19002085

19002085

Reg. No.................................

Name....................................

M.Sc. DEGREE (C.S.S.) EXAMINATION, NOVEMBER 2019

Third Semester

Faculty of Science

Branch II—Physics—A—Pure Physics

PH3C10—COMPUTATIONAL PHYSICS

(2012—2018 Admissions)

Time : Three Hours   Maximum Weight : 30

Part A

Answer any **six** *questions.*
Weight 1 *each.*

1. How to detect errors by using difference tables ?

2. Obtain the divided difference table for the following data :

x	:	– 1	0	2	3
$f(x)$	:	– 8	3	1	12

3. Write note on T-test.

4. Derive Newton's divided difference interpolation formula.

5. State the Romberg's integration formula with h_1 and h_2. Further, obtain the formula when $h_1 = h$ and $h_2 = h/_2$.

6. Compare the errors in Trapezoidal and Simpson's rules for numerical integration.

7. Write note on Milne's predictor-corrector method for numerical differentiation.

8. Write note on method of simultaneous displacements for the solution of linear systems.

9. State implicit finite difference scheme for one dimensional heat equation.

10. Write down the standard five point formula to find the numerical solution of Laplace equation.

(6 × 1 = 6)

Turn over

Part B

Answer any **four** *questions.*

Weight 2 each.

11. Find the cubic polynomial which takes the following values :

    $y\ (0) = 1, y\ (1) = 1, y\ (2) = 1$ an $y\ (3) = 10$ and hence obtain $y\ (4)$.

12. The function $y = \sin x$ is tabulated below :

x	0	$\pi/4$	$\pi/2$
$y = \sin x$	0	0.70711	1.0

13. From the following table of values of x and y, determine the value of $\frac{dy}{dx}$ at each of the points by fitting a cubic spline through them.

x	:	1	2	4	5
y	:	1	3	4	2

14. Solve by Euler's method, the equation :

    $$\frac{dy}{dx} - \sqrt{xy} = 2,\ y\ (1) = 1.$$

    Find the value of $y\ (2)$ in steps of 0.1 using Euler's modified method.

15. Solve the following system by Gauss elimination method :

    $$2x + 2y + z + 2u = 7$$

    $$x - 2y - u = 2$$

    $$3x - y - 2z - u = 3$$

    $$x - 2u = 0$$

16. Solve the equation $\frac{\partial \mu}{\partial t} = \frac{\partial^2 \mu}{\partial x^2}$ subject to the conditions $u\ (x,\ 0) = \sin \pi x$, $0 \le x \le 1$; $u\ (0,\ t) = u\ (1,\ t) = 0$ using Crank-Nicholson method taking $h = \frac{1}{3}$ and $k = \frac{1}{36}$.

(4 × 2 = 8)

Part C

Answer **all** *questions.*

Weight 4 *each.*

17. (a) Explain cubic spline interpolation and end conditions.

Or

(b) Explain the methods for fitting exponential and power function curves with the help of the principle of least square fit.

18. (a) Explain : (i) Monte-Carlo evaluation of numerical integrals ; and (ii) numerical double integration.

Or

(b) Explain the Runge-Kutta method for solving ordinary differential equations.

19. (a) Explain power and Jacobi's method to solve eigen value problems.

Or

(b) Explain the predictor-corrector method to solve ordinary differential equations.

Turn over

20\. (a) Solve numerically $4u_{xx} = u_{tt}$ with the boundary conditions $u\ (0, t) = 0 = u\ (4, t)$ and the initial conditions $u, (x, 0) = x\ (4 - x)$ taking $h = 1$ and $k = \frac{1}{2}$.

Or

(b) Solve the equation $\frac{\partial \mu}{\partial t} = \frac{\partial^2 \mu}{\partial x^2}$ subject to the conditions $u\ (x,\ 0)\ =\ \sin\ \pi x\ ,\ \ 0 \le x \le 1$; $u\,(0, t) = u(1, t) = 0$ using Crank-Nicholson method taking $h = \frac{1}{3}$ and $k = \frac{1}{36}$.

(4 × 4 = 16)