



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – PHYSICS

FIRST SEMESTER – APRIL 2018

MT 1100- MATHEMATICS FOR PHYSICS

Date: 28-04-2018
Time: 09:00-12:00

Dept. No.

Max. : 100 Marks

PART A

Answer ALL the questions.

(10 X 2 = 20)

1. Find the n^{th} derivative of e^{ax} .
2. Prove that the polar subnormal of the curve $r = a\theta$ is constant.
3. State Cayley-Hamilton theorem.
4. Define symmetric and skew symmetric matrices.
5. Find $L(\sinh 3t)$.
6. Obtain the inverse Laplace transform of $\frac{s}{s^2+4}$.
7. Write down the expansion of $\cos n\theta$.
8. Prove that $\cosh^2 x - \sinh^2 x = 1$.
9. Define binomial distribution.
10. Find the median of the set $A = \{20, 40, 16, 80, 100\}$.

PART B

Answer any FIVE questions.

(5 X 8 = 40)

11. Find y_n where $y = \frac{2x+1}{(2x-1)(2x+3)}$.
12. Find the characteristic equation of the matrix $A = \begin{pmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{pmatrix}$ and show that the matrix A satisfies the equation.
13. Find $L(te^{-t} \sin t)$.
14. Prove that $\frac{\sin 7\theta}{\sin \theta} = 64\cos^6 \theta - 80\cos^4 \theta + 24\cos^2 \theta - 1$.
15. Sum to infinity the series $1 + \frac{1+2}{2!} + \frac{1+2+2^2}{3!} + \frac{1+2+2^2+2^3}{4!} + \dots$.
16. Write a short note on normal distribution.
17. Find $L^{-1}\left(\frac{s-3}{s^2+4s+13}\right)$.
18. If X is a Poisson variate such that $P(X = 2) = 9 P(X = 4) + 90 P(X = 6)$, find the mean of X .

PART C

Answer any TWO questions.

(2 X 20 = 40)

19. (a) If $y = \sin(m\sin^{-1}x)$, show that $(1 - x^2)y_2 - xy_1 + m^2y = 0$ and $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} + (m^2 - n^2)y_n = 0$.

(b) Find the eigenvalues and eigenvectors of the matrix $A = \begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$. (10+10)

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

(b) Find the Laplace transform of $f(t) = \begin{cases} 1 & : 0 < t < b \\ -1 & : b < t < 2b \end{cases}$. (10+10)

21. (a) Express $\cos 6\theta$ in terms of $\sin \theta$.

(b) Prove that $32\sin^4 \theta \cos^2 \theta = \cos 6\theta - 2\cos 4\theta - \cos 2\theta + 2$. (10+10)

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

| Class Interval | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | 50 - 55 |
|----------------|---------|---------|---------|---------|---------|---------|---------|
| Frequency | 170 | 110 | 80 | 45 | 40 | 30 | 25 |

(b) Sum the series to infinity $\frac{4}{2 \cdot 4} + \frac{4 \cdot 5}{2 \cdot 4 \cdot 6} + \frac{4 \cdot 5 \cdot 6}{2 \cdot 4 \cdot 6 \cdot 8} + \dots$ (10+10)

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