

# KAMARAJ COLLEGE (Autonomous)

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(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

(5 Pages)

Reg. No:.....

Question Code: 26E03305

Course Code : 24PMPH33

PG Degree - End Semester Examinations, April 2026

Third Semester

M.Sc., PHYSICS

Numerical Methods and Programming in C++

(For those who joined in July 2024 onwards)

Time : 3Hours

Maximum : 75 Marks

## PART - A (10 × 1 = 10 Marks)

Answer ALL Questions

Choose the correct answer :

- CO:1 1. In Newton Raphson method if the curve  $f(x)$  is constant then  
K:1 \_\_\_\_\_
- (a)  $f(x) = 0$  (b)  $f(x) = 1$   
(c)  $f'(x) = 0$  (d)  $f'(x) = \text{constant}$
- CO:1 2. Find x, y and z for the given system of equations.  
K:2  $x-4y+2z=7; 3x-y+z=9 ; x+3y+6z=2$
- (a)  $x = 2, y = -1, z = 0.5$  (b)  $x = 2, y = 0, z = 0.5$   
(c)  $x = 2, y = -1, z = 0$  (d)  $x = 1, y = -1, z = 0.5$
- CO:2 3.  $y=ab^x$  can be reduced to a linear equation as  
K:2
- (a)  $\log y = \log a + \log b$  (b)  $\log y = \log a - \log b$   
(c)  $\log y = \log a + x \log b$  (d)  $\log y = \log a - x \log b$
- CO:2 4. Which interpolation method is specifically designed for data sets  
K:2 with unequal intervals?
- (a) Gregory-Newton forward interpolation formula (b) Gregory-Newton backward interpolation formula  
(c) Lagrange's Interpolation formula (d) Both (a) and (b)
- CO:3 5. Numerical differentiation is considered "unstable" compared to  
K:2 numerical integration because
- (a) It uses more memory in C++ programming.

(b) Small errors in data values are magnified when taking differences.

(c) It requires equal intervals only.

(d) It can only be used for linear equations.

CO:3 6. Identify the method that uses a statistical approach to estimate  
K:1 the value of an integral?

(a) Simpson's 1/3 rule (b) Simpson's 3/8 rule

(c) Monte Carlo Method (d) Taylor Series method

CO:4 7. In the Runge-Kutta fourth-order method for solving a first-order  
K:2 ordinary differential equation  $\frac{dy}{dx} = f(x, y)$  which of the following represents the correct weighted average for calculating the final increment  $\Delta y$ ?

(a)  $\Delta y = \frac{1}{4}(k_1 + k_2 + k_3 + k_4)$

(b)  $\Delta y = \frac{1}{6}(k_1 + k_2 + k_3 + k_4)$

(c)  $\Delta y = \frac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4)$

(d)  $\Delta y = \frac{1}{4}(k_1 + 2k_2 + 2k_3 + k_4)$

CO:4 8. According to the classification of second-order partial differential  
K:1 equations, which category does Laplace's equation fall into

(a) Parabolic (b) Hyperbolic

(c) Elliptic (d) Circular

CO:5 9. Identify an invalid keyword in the C++ programming

K:1 (a) int (b) float

(c) inte (d) double

CO:5 10. In C++ Programming, which of the following is listed as a  
K:2 component for organizing data alongside Arrays and Strings?

(a) Classes (b) Templates

(c) Array (d) Structures

**PART - B (5 X 5 = 25 Marks)**

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

**Answer should not exceed 250 words.**

CO:1 11. (a) Illustrate the limitations of the Newton-Raphson method.

K:3

**(OR)**

(b) Illustrate the idea of pivoting in the Gauss Elimination method.

CO:2 12. (a) Certain experimental values of X and Y are given below:

K:4

(0, -1), (2, 5), (5, 12), (7, 20). If the straight line  $Y = a_0 + a_1X$  is fitted to the above data, find the approximate values of  $a_0$  and  $a_1$ .

