F 4704 (Pages : 3) Reg. No.....

Name.....

M.Sc. DEGREE (C.S.S.) EXAMINATION, JANUARY 2017

Third Semester

Faculty of Science

Branch II—Physics—A—Pure Physics

PH 3C 10—COMPUTATIONAL PHYSICS

(2012 Admission onwards)

Time : Three Hours Maximum Weight : 30

Part A

Answer any **six** *questions.*
Each question carries 1 *weight.*

1. Explain the basic idea of interpolation method.
2. State the principle of curve fitting by sum of exponential.
3. What is T-set ? Explain.
4. State and explain Trapezoidal rule.
5. Briefly explain Monte Carlo method for evolution of integrals.
6. What is the relevance of modified Euler's method ? Explain.
7. State the principle behind Gauss-Seidel iteration method.
8. How inverse of a matrix is determined by Gauss Jordan ?
9. State the features of Nicholson method.
10. Give the principle of weighted average implicit method.

(6 × 1 = 6)

Part B

Answer any **four** *questions.*
Each question carries 2 *weight.*

11. Discuss Newton's forward difference method with table.
12. Obtain Newton's general interpolation formula with divided differences.
13. Evaluate $I = \int_0^1 \sin \pi x \, dx$ using Cubic spline method.
14. Derive Simpsons 1/3 rule using the method of undetermined coefficients.

Turn over

15. Use the predictor- corrector formula for tabulating a solution of $10\frac{dy}{dx} = x^2 + y^2, y(0) = 1$ for the interval $0 < x \leq 0.4$ with $h = 0.1$.

16. Use Gauss- Jordan method to find the inverse of the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix}$.

$(4 \times 2 = 8)$

Part C

Answer **all** *questions.*
Each question carries 4 *weight.*

17. (a) Obtain the derivation of the governing equations in interpolation with Cubic splines. Arrive at the end conditions.

Or

(b) Discuss the theory of Lagrangian method of interpolation. Bring out its usefulness. Give the error in Lagrangian interpolation formula.

18. (a) Arrive at the Trapezoidal rule starting from numerical integration. Evaluate $\int_0^{\pi} t\sin t\, dt$ and $\int_{-2}^{+2} \frac{tdt}{5+2t}$.

Or

(b) Discuss on numerical double integration process. Evaluate $I = \int_0^1 \int_0^1 e^{x+y} dxdy$ using Trapezoidal and Simpson's rules.

19. (a) Discuss Euler's method for numerical solutions and also arrive at the error estimates. Solve $\frac{dx}{dy} + 2y = 0, y(0) = 1$ and $\frac{dx}{dy} - 1 = y^2, y(0) = 0$. In each case take $h = 0.1$ and obtain $y(0.1)$, $y(0.2)$ and $y(0.3)$.

Or

(b) Discuss the Jacobi's method to solve eigen value problems. Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$.

20. (a) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 x}{\partial x^2}$ subject to initial condition $u = \sin \pi x$ at $t = 0$ for $0 \leq x \leq 1$ and $x = 0$ at $x = 0$ and $x = 1$ for $t > 0$, by the Gauss Seidel method.

Or

(b) Discuss Schmitt method. Illustrate. Give its features and limitations.

$(4 \times 4 = 16)$