



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – PHYSICS

FOURTH SEMESTER – NOVEMBER 2016

PH 4504/PH 4502/PH 6604 – MATHEMATICAL PHYSICS

Date: 04-11-2016

Dept. No.

Max. : 100 Marks

Time: 01:00-04:00

PART - A

Answer ALL questions:

(10 x 2 = 20 Marks)

1. Represent $z = \frac{1+i}{1-i}$ in polar form.
2. Find the value of $\ln(-1)$.
3. Evaluate $\int_0^{-i} z^2 dz$
4. What is the principle of deformation of path?
5. What are fundamental mode and overtones of a vibrating string?
6. Determine the value of c if $u(x,t) = e^{-16t} \sin 2x$ satisfies $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$.
7. Give the change of scale property of a Fourier transform.
8. Define Fourier cosine transform of a function.
9. Write the Lagrangian interpolation formula for unequal intervals.
10. Compute the value of $y(0.02)$ for $y' = 1 + y^2$ with $y(0) = 0$ and $h = 0.02$ using Euler's method.

PART - B

Answer any FOUR questions:

(4 x 7.5 = 30 Marks)

11. Find the real and imaginary parts of $\tan(x + iy)$.
12. Evaluate $\int_C \frac{\sinh z}{z^4} dz$ in counter clockwise where C is the circle $|z| = 2$.
13. Obtain the general solution of one dimensional wave equation using product method.
14. State and prove convolution theorem for Fourier transforms.
15. Evaluate $\int_0^{-2} \frac{dx}{1+x^3}$ by dividing into 8 equal parts using Simpson's $1/3^{\text{rd}}$ rule.

PART - C

Answer any FOUR questions:

(4 x 12.5 = 50 Marks)

16. (a) Derive Cauchy-Riemann equations for a function $f(z)$ to be analytic.
(b) Show that $u = \sin x \cosh y$ is a harmonic function. (7.5+5)
17. (a) Evaluate $\int_C \bar{z} dz$ from $z = 0$ to $z = 4 + 2i$ along the curve C given by $z = t^2 + it$.
(b) State and prove Cauchy's integral theorem. (5+7.5)
18. Obtain the solution of two dimensional Laplace equation in electrostatic potential problem.

19. (a) Find the Fourier sine transform of $\frac{e^{-x}}{x}$.

(b) If $F(w)$ is the Fourier transform of $f(x)$, show that $F\{f''(x)\} = -w^2 F(w)$. (7.5 +5)

20. Derive Newton's forward interpolation formula and use it to find $y(31.25)$ from the following table

x	30	31	32	33	34
y	0.5000	0.5150	0.5299	0.5466	0.5592

(5+7.5)
