LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**B.Sc.** DEGREE EXAMINATION – **PHYSICS**

FOURTH SEMESTER – APRIL 2011

# PH 4504/PH 4502/PH 6604 - MATHEMATICAL PHYSICS

 Date : 07-04-2011 Dept. No. Max. : 100 Marks

 Time : 1:00 - 4:00

**PART-A**

Answer **ALL** questions. (10 x 2 = 20 marks)

1. Given z1 = a - i and z2 = a + i fine z1\* z2, for any real ‘a’.

2. Verify that f(z) = z is analytic.

3. State two conditions for a function to be Fourier transformed.

4. Define the eigen value problem for the operator

5. Express the Laplacian in polar coordinates.

6. State Cauchy’s integral theorem.

7. Evaluate , ‘c’ is circle of radius 1.

8. State Parseval’s theorem.

9. Write down the difference operator and the shift operator.

10. Write down trapezoidal rule for integration.

**PART-B**

Answer any **FOUR** questions. (4 x 7.5 = 30 marks)

11. a). Show that |z|2 = 1 describes a circle centered at the origin with radius 1.

 b). Simplify (1+i)(2+i) and locate it in the complex plane.

12. Verify the Cauchy’s integral theorem for along the boundary of a rectangle with vertices

 (0,0) , (1,0), (1,1) and (0,1) in counter clock sense.

13. Find DAlembert’s solution of the wave equation for a vibrating string.

14. If f(s) is the Fourier transform of f(x), show that F{f(ax)} = (1/a)F(s/a) and

 F{f’(x)} = is F(s). Here the prime denotes differentiation with respect to ‘x’.

15. Use Euler’s method to solve, given y(0) = 1, find y(0.04) with h = 0.01.

**PART-C**

Answer any **FOUR** questions. (4 x 12.5 = 50 marks)

16. a) Establish that the real and complex part of an analytic function satisfies the Laplace equation.

 b) Prove that  is harmonic and find its conjugate function. (6+6.5)

17. Verify

 a). for f(z) = z, with z0 = -1-i and z= 1+i.

 b). 

 for f(z) = 3z and g(z) = -3, and any real constants c1 and c2.

18. Using the method of separation of variables obtain the solution for one dimensional

 heat equation. , with u(l,t) = 0 and u(0,t)=0.

19. a) State and prove convolution theorem for Fourier transforms.

 b) Find the Fourier sine transform of .

20. Derive the Newton’s forward interpolation formula and deduce the Trapezoidal and Simpson’s rule

 for integration.

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