(7 pages)

Reg. No. : ....

Code No. : 7143   **Sub. Code : PPHM 24**

M.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2019.

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 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. The rate of convergence of muller method is _____

   (a) 1.618   (b) 1.84

   (c) 2.618   (d) 2.84.

2. The error equation of secant method is given by $C =$ _____.

   (a) $\dfrac{1}{2}\dfrac{f'(\Sigma)}{f(\Sigma)}$ (b) $\dfrac{1}{4}\dfrac{f''(\Sigma)}{f'(\Sigma)}$

   (c) $\dfrac{1}{4}\dfrac{f'(\Sigma)}{f(\Sigma)}$ (d) $\dfrac{1}{2}\dfrac{f''(\Sigma)}{f'(\Sigma)}$.

3. The linear form of the equations $x\,a^{y} = b$ is $y =$ _____.

   (a) $\dfrac{\log_{10}^{b} - \log_{10}^{x}}{\log_{10}^{a}}$ (b) $\dfrac{\log_{10}^{a} - \log_{10}^{x}}{\log_{10}^{b}}$

   (c) $\dfrac{\log_{10}^{b} + \log_{10}^{x}}{\log_{10}^{a}}$ (d) $\dfrac{\log_{10}^{a} + \log_{10}^{x}}{\log_{10}^{b}}$.

4. In cubic spline, the condition for natural spline is given by _____.

   (a) $M_0 = M_n$ (b) $M_0 = M_n = M_{n+1}$

   (c) $M_0 = M_n = 0$ (d) $M_n = 2M_{n+1}$.

5. The error constant of Trapezoidal methods is _____.

   (a) $-\dfrac{h^3}{6}$ (b) $-\dfrac{h^3}{3}$

   (c) $-\dfrac{h^3}{3}$ (d) $-\dfrac{h^3}{6}$.

6. In Newton Cote's formula, substituting _____ gives the Simpson's 3/8 rule.

   (a) 1   (b) 2

   (c) 3   (d) 4.

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7. If the condition are specified at two ore more points, then it is called a ——————— value problem.

   (a) finite   (b) boundary

   (c) initial   (d) infinite.

8. Taylor and Picard methods are examples of ——————— methods.

   (a) point wise   (b) step by step

   (c) average   (d) root mean square.

9. The header file required for handling

   (a) conio-h   (b) stdlib.h

   (c) math.h   (d) iostream.h

10. The variable declaration "float" can handle a data of range ———————.

   (a) 0 to 10^{-34} (b) 0 to 10^{-38}

   (c) 0 to 10^{-64} (d) 0 to 10^{-68}.

PART B — (5 × 5 = 25 marks)
Answer ALL questions choosing either (a) or (b).
Each answer should not exceed 250 words.

11. (a) Find by Newton-Raphson method correct to 4 decimal places, the root of the equation $3x - \cos x - 1 = 0$.

Or

(b) Solve the following system using Gauss Jordan method.

$$2x + y + 4z = 12$$
$$8x - 3y + 2z = 20$$
$$4x + 11y - z = 33$$

12. (a) Derive the Newton's forward interpolation formula for equal intervals.

Or

(b) Use the following table, apply Gauss's forward formula to get $f(3.75)$,

x :	2.5	3.0	3.5	4.0	4.5	5.0
$f(x)$:	24.145	22.043	20.225	18.644	17.262	16.047

13. (a) Using Trapezoidal rule, evaluate $\int_{0}^{\pi/3} \tan x \, dx$, taking 8 equal intervals.

Or

(b) Find sec 31 from the following data :

θ :	31	32	33	34
$\tan \theta$:	0.6008	0.6249	0.6494	0.6745

14. (a) Use Euler's method with $h = 0.025$, to find the solution of the equation $y' = \dfrac{y-x}{y+x}$ with $y(0) = 1$ in the range $0 < x < 0.1$.

Or

(b) Solve $y' = 1 + y^2$, $y(0)$ for $x = 0.2(0.2)0.6$, by Runge Kutta method of fourth order.

15. (a) Write a C++ program for solving a transcendental equation $x^3 - 3x^2 + 4x - 2 = 0$ using Newton – Raphson method.

Or

(b) Write a C++ program for solving the integral $\displaystyle\int_0^3 \dfrac{x^2 + x}{2}\,dx$ using Monte Carlo method.

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Find the inverse of the matrix using Gaussian elimination method.

$$\begin{bmatrix} 2 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}.$$

Or

(b) Perform five iterations of the Muller method to find the root of the equation $f(x) = \cos x - x e^x = 0$. Use the initial approximation $x_0 = -1.0$ $x_1 = 0.0$ and $x_2 = 1.0$.

17. (a) The table gives the distances in nautical miles of the visible horizon for the given heights in feet above the earth's surface.

x:	100	150	200	250	300	350	400
y:	10.63	13.05	15.04	16.81	18.42	19.90	21.27

Find the value of y when $x = 410$ feet by a suitable formula.

Or

(b) Using the following given datas of a function of variable t,

t:	0.1	0.2	0.3	0.4
f:	0.76	0.58	0.44	0.35

Obtain a least square fit of the form $f = a e^{-3t} + b e^{-2t}$.

18. (a) Find the value of $\log_e 2^{1/3}$ from $\displaystyle\int_0^1 \dfrac{x^2}{1+x^3}\,dx$ using Simpson's 1/3 rule taking $h = 0.25$.

Or

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(b) Find $y'(50)$ and $y''(50)$ from the table of values given below.

$x:$	50	51	52	53	54	55	56
$y:$	3.6840	3.7084	3.7325	3.7563	3.7798	3.8030	3.8259

Using Forward difference formula.

19. (a) Solve $y' = x + \sqrt{y}$, $y(0) = 1$, for $x = 0.2(0.2)0.6$ by modified Euler method.

Or

(b) Find $y(0.8)$ using Milne's predictor corrector method correct to four decimal places given $\dfrac{dy}{dx} = (1 + x^2)$ y, $y(0) = 1$, obtain $y(0.2)$ $y(0.4), y(0.6)$ by Euler method.

20. (a) Write a C++ program for solving the differential equation using Runge-Kutta fourth order method and also to solve the radio-active decay problem using it.

Or

(b) Write a C++ program for solving the given simultaneous equations using Gauss elimination method and also to find the current in the wheat stone bridge network.

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