LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIRST SEMESTER – NOVEMBER 2015

MT 1100 - MATHEMATICS FOR PHYSICS

Date : 11/11/2015   Dept. No.   Max. : 100 Marks
Time : 01:00-04:00

Part A

Answer all Questions: (10 x 2 = 20)

1. What is Leibnitz's theorem.
2. Find the polar subtangent and polar subnormal for the curve $r = e^{cot}$.
3. Evaluate $L[\cos^2 t]$
4. Find the value of $L^{-1}\left[\dfrac{1}{(s+a)^2}\right]$.
5. Prove that $a^x = 1 + \dfrac{x\log a}{1!} + \dfrac{x^2}{2!}(\log a)^2 + ...$
6. Define rank of the matrix. $\cos n_{"}$.
7. Write down the expansion for
8. If $\sin^2{}_{"} + \cos^2{}_{"} = 1,$ Show that $\cosh^2 x - \sinh^2 x = 1$.
9. What is the chance that the leap year selected at random will contain 53 Sundays?
10. Define Binomial distribution.

Part B

Answer any FIVE questions: (5 Î 8 = 40)

11. Sum the series $1 + \dfrac{3}{4} + \dfrac{3.5}{4.8} + \dfrac{3.5.7}{4.8.12} + ...$
12. Find $L(te^{-t}\sin t)$.
13. Verify Cayley – Hamilton theorem for the matrix $A = \begin{pmatrix} 8 & -8 & 2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{pmatrix}$
14. Find the slope of the tangent with initial line for the cardioids $r = a(1-\cos{}_{"})$ at ${}_{"} = \dfrac{f}{6}$.
15. Two unbiased dice are thrown . Find the probability that:i) the first die shows 6 ii) the total of the number on the dice is 8. iii) the total of the number on the dice is greater than 8. iv) the total number of the dice is 13.
16. If $\sin(A + iB) = x + iy$, , Prove that $\dfrac{x^2}{\sin^2 A} - \dfrac{y^2}{\cos^2 A} = 1$ and $\dfrac{x^2}{\cosh^2 B} + \dfrac{y^2}{\sinh^2 B} = 1$.
17. Find the angle of intersection of the cardioids $r = a(1+\cos{}_{"})$ and $r = b(1-\cos{}_{"})$.
18. Expand $\cos^5{}_{"} \sin^4{}_{"}$ in terms of cosines of multiples of ${}_{"}$.

Part C

Answer any TWO questions: $(2 \times 20 = 40)$

19. (a) Prove that $1.5 + \dfrac{2.6}{1!} + \dfrac{3.7}{2!} + ...\infty = 13e$.

(b) Find the Eigen values Eigen vectors of the matrix $.\begin{pmatrix} 11 & -4 & -7 \\ 7 & -2 & -5 \\ 10 & -4 & -6 \end{pmatrix}$ **(10+10)**

20. (a) Solve the equation $\dfrac{d^2 y}{dt^2} + 2\dfrac{dy}{dt} + 2y = 5\sin t$ given y(0) =0 and y'(0) =0 using

Laplace transform.

(b) Find the value of $L^{-1}\left[\dfrac{1}{s(s+1)(s+2)}\right]$. **(10+10)**

21. (a) If $y = \left(x + \sqrt{1+x^2}\right)^m$ then prove that $\left(1+x^2\right) y_{n+2} + \left(2n+1\right) xy_{n+1} + \left(n^2 - m^2\right) y_n = 0$.

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

22. (a) Calculate the mean and standard deviation for the following table giving the age
distribution of 542 members:

Age in years	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Number of members	6	5	8	15	7	6	3

(b) Given the following table:

X	-3	6	9
P(x)	1/6	1/2	1/3

Compute (i) E(x) (ii) $E(X^2)$ and using the laws of expectation, evaluate $E(2X + 1)^2$

(10+10)

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