LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIRSTSEMESTER – APRIL 2017

16UMT1AL01- MATHEMATICS FOR PHYSICS - I

Date: 02-05-2017 Dept. No. Max. : 100 Marks
01:00-04:00

SECTION A

ANSWER ALL QUESTIONS. **$(10\times2=20)$**

1. Find the n^{th} derivative of $\cos(ax+b)$.
2. Show that in the parabola $y^2=4ax$, the subnormal is constant.
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. State Cauchy's Root test.
5. Find the Laplace transform of $\sin^2 2t$.
6. Obtain the inverse Laplace transform of $\frac{k}{s^2+k^2}$.
7. State Cayley-Hamilton theorem.
8. Define symmetric matrix.
9. What is the chance a leaf year selected at random will contain 53 Sundays?
10. Define Binomial distribution.

SECTION B

ANSWER ANY FOUR QUESTIONS. **$(5\times8=40)$**

11. Find n^{th} derivative of $y=\frac{x^2}{(x-1)^2(x+2)}$.
12. Find the angle of intersection of the cardioids $r=a(1+cos\theta)$ and $r=b(1-cos\theta)$.
13. Examine the convergence of the series $\sum_0^\infty\frac{n^3+1}{2^n+1}$.
14. Find the Laplace transform of $f(t)=\begin{cases}1 & : \ 0<t<b\\ -1 & : \ b<t<2b\end{cases}$.
15. Find $L^{-1}(\frac{1}{s(s+1)(s+2)})$.
16. Find the characteristic equation of the matrix $A=\begin{pmatrix}2&2&0\\2&1&1\\-7&2&-3\end{pmatrix}$ and hence determine its inverse.
17. Two unbiased dice are thrown. Find the probability of getting (i) sum is 8 (ii) atmost the sum is 4 (ii) sum greater than 10 (iv) both the dice shows the same number?
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 $y = \sin(m\sin^{-1}x)$, prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y_n = 0$.

(b) Find the maximum value of $\frac{\log x}{x}$ for positive values of x. **(14+6)**

20. (a) Sum the series $1 + \frac{1+3}{2!} + \frac{1+3+3^2}{3!} + \frac{1+3+3^2+3^3}{4!} + \cdots$

(b) Discuss the convergence of the series $1 + \frac{(1!)^2}{2!}x + \frac{(2!)^2}{4!}x^2 + \frac{(3!)^2}{6!}x^3 + \cdots$ **(10+10)**

21(a) Using Laplace transform, solve $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + 5y = 4e^{-t}$, $y = \frac{dy}{dt} = 0$ when $t = 0$.

(b) Solve by Cramer's rule: $2x - y + 2z = 2$, $x + 10y - 3z = 5$, $x - y - z = 3$. **(10+10)**

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

(b) Obtain the correlation coefficient for the following data:

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

(10+10)

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