LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIRST SEMESTER – **NOVEMBER 2018**

MT 1100 – MATHEMATICS FOR PHYSICS

Date: 24-10-2018   Dept. No. [   ]   Max. : 100 Marks
Time: 01:00-04:00

PART A

Answer All Questions. (10 X 2 = 20)

1. Find the nth derivative of e^{ax}.

2. Prove that for the curve $\frac{1}{r} = A\theta + B$, the polar subtangent is constant.

3. Write down the expansions of e^x and e^{-x}.

4. Define symmetric matrix.

5. Find $L(cos3t)$.

6. Find $L^{-1}(\frac{a}{s^2+a^2})$.

7. Write down the expansion of $cosn\theta$.

8. Prove that $cosh^2x - sinh^2x = 1$.

9. Define binomial distribution.

10. Find the arithmetic mean of the set A = {10, 20, 30, 40, 50}.

PART B

Answer Any Five Questions. (5 X 8 = 40)

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

12. Verify Cayley-Hamilton theorem for the matrix $A = \begin{pmatrix} 1 & 2 & 0 \\ 2 & -1 & 0 \\ 0 & 0 & -1 \end{pmatrix}$.

13. Find $L(te^{-t}sint)$.

14. Express $\sin 7\theta$ in terms of $\sin\theta$.

15. The average salary of male employees in a firm was Rs. 5,200 and that of females was Rs. 4,200. The mean salary of all the employees was Rs. 5,000. Find the percentage of male and female employees.

16. Find the maxima and minima of the function $f(x) = 2x^3 - 3x^2 - 36x + 10$.

17. Find $L^{-1}(\frac{1}{s(s+1)(s+2)})$.

18. Write a short note on Poisson distribution.

Answer Any Two Questions.   **(2 X 20 = 40)**

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

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

   (b) Find the sum to infinity of the series $1 + \frac{3}{4} + \frac{3 \cdot 5}{4 \cdot 8} + \frac{3 \cdot 5 \cdot 7}{4 \cdot 8 \cdot 12} + \cdots$.

20. (a) Find the eigenvalues and eigenvectors of the matrix $A = \begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$.

   (b) Using Laplace transform, solve $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} - 3y = sint$, $y = \frac{dy}{dt} = 0$ when t = 0.

21. (a) Prove that $\sin^4 \theta \cos^2 \theta = \frac{1}{32}(\cos 6\theta - 2\cos 4\theta - \cos 2\theta + 2)$.

   (b) If $\cos\theta = \frac{1681}{1682}$, prove that the angle θ is $1° 58'$ nearly.

22. (a) Calculate the mean and standard deviation for the following data.

Class Interval	20 − 30	30 − 40	40 − 50	50 − 60	60 − 70	70 − 80	80 − 90
Frequency	3	61	132	153	140	51	2

   (b) Find y_n where $y = \frac{3}{(x+1)(2x-1)}$.

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