**(OR)**

(b) Find a solution using Newton's Forward Difference formula for the given data set

X	1891	1901	1911	1921	1931
F(x)	46	66	81	93	101

CO:3 13. (a) Compare forward and backward differences in numerical differentiation.

K:3

**(OR)**

(b) Compare the error estimation in Trapezoidal and Simpson's 1/3 rule.

CO:4 14. (a) Illustrate the value of  $y$  when  $x = 0.1$  given that  $y(0) = 1$  and  $y' = x^2 + y$ , using the modified Euler method.

K:3

**(OR)**

(b) Illustrate the structure of Dirichlet's and Cauchy's problems in partial differential equations.

CO:5 15. (a) Explain the use of header files in a C++ program and write a simple example.

K:3

**(OR)**

(b) Differentiate between decision-making and looping movements in C++ with one example.

**PART - C (5 X 8 = 40 Marks)**

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

**Answer should not exceed 600 words.**

CO:1 16. (a) Find a real root  $f(x) = x^3 - x + 1$  of the equation with the bracketed guess -2 and -1.

K:4

**(OR)**

(b) Find the solution for the system of equations  $2x+y+z=5$ ;  $3x+5y+2z=15$ ;  $2x+y+4z=8$  using Gauss Elimination method.

CO:2 17. (a) For the given data set construct the Forward and Backward difference tables and then evaluate for  $f(0.6)$   
K:5

<b>x</b>	0	0.25	0.5	0.75	1.0
<b>f(x)</b>	1	1.28	1.64	2.12	2.72

**(OR)**

(b) For the given data evaluate for  $f(0.6)$  using Lagrange's interpolation by deriving Lagrange's interpolation formula using Newton's polynomial of order n.

<b>x</b>	0	1
<b>f</b>	1	2.72

CO:3 18. (a) Compute the value of  $\int_0^1 (1+x^2)dx$  using Trapezoidal and Simpson's rule.  
K:5

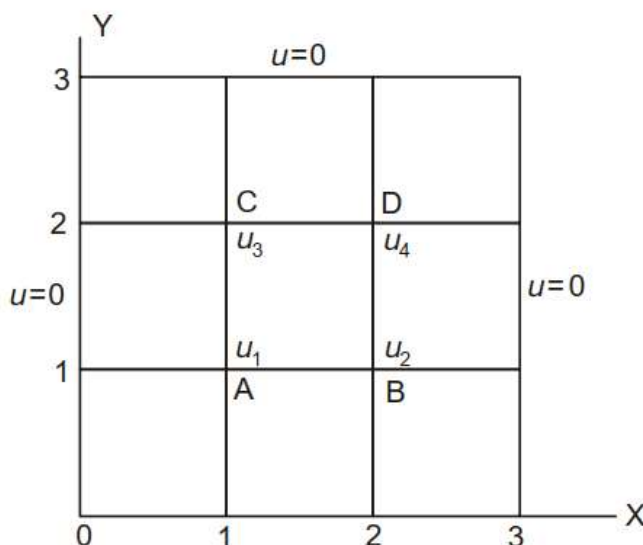
**(OR)**

(b) Estimate the value of  $y(0.2)$  for  $y' = \frac{x-y}{2}$ ,  $x_0 = 0$ ,  $y_0 = 0$  with step size of 0.1 using Taylor series method.

CO:4 19. (a) Given  $\frac{dy}{dx} = 1 + y^2$ , where  $y = 0$  and  $x = 0$ , find  $y(0.2)$  and  $y(0.4)$  using Runge-Kutta fourth order formula.  
K:4

**(OR)**

(b) Solve the Poisson Equation  $u_{xx} + v_{yy} = -10(x^2 + y^2 + 10)$  in the domain given below.



CO:5 20. (a) Experiment with radioactive decay develop the C++ program for decay constant.

- (b) Construct a C++ program for the charging and discharging of a condenser in an Rc circuit using Euler's method