

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**B.Sc. DEGREE EXAMINATION – PHYSICS****FIRST SEMESTER – NOVEMBER 2022****UMT 1301 – MATHEMATICS FOR PHYSICS**

Date: 01-12-2022

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

Part – A**Answer ALL Questions:****(10 x 2 = 20)**

1. Find the n^{th} derivative of $\cos(ax + b)$.
2. Show that the subtangent of the curve $y = a^x$ is of constant length.
3. Expand $(1 - x)^{-2}$.
4. State D' Alembert's ratio test.
5. Find $L(te^t)$.
6. Evaluate $L^{-1}\left[\frac{s}{s^2 - a^2}\right]$.
7. Define symmetric matrix with an example.
8. State Cayley Hamilton theorem.
9. Define rank correlation.
10. Define Poisson distribution.

Part – B**Answer any FIVE Questions:****(5 x 8 = 40)**

11. Find the angle of intersection of the cardioids $r = a(1 + \cos\theta)$ and $r = b(1 - \cos\theta)$.
12. Find the maxima and minima of the function $2x^3 - 3x^2 - 36x + 10$.
13. Sum the series $1 + \frac{3}{4} + \frac{3.5}{4.8} + \frac{3.5.7}{4.8.12} + \dots$
14. Evaluate the sum to infinity of the series $1 + \frac{1+3}{2!} + \frac{1+3+3^2}{3!} + \frac{1+3+3^2+3^3}{4!} + \dots \infty$
15. Find $L(te^{-t} \sin t)$.
16. Calculate the eigen values of the matrix $\begin{pmatrix} 3 & 2 \\ 1 & 4 \end{pmatrix}$.
17. Solve the following system of equations using Cramer's rule.
 $2x + 3y - z = 5, 4x + 4y - 3z = 3, 2x - 3y + 2z = 2$.
18. Calculate the mean and standard deviation from the following:

x	12	14	16	18	20	22	24
f	6	12	18	26	16	10	8

Part – C

Answer any TWO Questions:

(2 x 20 = 40)

19. (a) If $y = \sin(m \sin^{-1}x)$, prove that $(1 - x^2)y_2 - xy_1 + m^2y = 0$. Also prove that

$$(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} + (m^2 - n^2)y_n = 0.$$

(b) Discuss the maxima and minima of the function $x^3y^2(6 - x - y)$.

20. Using Laplace transform solve $y'' + 2y' + 5y = 4e^{-t}$ given that $y(0) = y'(0) = 0$.

21. Verify Cayley Hamilton theorem and find the inverse of the matrix $\begin{pmatrix} 1 & 2 & -1 \\ 3 & -3 & 1 \\ 2 & 1 & -2 \end{pmatrix}$.

22. Calculate the correlation coefficient and obtain the lines of regression for the following data.

X	1	2	3	4	5	6	7
Y	9	8	10	12	11	13	14

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