LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc.DEGREE EXAMINATION – **PHYSICS**

FIRSTSEMESTER – APRIL 2018

17/16UMT1AL01- MATHEMATICS FOR PHYSICS - I

Date: 30-04-2018   Dept. No.   Max. : 100 Marks
Time: 01:00-04:00

Part A (Answer ALL questions)

(10X2 = 20)

1. Find the n thderivative of $y = \sin(ax+b)$.

2. Show that in the parabola $y^2 = 4ax$, the subnormal is a constant.

3. Write the Cauchy's root test.

4. Find $L^{-1}\left[\dfrac{1}{s(s-a)}\right]$

5. Find $L(3t - 2e^{-2t})$.

6. Define Skew –Hermitianmatrix and give an example.

7. Find the characteristics equation for the matrix $A = \begin{bmatrix} 1 & 2 \\ -3 & 4 \end{bmatrix}$.

8. Define rank correlation.

9. Write the expansion of $(1-x)^{-4}$.

10. Define binomial distribution .

Part B (Answer any FIVE questions)   **(5 x 8 = 40)**

11. Find the angle of intersection of the curves $r = a\left(1+\cos\theta\right)$ and $r = b\left(1-\cos\theta\right)$

12. Find the maximum and minimum value of the function $f(x) = 2x^3 - 3x^2 - 36x + 10$.

13. Find $L\left[f(t)\right]$ if $f(t) = \begin{cases} 0 \; if \; 0 \le t < 4 \\ t^2 \; if \; 4 \le t < 5 \\ 2t \; if \; t \ge 5 \end{cases}$

14. Find $L^{-1}\left[\dfrac{1}{s(s-1)(s-2)}\right]$

1

15. Solve the following system of equations using Crammer's rule

$2x + 3y - z = 5$

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

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

16. Test the convergence of the series $\dfrac{1}{1.2.3} + \dfrac{3}{2.3.4} + \dfrac{5}{3.4.5} + ...\infty$

17. Show that $Log\sqrt{12} = 1 + \left(\dfrac{1}{2} + \dfrac{1}{3}\right)\dfrac{1}{4} + \left(\dfrac{1}{4} + \dfrac{1}{5}\right)\dfrac{1}{4^2} + \left(\dfrac{1}{6} + \dfrac{1}{7}\right)\dfrac{1}{4^3} + ...$

18. Calculate the correlation coefficient for the following heights (in inches) of fathers (X) and their sons (Y) .

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

Part C (Answer any TWO questions)   **(2 x 20 = 40)**

19. a) If $y = \sin(m\sin^{-1} x)$ prove that $(1 - x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y_n = 0$

    b) Find y_n if $y = \dfrac{x^2}{(x-1)^2(x+2)}$

                           (12 + 8)

20. a) Using Laplace transform solve the differential equation $\dfrac{d^2 y}{dx^2} + 2\dfrac{dy}{dx} + 5y = 4e^{-t}$ given $y(0) = 0$ and

    $y'(0) = 0$ using Laplace transform.

    b) Evaluate $L\left[\dfrac{1 - e^{-t}}{t}\right]$ (15 + 5)

21. a) Find the Eigen values and Eigen vectors of the matrix $A = \begin{bmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{bmatrix}$

    b) Verify Cayley - Hamilton theorem and hence find the inverse of the matrix $A = \begin{bmatrix} 7 & 3 \\ 2 & 6 \end{bmatrix}$

    (12 + 8)

22. a) Find the sum of the series $1 + \dfrac{1+3}{2!} + \dfrac{1+3+3^2}{3!} + ... + \infty$

    b) Calculate the mean and standard deviation for the following table giving the age distribution of 542 members.

Age in years	20 – 30	30 – 40	40 – 50	50 - 60	60 – 70	70 – 80	80 - 90
Number of members	3	61	132	153	140	51	2

$$\$\$\$\$\$\$\$\$$$