LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – NOVEMBER 2016

MT 3102 - MATHEMATICS FOR PHYSICS

Date: 12-11-2016   Dept. No. [   ]   Max. : 100 Marks
Time: 09:00-12:00

SECTION A

ANSWER ALL QUESTIONS. (10 × 2 = 20)

1. Find the nth derivative of $y = log(4x + 8)$

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

3. Write the expansion for $(1 - x)^{\frac{-p}{q}}$.

4. Define skew-symmetric matrix .

5. Find the Laplace transform of $\cos at$.

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

7. Write down the expansion for $\cos 5\theta$.

8. 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 Poisson distribution.

SECTION B

ANSWER ANY FIVE QUESTIONS. (5 × 8 = 40)

11. Find the nth differential coefficient of $cosx.cos2x.cos3x$.

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

13. Show that $log\left(\dfrac{n+1}{n}\right) = 2\left(\dfrac{1}{2n+1} + \dfrac{1}{3(2n+1)^3} + \dfrac{1}{5(2n+1)^5} + \cdots\right)$.

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

15. Find the Laplace transform of $f(t) = \begin{cases} e^{-t} & 0 < t < 4 \\ 0 & t > 4 \end{cases}$.

16. Express $sin^7\theta$ in a series of sines of multiplies of θ.

17. If $cos(x + iy) = cos\theta + isin\theta$, prove that $cos2x + cosh2y = 2$.

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

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

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

    (b) Find the maximum value of $\frac{logx}{x}$ for positive values of x. (12+8)

20. Find the characteristic roots and associated characteristic vectors of the matrix

$$A = \begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}.$$ (20)

21. (a) Express $sin7\theta$ in terms of $sin\theta$.

    (b) Find the sum to infinity of the series $1 + \frac{1+3}{2!} + \frac{1+3+3^2}{3!} + \frac{1+3+3^2+3^3}{4!} + \cdots \infty$.

    (10 + 10)

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

    (b) A manufacturer of cotter pins knows that 5% of his product 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)

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