LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc.DEGREE EXAMINATION – **PHYSICS**

SECONDSEMESTER – APRIL 2018

17/16PPH2MC02- MATHEMATICAL PHYSICS II

Date: 19-04-2018 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

PART – A

Answer **ALL** the Questions (10x2=20)

1. Prove the change of scale property of Laplace transforms
2. Find the Laplace transform of the functions i) $e^{at}\sin bt$ ii)$e^{-at}\cos h\, bt$
3. Write the expression for Fourier cosine transform.
4. Form differential equations for a circle defined by $x^2+y^2=a^2$
5. Obtain the associated Laguerrepolynomials $L_2^1(x)\,, L_2^2(x)$.
6. Show that $H_{2n}(0)=\frac{(-1)^n(2n)!}{n!}$ where H stands for Hermite polynomials
7. Prove that every subgroup of an abelian group is abelian.
8. Show that if a group G contains an element ‘a’ such that every element of G is of the form a^k for some integer k, then G is cyclic group.
9. Write the recurrence relation for binomial distribution.
10. Write a note on student’s t- distributions.

PART – B

Answer any **FOUR** Questions (4x7.5=30)

11. Find the Laplace transform of the square-wave function of period ‘a’ defined by

$$f(x)=\begin{cases}1, & when\ 0<t<\frac{a}{2}\\ -1, & when\ \frac{a}{2}<t<a\end{cases}$$

12. Solve the differential equation$\frac{dy}{dt}+y=3e^{2t}, y(0)=0$
13. Find the inverse Fourier transform of $F(s)=e^{-|s|y}$
14. Show that Hermite polynomials satisfy its own differential equation
15. Form matrix representation of the operations $E, \sigma_{xy}, \sigma_{yz}, \sigma_{xz}$
16. If the probability that an individual suffers a bad reaction from injection is 0.001 determine that out of 2000 individuals a) Exactly 3 b) more than 2 individuals c) None d) More than one individual suffer in a bad reaction.

PART – C

Answer any **FOUR** Questions (4x12.5=50)

17. Using convolution theorem evaluate $L^{-1}\left[\frac{1}{S(S^2+4)}\right]$

18. Solve the heat flow equation $\frac{\partial\theta}{\partial t} = c^2\frac{\partial^2\theta}{\partial x^2}, t > 0$ to determine the temperature $\theta(x,t)$ if the initial temperature of the infinite bar is given by $\theta(x,t) = \begin{cases}\theta_0, for\ |x| < a \\ 0, for\ |x| > a\end{cases}$

19. Prove that $L_{n+1}(x) = (2n+1-x)L_n(x) - n^2L_{n-1}(x)$ where L stands for Laguerre polynomials.

20. List the symmetry elements for C_{3V} point group, obtain group multiplication table, classes and form the character table

21. a) In a certain factory producing cycle tyres, there is a small chance of 1 in 500 tyres to be defective. The tyres are supplied in lots of 10, Using Poisson distribution, calculate the approximate number of lots containing no defective, one defective and two defective tyres respectively in a consignment of 10,000 lots.

    b) A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson distribution with mean 1.5. Calculate the number of days in a year on which i) car is not used ii) the number of days in a year on which some demand is refused.

    c) A manufacturer knows that the razor blades he makes contain on an average of 0.5% are defective. He packs them in packets of 5. What is the probability that a packet picked at random will contain 3 or more faulty blades?

22. a) A function $f(x)$ is defined as follows $f(x) = \begin{cases} 0, & x < 2 \\ \frac{1}{18}(2x+3), & 2 \le x \le 4 \\ 0, & x > 4 \end{cases}$ show that it is a probability density function.

    b) A manufacturer of envelopes knows that the weight of the envelope is normally distributed with mean 1.9 gm and variance 0.01 gm. Find how many envelopes weighing i) 2 gm or more, ii) 2.1 gm or more, can be expected in a given packet of 1000 envelopes. [Given: if t is the normal variable, then $\varphi(0 \le t \le 1) = 0.3413$ and $\varphi(0 \le t \le 2) = 0.4772$]

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