LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIRST SEMESTER – NOVEMBER 2017

17/16UMT1AL01 - MATHEMATICS FOR PHYSICS - I

Date: 13-11-2017 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

Part A (Answer ALL questions) **(10 x 2 = 20)**

1. Find the n th derivative of $y = \cos(ax+b)$.
2. Prove that the polar subtangent of the curve $r = e^{-\cot\sim}$ is $r\tan\sim$ and the polar subnormal is $r\cot\sim$.
3. Find $L^{-1}\left[\frac{1}{(s-a)^2}\right]$.
4. Find $L(3t-2e^{-2t})$.
5. Find the characteristics equation for the matrix $A=\begin{pmatrix} 2 & -1 \\ -8 & 4 \end{pmatrix}$.
6. Define Hermitian matrix and give one example.
7. Write the expansion of $(1-x)^{-4}$.
8. Write D'Alembert's ratio test.
9. Define poison distribution.
10. Define correlation.

Part B (Answer any FIVE of the following) **(5 x 8 = 40)**

11. Find the angle of intersection of the curves $r = a(1+\cos^{-})$ and $r = b(1-\cos^{-})$
12. Find the maximum and minimum value of the function $f(x) = x^3 - 18x^2 + 96x + 4$.
13. Find $L[f(t)]$ if $f(t) = \begin{cases} 0 \text{ if } 0 \le t < 4 \\ t^2 \text{ if } 4 \le t < 5 \\ 2t \text{ if } t \ge 5 \end{cases}$
14. Find $L^{-1}\left[\frac{s-3}{s^2+4s+13}\right]$

15. Solve the following system of equations by using Crammer's rule

$2x+3y-z=5$

$4x+4y-3z=3$

$2x-3y+2z=2$

16. Find the sum to infinity of the series

$1+\frac{3}{4}+\frac{3.5}{4.8}+\frac{3.5.7}{4.8.12}+....$

17. Show that $Log\sqrt{12}=1+\left(\frac{1}{2}+\frac{1}{3}\right)\frac{1}{4}+\left(\frac{1}{4}+\frac{1}{5}\right)\frac{1}{4^2}+\left(\frac{1}{6}+\frac{1}{7}\right)\frac{1}{4^3}+.....$

18. Find the Karl Pearson's coefficient between the height of father (x) and son (y).

x (in cm)	164	165	166	167	168	169	170
y(in cm)	166	167	165	168	170	168	172

Part C (Answer any TWO questions) **(2 x 20 = 40)**

19. a) Find y_n if $y=\frac{x^2}{(x-1)^2(x+2)}$

b) If $y=a\cos(log\,x)+b\sin(log\,x)$, show that $x^2y_{n+2}+(2n+1)xy_{n+1}+(n^2+1)y_n=0$ (10 + 10)

20. a) Using Laplace transform solve the differential equation $y'' + 4y' + 3y = e^{-t}$, given that $y(0) = 1$, $y'(0) = 0$.

b) Find $L\left[\frac{1-e^{-t}}{t}\right]$ (10 + 10)

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

b) Verify Cayley - Hamilton theorem and hence find the inverse of the matrix $A=\begin{bmatrix}7 & 3\\ 2 & 6\end{bmatrix}$

(12 + 8)

22. a) Find the sum of the series $1+\frac{1+3}{2!}+\frac{1+3+3^2}{3!}+.....+\infty$

b) In an evaluation of answer script the following marks were awarded by the examiners

1st	88	60	94	50	89	75	65	54	63	40
2nd	90	65	85	53	85	78	69	59	61	43

Calculate the Spearman's rank correlation coefficient between them. (10 + 10)

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