(7 pages) **Reg. No. :** .....

Code No. : SS 5862 **Sub. Code : PPHM 24**

M.Sc. (CBCS) DEGREE (Special Supplementary) EXAMINATION, APRIL 2020.

Second Semester

Physics

NUMERICAL METHODS AND PROGRAMMING IN C++

(For those who joined in July 2017 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Newton-Raphson method is applicable to the solution of ————————.

   (a) Algebric equations only

   (b) Transcedental equations only

   (c) Both (a) and (b)

   (d) None of the above

2. What is the order of convergence in Newton-Raphsons method?

(a) 1 (b) 2

(c) 3 (d) 4

3. To get a curve of best fit the sum of squares of residuals should be ————————.

(a) maximum (b) minimum

(c) 0 (d) none of the above

4. The method of group averages based on the assumption that the sum of the residues is ————————.

(a) zero (b) one

(c) two (d) three

5. The local error in Trapezoidal rule is of order ————————.

(a) 2 (b) 3

(c) 4 (d) 5

6. Simpson's one third rule on numerical integration is called a ———————— formula.

(a) open (b) closed

(c) both (a) and (b) (d) none of the above

7. If we increase the terms in Taylor formula then we get ————————.

(a) correct answer

(b) accurate answer

(c) more accurate answer

(d) all the above

8. Modified Euler's method will provide error-free solutions if the given function is ————————.

(a) linear (b) non linear

(c) both (a) and (b) (d) none of the above

9. The equation of the form $y = a + bx + cx^2$

(a) parabola (b) straight line

(c) normal equation (d) all the above

10. Euler's method uses straight-line segments to approximate the solution, this method is referred to as a ————————.

(a) first order method

(b) second order method

(c) third order method

(d) fourth order method

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Using Newton's-Raphson method, find the root between 0 and 1 of $x^3 = 6x - 4$ correct to 5 decimal places.

Or

(b) Find the root of the equation $y(x) = x^3 - 2x - 5 = 0$ which lies between 2 and 3 using Muller's method.

12. (a) By the method of least squares find the best fitting straight line to the data given below :

x :	5	10	15	20	25
y :	15	19	23	26	30

Or

(b) Using Lagrange's interpolation formula, find $y(10)$ from the following table :

x :	5	6	9	11
y :	12	13	14	16

13. (a) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule with $h = 0.2$.

Or

(b) Evaluate $\int_0^1 e^x dx$ by Simpson's one-third rule correct to five decimal places, by proper choice of h.

14. (a) Using Taylor series method find $y(1.1)$ and $y(1.2)$ correct to four decimal places given

$$\frac{dy}{dx} = xy^{1/3} \text{ and } y(1) = 1$$

Or

(b) Obtain the values of y at $x = 0.1, 0.2$ using second order R.K. method for the differential equation $y' = -y$ given $y(0) = 1$.

15. (a) Write a C++ program to solve the solution of Vander Waals equation.

Or

(b) Distinguish between global and static variables.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Solve the system by Gauss-Elimination method

$$2x + 3y - z = 5$$
$$4x + 4y - 3z = 3$$
$$2x - 3y + 2z = 2$$

Or

(b) By Gaussian elimination, find the inverse of $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 2 & 0 \\ 3 & -1 & -4 \end{bmatrix}$.

17. (a) A function $f(x)$ is given by the following table. Find $f(0.2)$ by a suitable formula.

x :	0	1	2	3	4	5	6
$f(x)$:	176	185	194	203	212	220	229

Or

(b) The following table gives the values of function of equal intervals.

x :	0.0	0.5	1.0	1.5	2.0
$f(x)$:	0.3989	0.3521	0.2420	0.1295	0.0540

Evaluate $f(1.8)$.

18. (a) Using the following table find $f(656)$ by Newton's divided difference formula.

x :	654	658	659	661
y :	2.8156	2.8182	2.8189	2.8202

Or

(b) Derive Newton's forward difference formula.

19. (a) Given $\frac{dy}{dx} = \frac{1}{2}(1 + x^2)y^2$ and $y(0) = 1$, $y(0.1) = 1.06$, $y(0.2) = 1.12$, $y(0.3) = 1.21$ evaluate $y(0.4)$ by Milne's predictor corrector method.

Or

(b) Given $\frac{dy}{dx} = 1 - y$ and $y(0) = 0$ find (i) $y(0.1)$ by Euler method using that value obtain (ii) $y(0.2)$ by modified Euler method.

20. (a) Write a C++ program to find the eigen values and eigen vectors of symmetry matrix.

Or

(b) Write a C++ program to find the Cauchy's constant.

———————