

2008

PHYSICS

PAPER—1101 (A & B)

*Full Marks : 40**Time : 2 hours**The figures in the right-hand margin indicate marks**Candidates are required to give their answers in their own words as far as practicable**Illustrate the answers wherever necessary*

PH-1101 A

*(Mathematical Methods of Physics)**[Marks : 20]*Answer Q. No. 1 and any *one* from the rest1. Answer any *five* bits: 2 × 5

- (a) Examine whether the set of vectors $\{ (1, 2, 4), (2, -1, 3), (0, 1, 2) \}$ are linearly dependent or independent.

(Turn Over)

(b) Find the eigenvalues of the matrix

$$\begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix}$$

(c) Find the residue of $\frac{z}{(z-a)(z-b)}$ at infinity.

(d) State Cayley - Hamilton theorem.

(e) Find the independent solutions of the equations

$$\frac{d^2 y}{dx^2} - 4y = x^2.$$

(f) Find the value of

$$\int_{-1}^{+1} (1+x) P_n(x) dx; n > 1.$$

(g) Write down the Rodrigue's formula for Laguerre's polynomials.

(h) Prove that

$$H_{2n}(0) = (-1)^n \frac{2n!}{n!}$$

2. (a) Write down Cauchy's integral formula and evaluate

$$\int_C \frac{e^{2z}}{(z+1)^4} dz$$

where C is the circle $|z| = 2$.

(b) Find the value of

$$\int_{-\infty}^{+\infty} \frac{xe^{-ix}}{x^2 + a^2} dx$$

by the method of residues.

(c) Find the Harmonic conjugate of

$$x^3 - 3xy^2. \quad (1+3)+4+2$$

3. (a) Use Gram-Schmidt process to obtain an orthogonal basis from the basis set $\{(1, 0, 1), (1, 1, 1), (1, 3, 4)\}$ of Euclidian space R^3 with standard inner product.

(b) Prove that

$$2x H_n(x) = 2n H_{n-1}(x) + H_{n+1}(x),$$

where $H_n(x)$ is Hermite function of degree n .

(c) Reduce the quadratic form

$$2xy + 2yz + 2zx$$

into Canonical form.

4 + 4 + 2

PH-1101 B

[Marks : 20]

Answer Q. No. 1 and any *one* from the rest

1: Answer any *five* bits:

2 × 5

- (a) Express the co-relations of the plasma states with the different states of matter by heating and cooling.

- (b) What is 'Debye length' ?
- (c) In the fourth state of matter, why is it usual to give temperature uses in the unit of energy ?
- (d) State Photo - ionization.
- (e) Discuss with symbol "Plasma parameters".
- (f) How will you distinguish classical diffusion from anomalous diffusion ?
- (g) What do you mean by the term, "plasma sheaths" ?
- (h) Graphically present the visual phenomena of (I - V) characteristics in a glow discharge.
2. Define 'mobility of electron'. What will be the effect on mobility of electron when a magnetic field is applied in a direction at right angles to the direction of flow of electrons ? Explain the results. 2 + 8

3. Draw a diagram of low-pressure electrical gas discharge system. With the help of Townsend advanced theory of Collision by Ionization deduce the Paschen's law and present graphical verification for different gases.

3 + 7
