



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc.DEGREE EXAMINATION – PHYSICS

THIRD SEMESTER – NOVEMBER 2017

MT 3100- ALLIED MATHEMATICS FOR PHYSICS

Date: 11-09-2017
Time: 09:00-12:00

Dept. No.

Max. : 100 Marks

SECTION-A

Answer ALL the questions(10 x 2 = 20)

1. Find $D^n(e^{ax})$.
2. Prove that the sub tangent to the curve $y=a^x$ is of constant length.
3. What is $L[\sin 4t + e^{3t}]$?
4. Find $L^{-1}\left[\frac{s}{(s+4)^2}\right]$.
5. What is the rank of the matrix $\begin{bmatrix} 2 & 4 \\ 6 & 12 \end{bmatrix}$?
6. Write down the expansion of $\sin \theta$ in ascending powers of θ .
7. Prove that $\cosh^2 x - \sinh^2 x = 1$.
8. Write down the probability mass function of binomial distribution.
9. Write the formula of Poisson distribution.
10. Write down the expansion of $\log_e(1+x)$.

SECTION-B

Answer any FIVE questions(5 x 8=40)

11. Find the angle of intersection of cardioids $r = a(1 + \cos \theta)$ and $r = b(1 - \cos \theta)$.
12. Verify Cayley-Hamilton theorem for the matrix $\begin{pmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{pmatrix}$.
13. Find the sum of the binomial series $1 + \frac{3}{4} + \frac{3 \cdot 5}{4 \cdot 8} + \frac{3 \cdot 5 \cdot 7}{4 \cdot 8 \cdot 12} + \dots$
14. If $\cos(x + iy) = \cos \theta + i \sin \theta$, then prove that $\cos 2x + \cosh 2y = 2$.
15. Find $L[t e^{-2t} \cos 3t]$.
16. Evaluate $L^{-1}\left[\frac{s}{(s+3)^2 + 4}\right]$.
17. Write down the expansion of $\cos 6\theta$ in terms of $\cos \theta$.

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

SECTION-C

(2 x 20=40)

Answer Any TWO questions

19. a) Find the Eigen values and Eigen vectors of the matrix $\begin{pmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{pmatrix}$.

b) Show that $1 + \frac{2^4}{2!} + \frac{3^4}{3!} + \frac{4^4}{4!} + \dots = 15e$. (12+8)

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

b) Find the angle at which the radius vector cuts the curve $\frac{l}{r} = 1 + e \cos \theta$. (10+10)

21. a) Expand $\sin^3 \theta \cos^5 \theta$ in a series of sines of multiples of θ .

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

22. Find the mean and standard deviation for the following table giving the age distribution of 542 students.

Age (in years)	20-30	30-40	40-50	50-60	60-70	70-80	80-90
No. of students	3	61	132	153	140	51	2

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