PG/IIS/PHS-203/12

M.Sc. 2nd Semester Examination, 2012

PHYSICS

PAPER—PHS-203 (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

Use separate scripts for Gr.-A & B

GROUP – A

[*Marks* : 20]

Answer **all** questions

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

(*a*) Write and discuss essential quantities which are used to describe the characteristics of plasma.

(*b*) Explain with schematric diagram the experimental aspect of linear pinch effect.

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

(*d*) Compare bremsstrahlung radiation loss with that due to cyclotron radiation loss.

(*e*) Indicate the origin of the plasma instabilities and mention their types.

(*f*) Diagramatically explain :

KINK and SAUSAGE instability in a plasma.

(*g*) Mentioning the conditions for quasi-equilibrium pinch, express and discuss Bennett's pinch relation.

(*h*) Discuss the term "plasma 'propulsion system".

2. Answer any *one* bit :

(*a*) Deduce the dispersion relation in plasma medium and show that when wavelength is large the oscillations propage as sound waves. 8 + 2

(*b*) What is thermo nuclear fusion reaction ? Discuss cylindrical configuration for a hypothetical controlled fusion reactor. For fusion plasma let $n = 10^{16}/cm^3$ at temperature 10 KeV. Find debye length. What are the essential elements for MHD generator ? 2 + 4 + 2 + 2

GROUP – B

[*Marks* : 20]

Answer **all** questions

1. Answer any *five* bits : 2 × 5

(*a*) Prove that

$$\frac{d\vec{A}}{dt} = -\frac{1}{2}\left(\vec{V} \times \vec{B}\right)$$

for a uniform magnetic field.

(*b*) Show that field vectors are guage invariant.

(*c*) Show that in a good conductor $\vec{H}$ lags behind $\vec{E}$ by $\pi/4$.

(*d*) What is the ratio of the skin depth in copper 1 kHz to that at 100 MHz.

(*e*) Show that electric charge is invariant under L. while the charge density is variant.

(*f*) Show that frequency of an electromagnetic wa remains unchanged by reflection and refration.

(*g*) Using equation of continuity and Ohm's la show that charge resides on the surface of a go conductor.

(*h*) Find the expression for transver current density, when vector field potent $\vec{A} = \hat{i}x^4 + \hat{k}z^2t^2$.

2. Answer any *one* of the following :

(*a*) Derive the expression of total power radiatio an accelerated charge particle at high velo Discuss the result with example when velocity acceleration of the particle are perpendicul each other.

(*b*) (*i*) Lienard radiation formula is,

$$P = \frac{1}{4\pi \epsilon_0} \frac{2e^2}{3c} \gamma^6 \left\{ \dot{\beta}^2 - \left(\vec{\beta} \times \vec{\dot{\beta}} \right)^2 \right\}$$

where notations have their usual meanings, using this, find expressions for radiated power for 'bremsstrahlung'.

(*ii*) The intensity of X-rays scattered by an electron at a distance from it and making an angle ϕ with the original direction is given by

$$I_e = \left[\frac{e^2}{4\pi \epsilon_0 mc^2} \right]^2 \cdot \frac{I \frac{1}{2} (1 + \cos^2 \phi)}{r^2}$$

where I = incident intensity.

using this equation, calculate intensity of scattered radiation I_s interms of I_e for an electron (*A*) when they scatter independently; (*B*) when all of them act as a scattering centre.

4 + 6
