LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc.DEGREE EXAMINATION –**PHYSICS**

THIRD SEMESTER – **APRIL 2019**

MT 3102– MATHEMATICS FOR PHYSICS

Date: 13-04-2019
Time: 01:00-04:00

Dept. No.

Max. : 100 Marks

PART A

Answer ANY FOUR questions(4 ×10 = 40)

1. If $y = \sin^{-1} x$, prove that $(1 - x^2)y_2 - xy_1 = 0$ and hence prove that

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

2. For the curves $x^2 = 4y$ and $y^2 = 4x$, find the angle of intersection.

3. Show that the matrix $A = \dfrac{1}{3}\begin{pmatrix} -1 & 2 & 2 \\ 2 & -1 & 2 \\ 2 & 2 & -1 \end{pmatrix}$ is orthogonal.

4. Find $L^{-1}\left[\dfrac{S+2}{(S^2+4S+5)^5}\right]$

5. Find $L\left[t\,e^{-2t}\cos 3t\right]$

6. Sum the series $\dfrac{2.4}{3.6} + \dfrac{2.4.6}{3.6.9} + \dfrac{2.4.6.8}{3.6.9.12} + \cdots \infty$

7. Calculate the mean 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
No of members	3	61	132	153	140	51	2

8. Ten coins are tossed simultaneously, find the probability of getting at least seven heads.

PART B

9. a) Find the length of the sub tangent and subnormal at (a,a) on the cissoids $y^2 = \dfrac{x^3}{2a-x}$.

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

(10+10)

10. a) Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$

    b) Verify Cayley-Hamlton theorem for the matrix $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$. (10+10)

11. a) Solve the differential equation $\dfrac{d^2 y}{dt^2} + 4\dfrac{dy}{dt} - 5y = 5$ $y = 0, \dfrac{dy}{dt} = 2$ when $t = 0$

    b) Evaluate $L\left(\dfrac{e^{-3t} - e^{-4t}}{t} \right)$ (10+10)

12. a) Sum to infinity the series $\dfrac{1.3}{2.4.6.8} + \dfrac{1.3.5}{2.4.6.8.10} + \dfrac{1.3.5.7}{2.4.6.8.10} + \cdots \infty$

    b) Sum to infinity of the series $\dfrac{4}{2.4} + \dfrac{4.5}{2.4.6} + \dfrac{4.5.6}{2.4.6.8} + \cdots \infty$ (10+10)

13. a) Prove that $\sin^5\theta = \dfrac{1}{16}(\sin 5\theta - 5\sin 3\theta + 10\sin\theta)$

    b) Expand $\sin^3\theta \cos^4\theta$ in terms of sines and multiples of angles.   (10+10)

14. a) If two dice are thrown what is the probability that the sum is

    i)   greater than 8

    ii)   neither 7 or 11

    b) A problem in statistics is given to the three students A,B and C whose   chances of solving it are $\dfrac{1}{2}, \dfrac{3}{4}$ and $\dfrac{1}{4}$ respectively. What is the probability that the problem will be solved.

    (10+10)

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