LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FOURTH& SIXTH SEMESTER – APRIL 2017

PH 4504 / PH 4502 / PH 6604- MATHEMATICAL PHYSICS

Date: 21-04-2017 Dept. No. Max. : 100 Marks
09:00-12:00

PART - A

Answer ALL questions: **(10 x 2 = 20 Marks)**

1. Given $z_1 = 4 - 3i$ and $z_2 = 2 + 5i$, find imaginary part of $z_1 z_2$.
2. Find the principal value of $ln\,(1 - i)$.
3. Integrate $\int_{-\pi i}^{\pi i} \cos z \, dz$
4. Evaluate $\int_C \frac{1}{z^2} dz$ where C is unit circle.
5. Determine the value of c if $u(x,t) = e^{-4\pi t} \cos 4x$ satisfies $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial^2 x}$.
6. Write the two dimensional wave equation.
7. Define inverse Fourier transform of a function.
8. Give the change of scale property of a Fourier transform.
9. Define shift operator.
10. Write Simpson's 1/3 rule.

PART – B

Answer any FOUR questions: **(4 x 7.5 =30 Marks)**

11. Find the real and imaginary parts of (a) $\sin z$ and (b) $\cosh z$.
12. Evaluate $\int_C \bar{z}\, dz$ from $z = 0$ to $z = 4 + 2i$ along the curve C given by line from $z = 0$ to $z = 2i$ and the line from $z = 2i$ to $z = 4 + 2i$.
13. Derive the wave equation for a vibrating string.
14. Find the Fourier cosine transform of $e^{-kx}, k > 0$.
15. Compute the values of y at $x = 0.1, 0.2, 0.3$ for $y' = x + y$ with $y(0) = 0$ and $h = 0.1$ using Euler's method.

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 $v = \cosh x \sin y$ is a harmonic function. **(7.5+5)**
17. (a) State and prove Cauchy's integral theorem.
    (b) Evaluate $\oint_C \frac{\sinh \pi z \, dz}{z^2 - 3z}$ in counter clockwise where C: |z-1|=1. **(7.5+5)**
18. Find the solution of two dimensional Laplace equation in electrostatic potential problem.
19. (a) State and prove convolution theorem for Fourier transforms.
    (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 Lagrange interpolation formula for unequal intervals and using it find $y(27)$ from the following table

x	14	17	31	35
y	68.7	64.0	44.0	39.1

(6+6.5)

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