LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **PHYSICS**

SECOND SEMESTER – **APRIL 2022**

PPH 2502 – MATHEMATICAL PHYSICS - II

Date: 17-06-2022　　　　Dept. No.　　　　　　　　　　Max. : 100 Marks
Time: 09:00 AM - 12:00 NOON

PART – A

Q. No　Answer **ALL** Questions　　　　　　　　　　　　　　　　**(10 x 2 = 20)**

1　State the first shifting property of Laplace transforms.

2　Evaluate $L\,(\cos at)$

3　State convolution theorem.

4　Draw the graph for $y = \sin 19x$.

5　Determine, $L_1(x)\ and\ L_2(x)$, where L's stand for Laguerre polynomials.

6　Write the generating function of Hermite's polynomials.

7　What is homomorphism?

8　Show that the group $G = \{-1, 1,\ i, -i\}$ under multiplication operation is cyclic.

9　Write the recurrence formulae for Poisson distribution.

10　Find the probability of throwing 9 with two dice.

PART – B

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

11　If $f(t)$ is a periodic function with a period ω, show that $L\big(f(t)\big) = \frac{1}{1-e^{-s\omega}} \int_0^{\omega} \frac{e^{-st}f(t)dt}{}$.

12　Expand $x^3 + x^2 - 3x + 2$ in a series of Laguerre polynomials, i.e. $\sum_{k=0}^{\infty} A_k L_k(x)$.

13　Obtain the symmetry transformations of a square and find the conjugate elements and determine the various classes present.

14　i) In a certain factory producing cycle tyres, there is a small chance of 1 in 500 tyres being 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.

(3.5)

ii) The number of arrivals of customers during any day follows Poisson distribution with a mean of 5. What is the probability that the total number of customers on two days selected at random is less than 2. (4)

15 Apply convolution theorem to evaluate $L^{-1}\left[\frac{1}{s^3(S^2+1)}\right]$.

16 Derive any two recurrence relations of Hermite's polynomials.

PART – C

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

17 Define periodic functions. Obtain an expression for Laplace transformation of a half wave rectifier.

18 Solve the equation using Fourier sine transformation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the following conditions

     i) $u(x, 0) = 0$

     ii) $u(x, 0) = e^{-x}$

     iii) $u(x, t)$ is bounded

19 Derive any two recurrence relations for Laguerre polynomials.

20 Identify symmetry elements present in the C_{3v} point group. Obtain character table from its group multiplication table.

21 i) A student takes his examination in four subjects $\alpha, \beta, \gamma, \delta$. He estimates his chances of passing in α as $\frac{4}{5}$, in β as $\frac{3}{4}$, in γ as $\frac{5}{6}$ and in δ as $\frac{2}{3}$. To qualify, he must pass in α and at least two other subjects. What is the probability that he qualifies?   (8.5)

ii) The overall percentage of failures in a certain examination is 20. If six candidates appear in the examination, what is the probability that at least five pass the examination?   (4)

22 Expand $f(x) = x^3$ in a series of Hermite polynomials.

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