



**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**

M.Sc. DEGREE EXAMINATION – PHYSICS

SECOND SEMESTER – **APRIL 2015**

**PH 2815 - MATHEMATICAL PHYSICS - II**

Date : 18/04/2015

Dept. No.

Max. : 100 Marks

Time : 01:00-04:00

**PART A**

**Answer all questions**

**10 x 2 = 20**

1. Define the Laplace transform of Heavy side function.
2. State convolution theorem.
3. Define Fourier sine transform.
4. Sketch the graph  $y=e^{-x}$ .
5. Applying the properties of special function, evaluate  $\int_0^{\infty} e^{-x} (2 - 4x + x^2) dx$ .
6. Define error function.
7. Define the terms “irreducible” and “reducible” representation.
8. State the great orthogonality theorem.
9. List down the recurrence relations of Poisson’s distribution.
10. What are mutually exclusive and independent events? Give an example each.

**Part B**

**Answer any four questions**

**4 x 7.5 = 30**

11. Find  $L(\sinh at), L^{-1}(\frac{1}{s^n})$ .
12. Find the Fourier transformation of  $f(x) = x^2$ .
13. Express  $f(x) = x^3$  using Hermite’s polynomials.
14. Identify the symmetry operations present in the  $C_{4v}$  point group and construct group multiplication table
15. Using generating function, establish the Hermite’s orthogonality condition for polynomials.
16. The probability that a student is accepted to a prestigious college is 0.3. If 12 students from the same school apply, what is the probability that at most 4 are accepted?

**Part C**

**Answer any four questions**

**4x 12.5= 50**

17. An inductor of 3 Henrys is in series with a resistance of 30 ohms and an emf of 150 volts. Assuming  $t=0$ , at  $i=0$ , find the current at time  $t>0$  using Laplace transform technique.
18. Obtain the general solution of partial differential equation  $\frac{\partial^2 y}{\partial t^2} = a^2 \frac{\partial^2 y}{\partial x^2}$  with the following boundary conditions  $y_x(L,t)=0$  ;  $y(0,t)=0$  ;  $y(x,0)=f(x)$   $|y(x,t)| < M$ ,  $0 < x < L$ ;  $y_t(x,0)=0$
19. Solve Hermite's differential equation by Froebenious power series method.
20. Derive the orthogonality relation for Laguerre's polynomials.
21. i) Derive transformation matrix for inverse, identity operations ii) List down the golden rules used to construct character table. Identify the classes present in the  $C_{3v}$  point group and construct character table.
22. i) A coin is tossed 6 times what is the probability of getting 3 or more heads.  
ii) Find the binomial distribution to the following frequency distribution.

No of success	0	1	2	3	4	5	6	7
Frequency	14	22	45	63	28	19	13	2

Calculate the theoretical frequency. Find S.D of both and compare them.

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