LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

SECOND SEMESTER – NOVEMBER 2016

PH 2812 - MATHEMATICAL PHYSICS

Date: 08-11-2016 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

PART A

Answer all questions **10 x 2 = 20**

1. Write the equation of a circle having radius 15 units and centre at (5,1)
2. State the condition for a function to be harmonic.
3. Graph the function f(t) = 13 if $0 < t < \pi$, f(t)= 0 if $\pi<t<2\pi$
4. Define inverse Fourier cosine and sine transform.
5. What are boundary conditions?
6. State convolution theorem
7. State the conditions for which differential equation is Sturm-Liouville type.
8. Define the terms "eigen function" and "eigen vectors"
9. State Lagrange's theorem.
10. What is homomorphism?

Part B

Answer any four questions **4 x 7.5 = 30**

11. State and prove Cauchy's theorem
12. Find $L\left[\frac{\sin at}{t}\right]$. Hence show that $\int_0^{\infty} \frac{\sin t}{t} dt = \frac{\pi}{2}$
13. Solve two-dimensional wave equation.
14. Show that Hermite's polynomials satisfy their own differential equation.
15. Develop transformation matrix for rotation operation. Predict the number of rotational and vibrational modes of linear molecule CO_2.

Part C

Answer any four questions **4 x 12.5= 50**

16. i) Derive Cauchy-Riemann equations for a function to be analytic.
    ii) If $w = u + iv$ is an analytic function and $= x^2 - y^2 + \frac{x}{x^2+y^2}$, find u.
17. Find the temperature in a laterally insulated bar of length L whose ends are kept at temperature zero assuming that the initial temperature $f(x) = \begin{cases} x & if\ 0 < x < \frac{L}{2} \\ L - x & if\ \frac{L}{2} < x < L \end{cases}$
18. Solve $\frac{\partial u}{\partial t} = \alpha \frac{\partial^2 u}{\partial x^2}$; $0 < x < L, and\ t > 0; u(0,t) = 0; u(L,t) = 0; u(x,0) = f(x)$; $|u(x,t)| < M$ and interpret physically.
19. Solve Lengendre's differential equation by Frobenius power series method.
20. State and prove great orthogonality theorem

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