



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – PHYSICS

SECOND SEMESTER – APRIL 2017

16PPH2MC02- MATHEMATICAL PHYSICS II

Date: 21-04-2017
01:00-04:00

Dept. No.

Max. : 100 Marks

PART A

Answer all questions

(10 x 2 = 20)

1. Find the Laplace transform of $[14e^{-7t}]$
2. Evaluate $L^{-1}\left[\frac{s}{s^2+16}\right]$
3. Show that if $f(s)$ is the Fourier transform of $f(x)$, then $\frac{1}{b}f\left(\frac{s}{b}\right)$ is the Fourier transform of $F(bx)$
4. Draw the graph for $y = \cos x$
5. Sketch the graph for error function and complementary error function
6. Write the generating function for associated Laguerre polynomial
7. What is homomorphism?
8. Prove that every subgroup of an Abelian group is Abelian.
9. Obtain the probability of throwing an even number with an ordinary six faced die.
10. Define the terms “equally likely events” and “sample space”.

PART B

Answer any four questions

(4 x 7.5 = 30)

11. Obtain the Laplace transform of saw-toothed wave of a period T , given by $f(t) = \frac{t}{T}$ when $0 < t < T$.
12. Find the Fourier cosine and sine transform of $f(x) = 14e^{-25x} + 19e^{-x}$
13. Derive the Recurrence relation $L_{m+1}(x) + m^2L_{m-1}(x) = (2m + 1 - x)L_m(x)$ where L 's stand for Laguerre polynomials.
14. Identify the symmetric elements present in C_{2v} point group. Construct group multiplication table for the same.
15. A die is thrown 8 times. Find the probability that 3 will show exactly (i) at least seven times (ii) at least once (iii) exactly 2 times
16. a) Write the recurrence formula associated with Poisson distribution.
b) Suppose that a book of 500 pages contains 40 printing mistakes. Assume that these errors are randomly distributed throughout the book and x , the number of errors per page has a Poisson distribution. What is the probability that 10 pages selected at random will be free of errors? **(2.5+5)**

PART C

Answer any four questions

(4 x 12.5 = 50)

17. i) Find the Laplace transform of the rectangular wave given by $f(t) = \begin{cases} 5, & 0 < t < b \\ -5, & b < t < 2b \end{cases}$
- ii) Obtain the general expression for Fourier transform of derivatives (8.5+4)
18. Develop the Fourier transform of the function $f(x) = \begin{cases} 1 + \frac{x}{a}; & -a < x < 0 \\ 1 - \frac{x}{a}; & 0 < x < a \\ 0 & \text{otherwise} \end{cases}$
19. Derive any two recurrence relations for Hermite polynomials. Show that the polynomials satisfy their own differential equations. (4+4+4.5)
20. Identify symmetry elements present in the C_{3v} point group. Obtain character table from its group multiplication table.
21. (i) Compute the students t for the following values in a sample of eight: -4, -2, -2, 0, 2, 2, 3, 3 taking the mean of universe to be zero.
- (ii) If the variance of the Poisson distribution is 2, find the probabilities for $r = 1, 2, 3, 4$ from the recurrence relation of the Poisson distribution. Also find $P(r \geq 4)$.
22. Using Frobenius power series method, solve Laguerre differential equation.

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