



# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

## B.Sc. DEGREE EXAMINATION – PHYSICS

FOURTH SEMESTER – NOVEMBER 2013

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

Date : 05/11/2013  
Time : 1:00 - 4:00

Dept. No.

Max. : 100 Marks

#### PART-A

Answer **ALL** questions:

(10 x 2 = 20)

1. Express  $z = 1 + i$  in polar form.
2. What is a rational function?
3. State true or False: Analyticity of a function depends on the domain of definition.
4. Give two properties of complex line integral.
5. State Cauchy's integral theorem.
6. Write 2-dimensional Laplace equation in polar form.
7. If  $x = a \sin(\omega t)$  is a solution of  $\frac{d^2x}{dt^2} + \frac{\kappa}{m}x = 0$ . Find  $\omega$ .
8. Define Fourier sine transform.
9. Write Simpson's  $\frac{1}{3}$  rd rule for integration.
10. Define the terms order and degree of a differential equation.

#### PART-B

Answer any **FOUR** questions:

(4 x 7.5 = 30)

11. Simplify the following a)  $\frac{1+i}{1-i}$ ; b)  $\frac{(2+i)(3+i)}{(1+i)}$ ; Locate them in the complex plane. (3+4.5)
12. Prove Cauchy's integral theorem.
13. State and prove convolution theorem for Fourier transforms.
14. Describe the D'Alamber's solution for the wave equation.
15. Use Euler's method to find  $y(0.2)$  and  $y(0.4)$  for the equation  $\frac{dy}{dx} = x + y$  with  $y(0)=0$ . Take step size as 0.2.

#### PART-C

Answer any **FOUR** questions

(4 x 12.5 = 50)

16. a) Define the singular point of a complex function .  
b) Establish the Cauchy-Riemann relation for a analytic complex function. (2+8+2.5)  
c) Prove that  $f(x,y) = x^2 - y^2 + 2 i xy$  is analytic.
17. a) State and prove Cauchy's integral formula  
b) Evaluate  $\int_c \frac{dz}{z}$ . Here  $c$  is a unit circle. (9+3.5)

18. a) Deduce the differential equation satisfied by the vibrating string

b) Differentiate partial differential equation from ordinary differential equation. (10+2.5)

19. a) If  $F(s)$  is the Fourier transform of  $f(x)$ , show that  $F\{f(ax)\} = (1/a) F(x/a)$  and  $F\{f'(x)\} = is F(s)$ . where prime means differentiation with respect to  $x$ .

b) Find the Fourier transform of  $e^{-\alpha x}$ . (9+3.5)

20. Give the Lagrange's interpolation formula.

Using  $(x, \ln x); (9, 2.19722); (9.5, 2.25129); (10, 2.30259); (11, 2.39790)$ . Find  $\ln(9.2)$ .

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