বিদ্যাসাগর বিশ্ববিদ্যালয়

VIDYASAGAR UNIVERSITY

Question Paper

B.Sc. Honours Examinations 2022

(Under CBCS Pattern)

Semester - IV

Subject : PHYSICS

Paper : C 8 - T

Mathematical Physics - III

Full Marks : 40

Time : 2 Hours

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

Group - A

Answer any ***four*** questions : 5×4=20

1. What is Cauchy Riemann condition. Apply on the function $f(z)=|z|^2$ and comment on its analyticity.

2. Solve $\int_0^{2\pi}\frac{1}{3+2\cos\theta}d\theta$ by contour integration.

3. Find the Fourier transform of the function $f(x)=e^{-x^2}$.

P.T.O.

4. Find the Eigenvalues and Eigenfunction of a matrix $\begin{bmatrix} 2 & 3 \\ 1 & 0 \end{bmatrix}$.

5. Using Cayley Hamilton Theorem find the inverse matrix $\begin{bmatrix} \cos A & \sin A \\ -\sin A & \cos A \end{bmatrix}$.

6. Find the residue of $f(z) = \dfrac{z}{(z-1)(z+1)^2}$ at all its singularities.

Group - B

Answer any ***two*** questions : 10×2=20

7. (a) Find the Fourier transform of the given function $f(x) = 1$ for $|x| < a$

0 for $|x| > a$

(b) Using contour integration evaluate the real integral $\int_0^\infty \dfrac{1}{1+x^2} dx = \dfrac{\pi}{2}$.

8. (a) Find out the eigenvalues and Eigen vectors of the given Hermitian matrix (10+5)

$$\begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

(b) Evaluate using Cauchy's integral formule $\int \dfrac{2z+1}{z^2-1} dz$ about $|z| = \dfrac{1}{2}$.

9. (a) Find the Fourier transform of the function $f(x) = \dfrac{e^{-ax}}{x}$.

(b) Evaluate the integral $\oint \dfrac{dz}{z-a}$ in the conventional positive sense, where C is any simply closed curve and $z = a$ is a point inside C. What is the value of the integral, if $z = a$ is outside C.

P.T.O.

10. (a) Find Fourier Cosine transform of $f(x) = e^{-ax}$, $(a > 0,\ x \geq 0)$.

(b) Find the Taylor series expansion of a function of the complex variable $f(z) = \dfrac{1}{(z-1)(z-3)}$ about the point $z = 4$.