



**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**

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

FIRST SEMESTER – NOVEMBER 2017

**MT 1100 - MATHEMATICS FOR PHYSICS**

Date: 07-11-2017  
Time: 01:00-04:00

Dept. No.

Max. : 100 Marks

**SECTION A**

ANSWER ALL THE QUESTIONS:

**(10x2 =20)**

- 1) Find the  $n^{\text{th}}$  derivative of  $y = \cos(ax + b)$ .
- 2) Write down the formula for subtangent and subnormal in polar coordinates.
- 3) Write the expansion of  $\log(1 + x)$ .
- 4) Define rank of the matrix.
- 5) State the formula for Laplace transformation of a periodic function.
- 6) Find the value of  $L^{-1}\left(\frac{1}{(s+2)^2 + 16}\right)$ .
- 7) Write down the expansion for  $\tan n_{\theta}$ .
- 8) Show that  $\cosh^2 \theta - \sinh^2 \theta = 1$ .
- 9) Two unbiased dice are thrown. Find the probability that the total of the numbers on the dice is greater than 8.
- 10) Define Normal distribution.

**SECTION B**

ANSWER ANY FIVE QUESTIONS:

**(5x8 =40)**

- 11) Find the angle of intersection of cardioids  $r = a(1 + \cos \theta)$  and  $r = b(1 - \cos \theta)$ .
- 12) Determine the maxima and minima of  $x^5 - 5x^4 + 5x^3 + 10$ .
- 13) Find the sum to infinity of the series  $1 + \frac{3}{4} + \frac{3.5}{4.8} + \frac{3.5.7}{4.8.12} + \dots$ .
- 14) Verify Cayley – Hamilton theorem for  $A = \begin{pmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{pmatrix}$ .
- 15) Find  $L[f(t)]$  if  $f(t) = \begin{cases} (t-1)^2, & \text{when } t > 1 \\ 0, & \text{when } t < 1 \end{cases}$ .
- 16) Find  $L^{-1}\left(\frac{1}{(s+1)(s^2 + 2s + 2)}\right)$ .
- 17) Write down the expansion of  $\cos 6\theta$  in terms of  $\cos \theta$ .
- 18) An urn contains 6 white, 4 red and 9 black balls. If 3 balls are drawn at random, find the probability that: (i) two of the balls are drawn white, (ii) one is of each colour, (iii) none is red, (iv) at least one is white.

**SECTION C**

ANSWER ANY TWO QUESTIONS:

(2x20 = 40)

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

b) Find the  $n^{\text{th}}$  differential coefficient of  $\cos x \cdot \cos 2x \cdot \cos 3x$ .

(14+6)

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

b) Sum the series  $1 + \frac{1+3}{2!} + \frac{1+3+3^2}{3!} + \frac{1+3+3^2+3^3}{4!} + \dots$

(10+10)

21) a) Express  $\cos^5 \sin^3$  in terms of *sines* of multiples of  $\cdot$ .

b) Separate into real and imaginary parts of  $\tan^{-1}(+i)$ .

(10+10)

22) a) Solve the equation  $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} - 3y = \sin t$  given that  $y = \frac{dy}{dt} = 0$  when  $t = 0$  using Laplace transform.

b) Calculate the mean 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 members	3	61	132	153	140	51	2

(14+6)

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