

F 6525

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Reg. No.....

Name.....

M.Sc. DEGREE (C.S.S.) EXAMINATION, JANUARY 2015

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.
Weight 1 each.*

1. Define interpolation and extrapolation.
2. State Lagrange's interpolation formula for unequal intervals.
3. State Adam's predictor corrector formulae.
4. State Simpson's 1/3 rule.
5. Explain concept of stability.
6. State Romberg's integration formula for h_1 and h_2 Further obtain the formula when $h_1 = h$ and $h_2 = h/2$.
7. Write down the explicit finite difference method for solving one dimensional wave function.
8. State the condition for convergence of Gauss-Seidal method.
9. Write down the Crank-Nicholson difference method to solve one- dimensional diffusion equation.
10. What are the differences between Jacobi method and power method of finding Eigenvalues and Eigenvectors ?

(6 × 1 = 6)

Part B

*Answer any four questions.
Weight 2 each.*

11. Evaluate $\int_4^{1.6} \frac{x}{\sin nx} dx$ using Simpson's $\frac{1}{3}^{rd}$ rule taking $n = 12$.

12. Find the largest Eigenvalue of $\begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ using power method.

Turn over

13. Apply Gauss-Jordan method to find the solution of the following system :

$$10x + y + z = 12$$

$$2x + 10y + z = 13$$

$$x + y + 5z = 7$$

14. Using Lagrange's method find the value of y when $x = 8$ for the following data :

x	...	5	9	11	12
y	...	121	73	25	26

15. Evaluate $\int_0^1 dx / (1+x^2)$ using Romberg's integration.

16. Using Newton's forward difference formulae calculate dy/dx and d^2y/dx^2 at 0.70 from the table

x	...	0.68	0.69	0.70	0.71
y	...	0.8086	0.8253	0.8422	0.8595

(4 × 2 = 8)

Part C

*Answer all questions.
Weight 4 each.*

17. (a) Explain curve fitting by least square method with suitable examples.

Or

(b) Explain Gauss elimination method. Solve the system of equations by Gauss elimination method.

$$2x + 3y - z = 5$$

$$4x + 4y - 3z = 3$$

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

18. (a) Explain Newton's interpolation formula. The population of a town in the census is as given in the data. Estimate the population for the year 1996 using (i) Newton's forward, (ii) Newton's Backward formula.

Year	...	1961	1971	1981	1991	2001
Population	...	46	66	81	93	101

Or

(b) Discuss about various numerical integration techniques with suitable examples.

19. (a) Explain Romberg's integration. Evaluate $\int_0^1 dx / (1 + x^2)$ using Romberg's method and trapezoidal method and compare both results.

Or

- (b) Solve the initial value problem $u' = -2tu^2$, $u(0) = 1$ with $h = 0.2$ on the interval $[0, 1]$ using the second order Runge-Kutta method.
20. (a) Explain the method of curve fitting using least squares. How can you fit a straight line and an exponential function to the given data points.

Or

- (b) Discuss Crank-Nicolson method with suitable examples.

(4 × 4 = 16)