

**2009**

**PHYSICS**

*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*

**PAPER—PH-1203 A**

**[ Marks : 20 ]**

**1. Answer any five from the following: 2 × 5**

**(a) What are the advantages of r.f. probe method over the double probe method ?**

**( Turn Over )**

- (b) Diagrammatically explain toroidal pinch-effect in plasma.
- (c) What are the major MHD instabilities in a linear pinch ?
- (d) A microwave beam of frequency  $6 \times 10^4$  MHz is found to be just reflected from a plasma. Calculate the electron density.
- (e) State and discuss Lawson criterion.
- (f) Explain recombination radiation loss in a plasma.
- (g) Explain the idea behind generation of oscillation in plasma.
- (h) Schematically draw the block of the Hypothetical controlled fusion reactor.

2. Answer any *one* bit:

- (a) What are the plasma parameter? Discuss the method of determining the electron temperature by spectroscopic technique with photomultiplier tube arrangement. 2 + 8
- (b) Name the processes of radiation loss from plasma. Find an expression for the energy radiated per unit volume due to bremsstrahlung loss in plasma. 2 + 8

( *Electrodynamics* )

PAPER — PH-1203 B

[ *Marks : 20* ]

1. Answer any *five* questions: 2 × 5

- (a) If alternating field  $E = E_0 \cos \omega t$  is applied to a conductor  $\lambda$  ( $\sigma = 10^7$  mho/m), show that the displacement current is negligible as compared to conduction current at any frequency lower than optical frequencies.

$$[ \epsilon_0 = 9 \times 10^{-12} \text{ F/m } ].$$

(b) What is Lorentz gauge? What are its advantages?

(c) In a source free region if

$$\vec{A} = \hat{i} x^4 + \hat{k} z^2 t^2$$

compute field vectors  $\vec{E}$  and  $\vec{B}$ .

(d) Write the form of electromagnetic potentials which exhibit the dependence of the potentials on the velocity of the charged particle.

(e) Show that

$$\frac{d\vec{A}}{dt} = -\frac{1}{2} (\vec{v} \times \vec{B}).$$

(f) Why radio communication is not possible under the sea?

(g) Show that the frequency of the electromagnetic wave remains unchanged by reflection and refraction.

(h) Kolkata Radiostation radiates a power of 0.5 MW at about 90 MHz from its antenna. Obtain a rough estimate of the strength of its electric field at V.U. Midnapore. The distance between Radiostation and V.U. is approximately 80 km.

2. Answer any *one* question:

10 × 1

(a) (i) Find the transformation equations for charge density ( $\rho$ ) and current density ( $\vec{J}$ ).

(ii) Treating the electric dipole to be equivalent to an accelerated charge, calculate the dipole moment amplitude ( $p_0$ ) in terms of charge ( $q$ ) and acceleration ( $a$ ). 5 + 5

(b) Obtain the expression of the total power radiated by an accelerated charge at high velocity, when the velocity and acceleration is colinear. What is Bremsstrahlung radiation? 8 + 2

