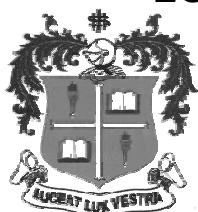# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – PHYSICS

FIRST SEMESTER – NOVEMBER 2013

MT 1100 - MATHEMATICS FOR PHYSICS

Date : 07/11/2013   Dept. No. [   ]   Max. : 100 Marks
Time : 1:00 - 4:00

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 $r = e^{\theta cot\alpha}$.
3. Prove that $L(t^n) = \dfrac{\Gamma(n+1)}{s^{n+1}}$.
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.
7. Write down the expansion for $\cos 5\theta$.
8. If $sin^2\theta + cos^2\theta = 1$, Show that $\cos h^2 x - sinh^2 x = 1$.
9. What is the chance of that the leap year selected at random will contain 53 Sundays?
10. Define Normal distribution.

Part B

Answer any FIVE questions: (5 × 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 $r = a(1-\cos\theta)$ at $\theta = \dfrac{\pi}{6}$.

15. A coin is tossed three times. Find the chances of throwing, (i) three heads (ii) two heads and one tail, (iii) head and tail alternately.

16. If $\sin(A + iB) = x + iy$, Prove that $\dfrac{x^2}{sin^2A} - \dfrac{y^2}{cos^2A} = 1$ and $\dfrac{x^2}{\cosh^2 B} + \dfrac{y^2}{\sinh^2 B} = 1$.

17. Find the angle of intersection of the cardioids $r = a(1+\cos\theta)$ and $r = b(1-\cos\theta)$.

18. Expand $\sin^4\theta\cos^2\theta$ in a series of cosines of multiples of θ.

Part C

Answer any TWO questions: (2 × 20 = 40)

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

(b) Find the eigen values eigen vectors of the matrix $\begin{pmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{pmatrix}$. (10+10)

20. (a) Solve the equation $\dfrac{d^2 y}{dx^2} + 2\dfrac{dy}{dx} - 3y = \sin t$ given that $y = \dfrac{dy}{dx} = 0$ when $t = 0$.

(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	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Number of members	3	61	132	153	140	51	2

(b) Given the following table:

X	-3	-2	-1	0	1	2	3
P(x)	0.05	0.10	0.30	0	0.30	0.15	0.10

Compute (i) E(x) (ii) E(2x+3) (iii) E(4x+5) (iv) E(x²) (v)E(2x-3). (10+10)

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