LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – NOVEMBER 2011

MT 3102 – MATHEMATICS FOR PHYSICS

Date :09-11-11 Dept. No. Max. : 100 Marks
Time : 9.00-12.00

PART – A

Answer ALL questions. **(10 × 2 = 20)**

1. If $y=\sin(ax+b)$, find y_n.
2. Find the slope of the curve $r=e^{\theta}$ at $\theta=0$.
3. Prove that $\dfrac{e-1}{e+1}=\dfrac{\frac{1}{2!}+\frac{1}{4!}+\frac{1}{6!}+......\infty}{\frac{1}{1!}+\frac{1}{3!}+\frac{1}{5!}+......\infty}$.
4. Find the rank of the matrix $\begin{pmatrix} 3 & -1 & 2 & 4 \\ -6 & 2 & -4 & -8 \\ -3 & 1 & -2 & -4 \end{pmatrix}$.
5. Find $L(\sin at)$.
6. Find $L^{-1}\left[\dfrac{1}{s(s+a)}\right]$.
7. Write down the expansion for $\sin n\theta$.
8. Show that $\cosh^2 x-\sinh^2 x=1$.
9. What is the chance that the leap year selected at random will contain 53 Sundays?
10. If a Poisson variate X is such that $P(X=1)=2P(X=2)$, find the mean.

PART – B

Answer any FIVE questions **(5 × 8 = 40)**

11. Find the n[th] differential of $e^{4x}\sin^2 x$.
12. Find the angle of intersection of the cardioids $r=a(1+\cos\theta)$ and $r=b(1-\cos\theta)$.
13. Sum the series $\dfrac{1^2}{1!}+\dfrac{1^2+2^2}{2!}+\dfrac{1^2+2^2+3^2}{3!}+......\dfrac{1^2+2^2+3^2+...+n^2}{n!}+....$
14. Verify Cayley-Hamilton theorem for the matrix $A=\begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$.
15. Find $L^{-1}\left[\dfrac{1}{(s+1)(s^2+2s+2)}\right]$.
16. Express $\dfrac{\sin 6\theta}{\sin\theta}$ in terms of $\cos\theta$.
17. If $\tan(x+iy)=u+iv$, prove that $\dfrac{u}{v}=\dfrac{\sin 2x}{\sinh 2y}$.

18. An insurance company insures 4,000 people against loss of both eyes in a car accident. Based on previous data, the rates were computed on the assumption that on the average 10 persons in 1,00,000 will have car accident each year that result in this type of injury. What is the probably that more than 3 of the insured will collect on their policy in a given year?

PART – C

Answer any TWO questions. **($2 \times 20 = 40$ marks)**

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

(15 marks)

(b) Find the maxima and minima of the function $2x^3 - 3x^2 - 36x + 10$. (5 marks)

20. (a) Find the sum to infinity of the series $\frac{1}{24} - \frac{1 \cdot 3}{24 \cdot 32} + \frac{1 \cdot 3 \cdot 5}{24 \cdot 32 \cdot 40} - ....$ (12 marks)

(b) Find the eigen values and eigen vectors of $\begin{bmatrix} 3 & -1 & 3 \\ -1 & 5 & 1 \\ 3 & 1 & 5 \end{bmatrix}$ (8 marks)

21. (a) Expand $\sin^3\theta\cos^3\theta$ in a series of sines of multiples of θ. (12marks)

(b) Evaluvate $\lim_{x\to 0} \frac{\tan x - \sin x}{\sin^3 x}$. (8 marks)

22. (a) Solve the equation $\frac{d^2y}{dt^2} - 10\frac{dy}{dt} + 24y = 24t$ given that $y = \frac{dy}{dt} = 0$ when $x = 0$. (12 marks)

(b) Find the mean and standard deviation for the following frequency distribution:

x	1	2	3	4	5	6	7
f	5	9	12	17	14	10	6

(8 marks)

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