PRABHAT KUMAR COLLEGE, CONTAI

M. Sc. 1st Semester Examination-2021

Subject: Physics Paper: **PHS 103** Full Marks: 50 Time: 2 hr

103.1: Electrodynamics

Answer any TWO questions

1. (a) What do you mean "gauge transformation"? (b) Write down the expression of retarded potentials and hence show that $\square^2 V = -\frac{\rho}{\varepsilon_0}$, symbols have their usual meaning. (c) Why the advanced potentials cannot be physically acceptable?

2. Write down the Lienard-Wiechart potentials for a moving point charge and hence calculate the electric field for this system.

3. (a) What do you mean "velocity field" and "acceleration field"? Show that the power radiated for instantaneously stationary charge is $P = \frac{\mu_0 q^2 a^2}{6\pi c}$, symbols have their usual meaning. (b) Define electromagnetic field tensor and show that $F^{\mu\nu}G_{\mu\nu}$ ($G_{\mu\nu}$ is dual of the $F^{\mu\nu}$) is invariant under the frame of references.

4. What do you mean by Ambipolar diffusion? Derive the expressions of diffusion of electrons and ions in plasma.

Internal Assesment-05

103.2: Materials: Preparation and Characterizations

Answer any TWO questions

Q1. a) Why nanomaterials are more reactive than their bulk counterpart? 2

b) For the thin film growth by thermal evaporation method, the growth rate depends on which parameters? 2

c) Describe briefly the CVD process of thin film growth. Discuss the different type reactions in case of CVD process of thin film growth. 6

Q2. a) Why dissimilar electrodes are used in case of AC sputtering? 2

b) Describe Czochralski process of single crystal growth. 4

c) What is the basic principle of transmission electron microscopy (TEM)? Describe the operation of TEM in image mode and diffraction mode . 4

Q3. a) Give the schematic representation of the interaction of electron beam with matter. 2

b) What is the basic principle of Sol-Gel synthesis? 2

c) Explain glass transition temperature, crystallization temperature and melting temperature. 3

d) Explain how deposition of alloy materials by sputtering is more stoichiometric than thermal evaporation? What are the advantages of RF sputtering over DC sputtering? 3

Q4. a) Show schematically basic components of Scanning Tunnelling Microscopy (STM) and explain the operational principle of the STM? 3

b) Explain Zone refining process for material purification in details. 3

c) What is Energy Dispersive X-ray spectroscopy (EDX)? 2

d) Give the working principle of Photoluminescence. 2