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Reg. No.....

Name.....

M.Sc. DEGREE (C.S.S.) EXAMINATION, FEBRUARY 2021

Third Semester

Faculty of Science

Branch II—Physics—A—Pure Physics

PH 3C 10—COMPUTATIONAL PHYSICS

(2012—2018 Admissions)

Time : Three Hours

Maximum Weight : 30

Part A

*Answer any **six** questions.*

Weight 1 each.

1. What is the condition of convergence and order of convergence of Newton-Raphson method ?
2. What is the nature of n^{th} divided difference of a polynomial of n^{th} degree ?
3. Define cubic spline which is commonly used for interpolation.
4. Obtain the formulae for numerical integration using Trapezoidal and Simpson's rules.
5. Find the polynomial which takes the following values :

$$x : 0 \quad 1 \quad 2$$

$$y : 1 \quad 2 \quad 1$$

6. What are the errors in numerical differentiation ?
7. Write note on Euler's method.

8. Find the numerically large eigen value of matrix $A = \begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$ by power method.

9. State standard five points finite difference formula for solving $u_{xx} + u_{yy} = 0$.
10. Write note on Crank-Nicholson method.

(6 × 1 = 6)

Turn over





21000136

Part B*Answer any **four** questions.**Weight 2 each.*

11. Using Lagrange's interpolation formula, express the function $\frac{x^2 + x - 3}{x^3 - 2x^2 - x + 2}$ as sum of partial fractions.
12. Evaluate $\int_0^1 \int_0^1 e^{x+y} dx dy$ using Trapezoidal and Simpson's rules.
13. Given that $\frac{dy}{dx} = \frac{1}{2}(1 + x^2)y^2$; $y(0) = 1$; $y(0.1) = 1.06$, $y(0.2) = 1.12$ and $y(0.3) = 1.21$. Evaluate $y(0.4)$ and $y(0.5)$ by Milne's predictor-corrector method.
14. Given, $y'' + xy' + y = 0$, $y(0) = 1$ and $y'(0) = 0$. Find the value of $y(0.1)$ using Runge-Kutta method of fourth order.
15. Find the solution, to three decimals, of the system

$$83x + 11y - 4z = 95$$

$$7x + 52y + 13z = 104$$

$$3x + 8y + 29z = 71.$$

Using Jacobi and Gauss-Seidel methods.

16. Solve, by Euler's method, the equation $\frac{dy}{dx} = x + y$, $y(0) = 0$. Choose $h = 0.2$ and compute $y(0.4)$ and $y(0.6)$.

(4 × 2 = 8)





21000136

Part C

Answer all questions.

Weight 4 each.

17. (a) Explain the least square method for fitting a straight line and power curve.

Or

- (b) Derive Newton's forward and backward interpolation formulae.

18. (a) Starting from the general formula for numerical integration, obtain Trapezoidal and Simpson's rules.

Or

- (b) Write an essay on Gaussian integration method.

19. (a) Explain the predictor-corrector methods for the numerical solution of ordinary differential equations.

Or

- (b) Explain Gauss elimination method to find the inverse of a matrix with an example.

20. (a) Solve $\nabla^2 u = 8x^2y^2$ for square mesh dividing the square into 16 sub-squares of length 1 unit.

Given, $u = 0$ at the four boundaries.

Or

- (b) Explain Schmidt method and weighted average implicit method for the numerical solution of partial differential equations.

(4 × 4 = 16)

