LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIRST SEMESTER – **NOVEMBER 2016**

MT 1100 – MATHEMATICS FOR PHYSICS

Date: 09-11-2016 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

SECTION A

ANSWER ALL QUESTIONS. **(10 × 2 = 20)**

1. Write the Leibnitz formula for the n^{th} derivative of a product.
2. Write the formula for Subtangent and Subnormal in Polar form.
3. Prove that $\frac{e^2-1}{e^2+1} = \frac{\frac{1}{1!}+\frac{1}{3!}+\frac{1}{5!}+\ldots\infty}{1+\frac{1}{2!}+\frac{1}{4!}+\ldots\infty}$.
4. Define rank of a Matrix.
5. Find $L(1+12t-6e^{-t})$.
6. Find $L^{-1}\left[\frac{7}{(s-3)^2+16}\right]$.
7. Write down the expansion of $Sinn\theta$.
8. Separate the real and imaginary parts of $cos(x+iy)$.
9. Two dice are thrown. What is the probability that the sum of the numbers is less than 4?
10. Define Binomial distribution.

SECTION B

ANSWER ANY FIVE QUESTIONS. **(5 × 8 = 40)**

11. Find the n^{th} differential coefficient of $cosx.cos2x.cos3x$.
12. Show that in the parabola $y^2 = 4ax$, the subtangent at any point is double the abscissa and the subnormal is constant.
13. Find the sum to infinity of the series $1+\frac{3}{4}+\frac{3.5}{4.8}+\frac{3.5.7}{4.8.12}+\cdots\infty$.
14. Find the eigen values of the matrix $\begin{pmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{pmatrix}$.
15. Prove that $cos^5\theta = \frac{1}{16}[cos5\theta + 5cos3\theta + 10cos\theta]$.
16. If $\sin(A+iB) = x+iy$, then prove that (i) $\frac{x^2}{cosh^2B}+\frac{y^2}{sinh^2B} = 1$ and (ii) $\frac{x^2}{sin^2A}-\frac{y^2}{cos^2A} = 1$.
17. Find the inverse Laplace transform of $\frac{1}{s(s+1)(s+2)}$.
18. (i) Prove that $\sum_{x=0}^{\infty}\frac{e^{-\lambda}\lambda^x}{x!} = 1$.

    (ii) The mean and variance of a binomial distribution are 4 and $\frac{4}{3}$ respectively. Find $P(X \geq 1)$.

    (4+4)

SECTION C

ANSWER ANY TWO QUESTIONS. **(2 x 20 = 40)**

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

    (b) Find the Maxima and Minima of the function $f(x) = 2x^3 - 3x^2 - 36x + 10$.

(12+8)

20. (a) Verify Cayley – Hamilton theorem for the matrix

$$\begin{pmatrix} 4 & -8 & 3 \\ 4 & -1 & -2 \\ 1 & -4 & 1 \end{pmatrix}$$

(b) Find the Laplace transform of $t\left(\frac{cos3t+3cost}{4}\right)$. **(14+6)**

21. (a) Express $sin7\theta$ in terms of $sin\theta$.

(b) 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

(10 + 10)

22. (a) Solve $y'' + 4y' - 5y = 5$, given y(0)=0 and $y'(0) = 2$.

(b) A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as Poisson variate with mean 1.5. Calculate the proportion of days on which (i) neither car is used, and (ii) some demand is refused.

(12+8)

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