(8 pages)

Reg. No. :

Code No.: 6862 Sub. Code: PPHM 24

M.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2021.

Second Semester

Physics — Core

NUMERICAL METHODS AND PROGRAMMING IN C^++

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A — $(10 \times 1 = 10 \text{ marks})$

Answer ALL questions.

Choose the correct answer.

- 1. The order of convergence in secent method is
 - (a) 0.162 (b) 16.2
 - (c) 1.62 (d) 0.0162
- 2. On bisection method the convergence is ______ and steady
 - (a) fast (b) slow
 - (c) super fast (d) none

- 3. Newton Backward formula is used if the table is too ______ and if the required point is closed to the end of the table.
 - (a) short (b) long
 - (c) very short (d) none
- 4. Cubic spline interpolation is used to very often to avoid the problem of ______ phenomenon.
 - (a) Runges (b) Newtons
 - (c) Langrangian (d) None
- 5. The error term in the Simpson rule is _____.

(a)
$$-\frac{h^5}{90}f^{IV}(0)$$
 (b) $-\frac{h^3}{12}f^{II}(0)$
(c) $-\frac{h^4}{24}f^{III}(0)$ (d) $-\frac{h^2}{6}f^{I}(0)$

6. The method of the form
$$\int_{-\infty}^{+\infty} e^{-x^2} f(x) dx = \sum_{K=0}^{n} \lambda_K f_K$$
 is

called _____ methods.

- (a) Gauss Legendre
- (b) Gauss Legurre
- (c) Gauss Hermite Integral
- (d) None

Page 2 Code No. : 6862

7.	The	truncation	error	in	the	fourth	order	Runge-
	Kutt	a method is	of the	e or	der o	of		

- (a) h^3 (b) h^4
- (c) h^2 (d) h^5
- 8. The major problem with the taylors series method is the evaluation of ______ derivative.
 - (a) lower order (b) higher order
 - (c) zeroth order (d) none
- 9. What is the insertion operator in C^{++} ?
 - (a) << (b) >>
 - (c) > (d) <
- 10. Unsigned numbers in C⁺⁺ are _____.
 - (a) Negative numbers
 - (b) Non negative numbers
 - (c) Float
 - (d) None

Page 3 Code No. : 6862

PART B — $(5 \times 5 = 25 \text{ marks})$

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

11. (a) Perform four interations of the Newton Raphson method to find the smallest positive root of the equation $f(x) = x^3 - 5x + 1 = 0$.

Or

- (b) Use the secant method to estimate the root of the equation $x^2 4x 10 = 0$ with the initial estimates of $x_1 = 4$ and $x_2 = 2$ (Perform four iterations)
- 12. (a) An experiment gave the following table of values for the dependent variable y for a set of known values of x. Obtain an approximate least square fit for the data.

x	1	2	3	4	5	6	7	8	9
у	5.5	7.0	9.6	10.5	12.6	14.4	17.6	19.5	20.5

Or

(b) The following table of x_i , $f(x_i)$ is given. Find

the cubic splines for this table.

x	1	2	3	4	5	
$f(x_i)$	30	15	32	18	25	
		Р	age 4	4	Code	No. : 6862
						[P.T.O.]

x0.40.60.8f(x)0.2560.12960.4096

13. (a) The following data for the function $f(x) = x^4$ is

Find f'(0.8) and f''(0.8) using quadratic interpolation.

Or

(b) Evaluate the integral
$$I = \int_{1}^{2} \frac{2xdx}{1+x^4}$$
 using Gauss

Legendre three point formula.

14. (a) Using Taylors Series method of the fourth order find y at x = 1.1 and 1.2 by solving the equation $\frac{dy}{dx} = x^2 + y^2$, y(1) = 2.

Or

(b) Find y(0.25) and y(0.5) using modified Eulers method with h = 0.25, given that $\frac{dy}{dx} = 3x^2 + y$, y(0) = 4.

Page 5 Code No. : 6862

15. (a) Explain in detail with a graph the logic used in least squares fitting method.

Or

(b) Explain with a C⁺⁺ program to find Cauchys constant.

PART C — $(5 \times 8 = 40 \text{ marks})$

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

16. (a) Solve the following system of equations by Gauss Elimination Method.

$$5x_1 - x_2 + x_3 = 10$$

$$2x_1 + 4x_2 = 12$$

$$x_1 + x_2 + 5x_3 = -1$$

Or

(b) Solve the following system of equations by Gauss Joardon Elimination method.

 $10x_1 + x_2 - x_3 = 11.19$ $x_1 + 10x_2 + x_3 = 20.08$ $-x_1 + x_2 + 10x_3 = 35.61$

17. (a) Apply Langranges interpolation formula to find f(x) if f(1)=2, f(2)=4, f(3)=8, f(4)=16 and f(7)=128. Hence find f(5) and f(6).

```
Or
Page 6 Code No. : 6862
```

(b) Given the table of values

i	0	1	2	3	
x_i	1	2	3	4	
$f(x_i)$	0.5	0.3333	0.25	0.20	

Estimate the values of f(2.5) using Cubic Spline functions.

18. (a) Find the value of
$$\int_{0}^{\frac{\pi}{2}} \sqrt{1 - 0.162 \sin^2 x} \, dx$$
 using Simpson's $\frac{1}{3}$ rule.

Or

(b) Compute the value of
$$\pi$$
 from the formula $\frac{\pi}{4} = \int_{0}^{1} \frac{dx}{1+x^2}$ using trapezoidal rule with ten subintervals.

19. (a) Solve the equation $\frac{dy}{dx} = \frac{1}{x+y}$, y(0) = 1 for y(0.1) and y(0.2) using Runge Kutta method of the fourth order.

Or

(b) Derive Ruler's formula for finding the solution of a differential equation.

Page 7 Code No. : 6862

20. (a) Write a C⁺⁺ program to calculate the eigen values of symmetry matrics.

 \mathbf{Or}

(b) Write a C⁺⁺ program to evaluate the area under the curve of a function $f(x) = x^2 + 2x + c$ using Simpson's method.

Page 8 Code No. : 6862