TM153525B **Reg. No:.....**

Name:.....

M. Sc. DEGREE (C.S.S.) EXAMINATION, APRIL 2017
(Supplementary – 2015 Admission)
SEMESTER III - (PHYSICS)
PH3C10TM - COMPUTATIONAL PHYSICS

Time: Three Hours **Maximum Marks: 75**

PART A

I. Answer any five questions. Each question carries 3 marks

1. Write down the Crank- Nicolson formula for solving partial differential equations and explain the terms
2. Explain the principle of least squares
3. Prove that $E\Delta=\Delta E$
4. Discuss the accuracy of various numerical integration methods.
5. Find the value of D^2 in terms of the forward and backward difference operators, where D is the differential operator
6. Discuss the features of predictor- corrector methods
7. Write a note on RK method.

(5x3=15)

PART B

II. Answer any six questions. Each Question carries 5 marks

8. Given $\frac{dy}{dx} = x^3 + y$; y(0)=1, compute y(0.02) by Euler's method taking h=0.01
9. Given $\frac{dy}{dx} = \frac{1}{2}(1+x^2)y^2$ and y(0)=1, y(0.1)=1.06, y(0.2)=1.12, y(0.3)=1.21. Evaluate y(0.4) by Milne's Predictor-Corrector method.
10. Using Newton's divided difference formula, find the interpolation polynomial for the following data. Hence find y(3)

X	0	1	2	5
Y	2	3	12	147

11. The following data gives the melting point of an alloy of lead and zinc, where t is the temperature in ^{0}C and P is the percentage of lead in the alloy

P	40	50	60	70	80	90
t	184	204	226	250	276	304

Find the melting point of the alloy containing 84% lead.

12. Using the method of least squares, fit a curve of the form $y=ab^x$, to the following data

x	2	3	4	5	6
y	8.3	15.4	33.1	65.2	127.4

13. Derive the central difference approximation to the third derivative

$$\left(\frac{\partial^3 u}{\partial x^2}\right)_{i,j} = \frac{u_{i+2,j}-2u_{i+1,j}+2u_{i-1,j}-u_{i-2,j}}{2(\Delta x)^3}$$

14. The function u satisfies Laplace's equation at all points within the square given in the following figure and has the boundary values as indicated. Compute a solution correct to 2 decimals.

4	3	2	1		0
3					1
2		U7	U8	U9	2
1		U4	U5	U6	3
		U1	U2	U3	
0	1	2	3		4

15. From the following table of values, estimate y'(2) and y"(2) using appropriate central difference formula

X	0	1	2	3	4
Y	6.9897	7.4036	7.7815	8.1281	8.4510

16. Evaluate $\int_0^{\frac{\pi}{2}} \int_0^{\frac{\pi}{2}} \sqrt{sin(x+y)}dxdy$ by numerical double integration

(6x5=30)

PART C

III. Answer two questions. Each question carries 15 marks

17. Find the approximate value of $y = \int_0^{\pi} sinx\, dx$ using (i) trapezoidal rule (ii) Simpson's 1/3 rule (iii) Simpson's 3/8 rule (iv) Romberg's integration by dividing the range of integration into six equal parts. Calculate the percentage error from its true value in each case.
18. Fit the following 4 points by cubic spline using the conditions $y"_0=y"_3=0$. Hence compute y(1.5) and y'(2)

I	0	1	2	3
x_I	1	2	3	4
y_I	1	5	11	8

19. Explain Jacobi's method, Gauss Seidel method and SOR method by solving the Laplace's equation in the given domain for 3 successive iterations

	10		10	
0				0
0				0
	0		0	

20. (a) Solve the following system of equations by Gauss elimination method 4x+y+z=4; x+4y-2z=4; 3x+2y-4z=6

(b) Find the inverse of $A = \begin{bmatrix} 1 & 2 & 3 \\ -1 & 3 & -2 \\ 2 & 0 & -4 \end{bmatrix}$ by Gauss Jordan method

(2 x15= 30)