



# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – MATHEMATICS

THIRD SEMESTER – APRIL 2014

**MT 3102/3100 - MATHEMATICS FOR PHYSICS**

Date : 05/04/2014

Dept. No.

Max. : 100 Marks

Time : 09:00-12:00

## Section A

Answer ALL questions:

(10 x 2 = 20)

1. Find the  $n$  th derivative of  $y = \log(4x + 8)$ .
2. Find the slope of the curve  $r = e^\theta$  at  $\theta = 0$ .
3. Write the expansion for  $(1 - x)^{-p}$ .
4. Define symmetric matrix and give an example.
5. Find  $L(r^2 + 2t)$ .
6. Find  $L^{-1}\left[\frac{1}{(s-a)^2}\right]$ .
7. Write down the expansion for  $\tan n\theta$ .
8. Show that  $\cos h2x = \cos h^2 x + \sinh^2 x$ .
9. What is the chance of that the leap year selected at random will contain 53 Sundays?
10. If the mean and variance of Binomial distribution is 4 and  $4/3$ . Find  $P(X = 0)$ .

## Section B

Answer any FIVE questions:

(5 x 8 = 40)

11. Find the  $n^{\text{th}}$  differential coefficient of  $\cos x \cos 2x \cos 3x$ .
12. Find the angle of intersection of curves  $r = a(1 + \cos \theta)$  and  $r = b(1 - \cos \theta)$ .
13. Find the sum to infinity of the series  $\frac{5}{3.6} + \frac{5.7}{3.6.9} + \dots$
14. Find the characteristic roots of the matrix  $\begin{pmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{pmatrix}$ .
15. Find  $L^{-1}\left(\frac{s}{(s^2 + a^2)^2}\right)$ .
16. Express  $\sin^7 \theta$  in a series of sines of multiples of  $\theta$ .
17. If  $\cos(x + iy) = \cos \theta + i \sin \theta$ , prove that  $\cos 2x + \cosh 2y = 2$ .
18. Calculate the mean and standard deviation for the following table giving the age distribution of 542 members

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

**Section C**

**Answer any TWO questions:**

**(2 x 20 = 40)**

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

b) Prove that  $\log \frac{n+1}{n-1} \approx \frac{2n}{n^2+1} + \frac{1}{3} \left( \frac{2n}{n^2+1} \right)^3 + \frac{1}{5} \left( \frac{2n}{n^2+1} \right)^5 + \dots \infty$ . (12 + 8)

20. a) Verify Cayley-Hamilton theorem for the matrix  $A = \begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$  and also find  $A^{-1}$ .

b) Separate  $\tan^{-1}(x + iy)$  into real and imaginary parts. (12 + 8)

21. a) Find the Laplace transform of  $L(t^2 e^{-3t})$

b) Solve the equation  $y'' - 3y' + 2y = e^{2t}$ ,  $y(0) = -3$ ,  $y'(0) = 5$  (8 + 12)

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

b) A manufacturer of cotter pins knows that 5% of his product is defective. If he sells cotter pins in boxes of 100 and guarantees that not more than 10 pins will be defective, what is the approximate probability that a box will fail to meet the guaranteed quality? (12 + 8)