2017

M.Sc.

1st Semester Examination

PHYSICS

PAPER – PHS-103 (Gr. – A + B)

Full Marks : 50

Time : 2 Hours

(Electrodynamics – PHS 103A)

Answer Q1 and any one from Q2 and Q3

1. Answer any five bits: 5X2 = 10

(a) Define the distribution function in phase space under plasma kinetic theory.

(b) How energy is lost in the form of radiation emitted by excited atoms and ions.

(c) Write down the time dependent generalization of Coulomb's law and what happen if source terms are time independent.

(d) Write the relativistic Larmor formula of radiation for accelerated charged particle with significance.

(e) Show that $F^{\mu\nu} G_{\mu\nu} = 4 \dfrac{\vec{E}.\vec{B}}{c}$ where $F^{\mu\nu}$ is field tensor and $G_{\mu\nu}$ its dual.

(f) Prove that $\left(\vec{E}.\vec{B}\right)$ is covariant under Lorentz transformation.

(g) A linear antenna radiates a power of 100 kW at 40 MHz. Estimate the strength of its electric field at a distance of 40 km from the source.

(h) What is Kramer-Kronig dispersion relation?

(Turn Over)

2. (a) What are Lienard-Weichart potentials? Derive the expressions for these potentials. (2+6)

(b) Show that $\partial_\mu F^{\mu\nu} = \mu_0 J^\nu$ where $F^{\mu\nu}$ is field tensor and $J^\nu = (c\rho, \vec{J})$ (2)

3. (a) What is an oscillating dipole? (2)

(b) Find the expression for the electric and magnetic fields due to an oscillating dipole at a distance r from the dipole. (8)

(Material Preparation & Characterization – PHS 103B)
Answer Q1 and any one from Q2 and Q3

1. Answer any five bits: 5X2 = 10

(a) Why nanomaterials are more reactive than their bulk counterpart?

(b) What is the difference between AFM and STM?

(c) What is epitaxial growth? For epitaxial growth of oxide materials which process is convenient?

(d) For the thin film growth by thermal evaporation method, the growth rate depends on which parameters?

(e) Why dissimilar sizes of electrodes are used in case of AC sputtering?

(f) What is the significance of the peak observed in UV-VIS-NIR spectra?

(g) What is the advantage of the use of TEM over optical microscope?

(h) 'Liquid phase has lower impurity concentration compared to that of solid phase' – how is this characteristic used in zone refining process?

(Continued)

2. (a) Describe Czochralski process of single crystal growth. (4)

(b) What should be choice of solvent for solution growth of single crystal? (2)

(c) Describe briefly the CVD process of thin film growth. What are the reaction limited and mass transport limited growth? (4)

3. (a) What is epitaxy? What are basic differences between homoepitaxy and heteroepitaxy? (2+2)

(b) What do you mean by malleable and brittle nature of polymers? (1+1)

(c) What is luminescence? Does all luminescence belong to photo-luminescence category? Write down usages of photo-luminescence. (1+1+2)

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Internal Assessment-10