LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION –**PHYSICS**

FOURTH &SIXTH SEMESTER – **APRIL 2018**

PH 4504 / PH 4502 / PH 6604– MATHEMATICAL PHYSICS

Date: 09-05-2018 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

PART – A

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

1. Express the function $f(z) = z^2$ in the form $f(z) = u(x, y) + iv(x, y)$
2. Determine the principal value of the argument of the complex number $z = -1 + \sqrt{3}i$.
3. State some of the basic properties of line integral.
4. Evaluate $\oint_c \frac{e^{-z}}{z+1}\, dz$,where c is the circle $|z| = \frac{1}{2}$
5. Write down one Dimensional heat equation and a suitable separable solution for the same.
6. What is the basic difference between the solution of one dimensional wave equation and one dimensional heat equation?
7. State Parseval's theorem.
8. Define Fourier Transform and Inverse Fourier Transform.
9. Write down the Lagrange's formula to find $y(x)$ if three sets of values (x_0,y_0), (x_1,y_1) and (x_2,y_2) are given.
10. State Simpson's ⅓rd rule.

PART – B

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

11. Verify by direct substitution that Re (z^3) and Im (z^3) satisfy Laplace's Equation.
12. State and prove Cauchy's integral formula.
13. Applying the method of separation of variables techniques, find the solution to the P.D.E. $3\frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0$

14.Obtain Fourier Cosine Transform of

$$f(x) = \begin{cases} x\,, & for\ 0 < x < 1 \\ 2 - x\,, & for\ 1 < x < 2 \\ 0\,, & for\ x > 2 \end{cases}$$

15. By dividing the range into ten equal parts, evaluate $\int_0^{\pi} \sin x dx$ by Trapezoidal rule and Simpson's one third rule. Verify your answer with direct integration.

PART – C

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

16. (a) Prove that $\cosh(x - y) = cosh\, x\; cosh\, y - sinh\, x\; sinh\, y$

(b)Find the general value of $\log(1 + i) + \log \quad (1 - i)$

17. Evaluate $\int_{1-i}^{2+i} (2x + iy + 1)\, dz$ along the two paths: $(i) x = t + 1,\ y = 2t^2 - 1$

(ii)The straight line joining $1 - i$ and $2 + i$

18. Derive the solution of wave equation by D' Alembert's method.

19. (a) State and prove the convolution theorem on Fourier Transforms.

(b)Find the Fourier transform of

$$f(x) = \begin{cases} 1 & for \quad |x| < a \\ 0 & for \quad |x| > a \end{cases}$$

20.(a) Using Newton's forward interpolation formula, find f(1.5) from the following data

x	0	1	2	3	4
f(*x*)	858.3	869.6	880.9	829.3	903.6

(b)Given $\frac{dy}{dx} = \frac{y-x}{y+x}$, with y = 1 for *x* = 0. Find y approximately for *x* = 0.1 by Euler's method in five steps.

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