

## 2023/TDC(CBCS)/EVEN/SEM/ PHSHCC-401T/004

TDC (CBCS) Even Semester Exam., 2023

**PHYSICS** 

( Honours )

(4th Semester)

Course No.: PHSHCC-401T

( Mathematical Physics—III )

Full Marks: 50 Pass Marks: 20

Time: 3 hours

The figures in the margin indicate full marks for the questions

## SECTION—A

Answer any ten questions from the following:

2×10=20

- 1. Express (1+i) in polar form.
- 2. Find the square root of i.
- 3. Write Cauchy-Riemann condition in polar form.

(Turn Over)

J23/636

- 4. Define pole and order of a complex function.
- 5. Explain the terms 'simply' and 'multiply' connected regions.
- 6. Find the poles for the complex function cot z.
- 7. Find the residue of the complex function  $e^{1/z}$ .
- 8. State and explain Cauchy integral theorem.
- 9. Write down the Cauchy's integral formula.
- 10. Define Laplace transformation.
- 11. Find out the Laplace transformation of 1.
- 12. Give the formula for Laplace transformation of derivative of a function and explain relevant terms.
- 13. What are the advantages of using Laplace transformation (LT) and inverse LT?
- 14. What is the inverse LT of  $\frac{1}{(s-a)}$  when s > a?
- 15. Write down the formula for Laplace transformation of integration of a function.

J23/**636** (Continued)

## SECTION-B

Answer any five questions from the following:

6×5=30

2

- 16. (a) State and prove De Moivre's theorem.
  - (b) For z=2+3i, show |z| and arg(z) in the Argand plane (i.e., Argand diagram).
- 17. Derive the necessary and sufficient conditions for a complex function to be analytic.
- 18. Prove Cauchy integral theorem for simply connected regions. How can this be extended for multiply connected regions? 4+2=6
- 19. Evaluate the following by showing all the steps:

$$\int_0^{2\pi} \frac{d\theta}{3 + 2\sin\theta}$$

- 20. (a) Find the poles and residues at the poles for the complex function  $\frac{z}{\cos z}$ .
  - (b) Evaluate the following integral:

$$\oint_C \frac{(1-2z)\,dz}{z(z-1)(z-2)}$$

where C is a circle given by the equation  $|z| = 1 \cdot 5$ .

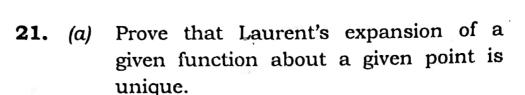
J23/**636** 

(Turn Over)

3



## (4)



3

(b) Expand the function  $f(z) = \frac{1}{z(z-1)}$  in terms of Laurent's series.

3

- 22. State and prove two-shift theorems of Laplace transformation.
- 23. (a) What is periodic function? Give example. 1+1=2
  - (b) Show that Laplace transform of  $e^{at} \sin \omega t$  is  $\frac{\omega}{(s-a)^2 + \omega^2}$ .

24. Write down the differential equation for the damped Harmonic oscillator. Use LT and inverse LT to solve it. 1+5=6

25. State convolution theorem. Solve the following differential equation using Laplace transformation y'' + 9y = 9u(t - 3); where y(0) = y'(0) = 0 and u(t - 3) is a step-unit function.

2+4=6



2023/TDC(CBCS)/EVEN/SEM/ PHSHCC-401T/004