LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **PHYSICS**

THIRD SEMESTER – **NOVEMBER 2024**

MT 3102 – MATHEMATICS FOR PHYSICS

Date: 22-11-2024 Dept. No. Max. : 100 Marks

Time: 01:00 pm-04:00 pm

SECTION A

Answer ANY FOUR of the following **4 x 10 = 40 Marks**

1. Find y_n where $y=\frac{3}{(x+1)(2x-1)}$.
2. Find the maxima and minima of the function $2x^3-3x^2-36x+10$.
3. Find sum to infinity of the series $1+\frac{3}{4}+\frac{3}{4}\frac{5}{8}+\frac{3}{4}\frac{5}{8}\frac{7}{12}+\ldots$.
4. Determine the inverse of $A=\begin{pmatrix}1&2&3\\2&4&5\\3&5&6\end{pmatrix}$.
5. Find $L(te^{-t}sint)$.
6. Express $\sin^5\theta$ in a series of sines of multiple of θ.
7. A car hire firm has two cars, which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson distribution with mean 1.5. Calculate the proportion of days on which (i) neither car is used, (ii) the proportion of days on which some demand is refused.
8. Solve the system of the following equations using Cramer's rule:
   $2x-y+3z=9; x+y+z=6; x-y+z=2$.

SECTION B

Answer ANY THREE of the following **3 x 20 = 60 Marks**

9. Explain the purpose of the Leibnitz's theorem and prove that if $y=\sin^{-1}x$, $(1-x^2)y_{n+2}-(2n+1)x\,y_{n+1}+n^2y_n=0$.
10. Find the eigenvalues and eigenvectors of the matrix $\begin{pmatrix}2&2&0\\2&1&1\\-7&2&-3\end{pmatrix}$.
11. Using Laplace transform, solve $y''+2y'-3y=sint$, given that $y(0)=y'(0)=0$.
12. Explain the regression analysis, and obtain the regression line for the following data.

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

13. (a) Find the sum to infinity of the series $1+\frac{1+3}{2!}+\frac{1+3+3^2}{3!}+\frac{1+3+3^2+3^3}{4!}+\ldots\infty$

    (b) X is a normal variable with mean 30 and standard deviation 5. Find the probabilities that (i) $26 \le X \le 40$, (ii) $X \ge 45$. (10+10)

14. (a) Express $\cos 4\theta$ in terms of $\sin\theta$.

(b) Evaluate: $\int_0^\infty t\, e^{-3t} cost\, dt$. (10+10)

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