PG/IIS/PHS-203/13

M.Sc. 2nd Semester Examination, 2013

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 & Gr.B

GROUP – A

[*Marks* : 20]

1. Answer any *five* : 2 × 5

(*a*) Graphically discuss the physical mechanism for the generation of electron and ion oscillations in a plasma.

(*b*) What do you mean by 'floating potential' ?

(*c*) Explain 'Snow plough model' as applied to plasma.

(*d*) Illustrate the different basic schemes for plasma confinement in magnetic field configuration.

(*e*) Explain how Faraday's laws of induction are applied to plasma generator.

(*f*) Discuss about thermal pinch in plasma.

(*g*) Schematically present the arrangement of Hypothetical controlled fusion reactor.

(*h*) A plasma is having $T_e = 300\ \text{K}$ and $n_e = 10^{15}\ \text{m}^{-3}$. A probe of area $5 \times 10^{-4}\ \text{m}^2$ is introduced into the plasma. Calculate the random current of electrons if the probe be given a potential with respect to the cathode.

2. Answer any *one* bit : 10×1

(*a*) Name the process of radiation loss from plasma. Find an expression for the energy radiated per unit volume due to bremsstrahlung loss in plasma. Why such radiation occur in the ultraviolate region of the spectrum. $2 + 6 + 2$

(*b*) Mentioning the conditions for quasi-equilibrium pinch deduce "Bennett's Pinch condition". With neat diagram describe the construction and action of a MHD generator. $(2 + 4) + 4$

GROUP – B

[*Marks* : 20]

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

1. Answer any *five* bits : 2×5

(*a*) An electromagnetic wave travels along z-axis. Which pair of space and time varying field would generate such a wave ?

(*b*) In terms of $\vec{A}$ and ϕ find $\vec{E}$ and $\vec{B}$.

(*c*) 2 kW LASER beam is concentrated by a lens into cross-sectional area about 10^{-6} cm^2. Find Value of Poynting vector.

(*d*) Find field equations in Lorentz gauge with

$$\vec{\nabla} \cdot \vec{A} + \mu \in \frac{\partial \phi}{\partial t} = 0.$$

(*e*) Show that for a charged particle having charge q and moving with a uniform velocity $\vec{v}$, the relation between magnetic vector potential and electrostatic potential ϕ is $\vec{A} = \frac{\vec{v}}{c^2}\phi$.

(*f*) What is 'radiation resistance' ?

(*g*) Define and write the properties of Dirac δ-function.

(*h*) Consider a parallel plate capacitor imersed in sea water and driven a voltage $V_0 \cos(2 \pi \gamma t)$. What is the ratio of conduction current to displacement current ? (Given : $\gamma = 4 \times 10^8$ Hz, $\in = 81 \in_0$, $\mu = \mu_0$ and $\rho = 0{\cdot}23\ \Omega$.m.)

2. (*i*) Give difference between Thomson scattering and Rayleigh scattering.

   (*ii*) Find the expression for the total scattering cross-section for unpolarised incident unpolarised radiation. 2 + 8

3. Starting from Maxwell's equations,determine the Lorentz transformations for the components of electromagnetic field vector $\bar{E}$ and $\bar{B}$. Using these transformation shows that $C^2B^2 - E^2$ is an invariant. 7 + 3
