(c) Functional (d) Both a and b
10. Identify the format string among the following
(a) & (b) /n
(c) %d (d) //n

PART - B (5 X 5 = 25 Marks)

**Answer ALL Questions choosing either (a) or (b).
Answer should not exceed 250 words.**

11. (a) Using bisection method, find a real root of
 $f(x) = x^3 - 2x - 5 = 0$ correct to three decimal places.

(OR)

- (b) Using Newton-Raphson method, find a real root, correct to 3 decimal places of the equation
 $\sin x = \frac{x}{2}$ and the root lies between $\frac{\pi}{2}$ and π .

12. (a) Using Newton's forward difference interpolation formula, find the sum $S_n = 1^3 + 2^3 + 3^3 + \dots + n^3$.

(OR)

- (b) Use Lagrange's interpolation formula to find the form of the function $y(x)$ from the following table

X	0	1	3	4
Y	-12	0	12	24

13. (a) Find the eigenvalues of the matrix using Jacobi's

method $A = \begin{pmatrix} 2 & 3 \\ 3 & 2 \end{pmatrix}$

(OR)

- (b) Derive Simpson's 1/3-rule.

14. (a) Apply modified Euler's method to determine the value of y when $x=0.1$. Given that $y(0) = 1$ and $y' = x + y^2$.

(OR)

- (b) Apply fourth order Runge-Kutta method to determine the value of $y(0.1)$, given that $\frac{dy}{dx} = y - x$ with $y(0) = 2$.

15. (a) Explain basic data types in C++.

(OR)

- (b) With suitable examples, explain the following terms in C++

- i.) Arrays
- ii.) Pointers

PART - C (5 X 8 = 40 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 600 words.

16. (a) Solve the given system of equations by Gauss-seidal method.

$$6x + y + z = 20$$

$$x + 4y - z = 6$$

$$x - y + 5z = 7$$

(OR)

- (b) Inspect the procedure to find the inverse of matrix by Gauss elimination method.

17. (a) Using the method of least squares, find constants a and b for the function $y = ae^{bx}$ fits the following data
(1.0, 2.473) (3.0, 6.722) (5.0, 18.274) (7.0, 49.673)
(9.0, 135.026)

(OR)

- (b) Establish Newton's divided-difference interpolation formula and give an estimate of the remainder term.

18. (a) Evaluate the integral $\int_0^6 \frac{dx}{1+x^2}$ using Trapezoidal rule.

(OR)

- (b) Using the central difference formula, Obtain $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.2$ from the given tabulated values

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.71	3.32	4.05	4.95	6.04	7.38	9.02
	83	01	52	30	96	91	50

19. (a) Solve the differential equations $y' = x - y^2$ with $y(0) = 1$ using Taylor series and find $y(0.1)$, correct to four decimal places.

(OR)

- (b) Find the solution of Laplace equation $u_{xx} + u_{yy} = 0$.

20. (a) Write a program for Newtons law of cooling by numerical differentiation.

(OR)

- (b) Write a program for charging and discharging of a condenser by Euler's method.