LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – **APRIL 2013**

MT 3102 - MATHEMATICS FOR PHYSICS

Date : 04/05/2013 Dept. No. Max. : 100 Marks

Time : 9:00 - 12:00

SECTION A

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

01. If $y=\sin(ax+b)$, find y_n.

02. Find the slope of the curve $r=e^{\theta}$ at $\theta=0$.

03. If $y=x-\frac{x^2}{2!}+\frac{x^3}{3!}-\frac{x^4}{4!}+...\infty$, then show that $x=y+\frac{y^2}{2!}+\frac{y^3}{3!}+...\infty$.

04. Define symmetric matrix and give an example.

05. Find $L(t^2+2t)$.

06. Find the inverse Laplace transform of $\frac{s}{s^2+k^2}$.

07. Write down the expansion of $\tan n\theta$.

08. If $1+\tan^2\theta=\sec^2\theta$, then prove that $1-\tanh^2 x=\sec h^2 x$.

09. What is the chance that a leap year selected at random will contain 53 Sundays?

10. If the mean and variance of a binomial distribution is 4 and $\frac{4}{3}$. Find $P(X=0)$.

SECTION B

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

11. Find the n^{th} differential coefficient of $e^x \sin x \sin 2x$.

12. Find the angle of intersection of the curves $r=\frac{a}{1+\cos\theta}$ and $r=\frac{b}{1-\cos\theta}$.

13. Find the sum to infinity of the series $1+\frac{3}{4}+\frac{3.5}{4.8}+\frac{3.5.7}{4.8.12}+...\infty$.

14. Verify Cayley-Hamilton theorem for the matrix $A=\begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$.

15. Find $L^{-1}\left[\frac{s}{(s^2+a^2)^2}\right]$.

16. If $\cos(x+iy)=\cos\theta+i\sin\theta$, then prove that $\cos 2x+\cosh 2y=2$.

17. Express $\cos 8\theta$ in terms of $\sin\theta$.

18. . Find the mean and standard deviation for the following frequency distribution:

Class Interval	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24	24 - 28
Frequency	10	12	18	7	5	3	4

SECTION C

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

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

(b) Prove thatl $\log\left(\frac{n+1}{n-1}\right) = \frac{2n}{n^2+1} + \frac{1}{3}\left(\frac{2n}{n^2+1}\right)^3 + \frac{1}{5}\left(\frac{2n}{n^2+1}\right)^5 + ...\infty$. (15 + 5)

20. (a) Find the characteristic roots and the associated characteristic vectors of the matrix

$$A = \begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}.$$

(b) A manufacturer of cotter pins knows that 5% of his products is defective. If he sells cotter pins in boxes of 100 and guarantees that not more than 10 pins will be defective, what is the approximate probability that a box will fail to meet the guaranteed quality? (12 + 8)

21. (a) Find the Laplace transform of $t^2 e^{-3t}$.

(b) Solve the equation $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + 5y = 4e^{-t}$ given that $y = \frac{dy}{dt} = 0$ when $t = 0$. (5 + 15)

22. (a) Express $\sin^3\theta \cos^5\theta$ in a series of sines of multiples of θ.

(b)) Separate $\tan^{-1}(x+iy)$ into real and imaginary parts. (12 + 8)

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