



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – PHYSICS

FIRST SEMESTER – APRIL 2016

MT 1100 - MATHEMATICS FOR PHYSICS

Date: 05-05-2016
Time: 01:00-04:00

Dept. No.

Max. : 100 Marks

PART A

Answer ALL the questions.

(10 X 2 = 20)

1. Find the 3rd derivative of $(ax + b)^m$.
2. Prove that the polar subtangent of the curve $r = e^{\theta \cot \alpha}$ is $r \tan \alpha$.
3. State Cayley-Hamilton theorem.
4. Define symmetric matrix.
5. Find the Laplace transform of $\cosh 5t$.
6. Obtain the inverse Laplace transform of $\frac{1}{s^2 + 1}$.
7. Write down the expansion of $\sin n\theta$.
8. State the relations between hyperbolic and circular functions.
9. Define Poisson distribution.
10. Find the arithmetic mean of the set $X = \{2, 4, 6, 8, 10\}$.

PART B

Answer any FIVE questions.

(5 X 8 = 40)

11. Find y_n where $y = \frac{x^2}{(x-1)^2(x+2)}$.
12. Find the characteristic equation of the matrix $A = \begin{pmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{pmatrix}$ and hence determine its inverse.
13. Find the Laplace transform of $f(t) = \begin{cases} 1 & : 0 < t < b \\ -1 & : b < t < 2b \end{cases}$.
14. Prove that $\sin^4 \theta \cos^2 \theta = \frac{1}{32}(\cos 6\theta - 2\cos 4\theta - \cos 2\theta + 2)$.
15. Sum the series $1 + \frac{1+3}{2!} + \frac{1+3+3^2}{3!} + \frac{1+3+3^2+3^3}{4!} + \dots$ to .
16. Define binomial distribution and determine the same for which the mean and variance are 4 and 3 respectively.
17. Find $L^{-1}\left(\frac{1}{s(s+1)(s+2)}\right)$.
18. Write a short note on normal distribution.

PART C

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

(b) Find the eigen values and eigen vectors of the matrix $\begin{pmatrix} 1 & 1 & 2 \\ 0 & 2 & 2 \\ -1 & 1 & 3 \end{pmatrix}$. (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 (i) $L((1 - e^{-t})/t)$ and (ii) $L(te^{-t} \sin t)$. (10+10)

21. (a) Express $\sin 7\theta$ in terms of $\sin \theta$.

(b) If $\cos \theta = \frac{1681}{1682}$, prove that the angle θ is $1^\circ 58'$ nearly. (10+10)

22. (a) Calculate the 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) Sum the series to infinity $\frac{15}{16} + \frac{15.21}{16.24} + \frac{15.21.27}{16.24.32} + \dots$ (10+10)
