PKC/PG/IS/PHS-103/18

2018

M.Sc.

1st Semester Examination

PHYSICS

PAPER – PHS-103 (Gr. – A + B)

Full Marks : 50

Time : 2 Hours

Use separate answer scripts for Group A and Group B

(Electrodynamics – PHS 103A)

Answer Q1, Q2 and any one from Q3 and Q4

1. Answer any two bits:

2X2 = 4

(a) What do you mean "gauge transformations"?

(b) Why the advance potential is not physically acceptable?

(c) Write down the time dependent generalization of the Coulomb's law.

(d) Write the physical meaning of electron and ion temperature.

2. Answer any two bits: 2X4 = 8

(a) Write down the Lienard-Wiechart potentials and hence calculate the magnetic field for a moving point charge.

(b) Discuss the effect of magnetic field on the mobility of electrons for plasma.

(c) Calculate the electric field of a point charge moving with uniform velocity.

(Turn Over)

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(d) An infinite straight wire carries a linearly increasing current I(t) = Kt, t > 0; = 0, otherwise. Find the electric field generated.

3. Calculate the total power radiated over a sphere of radius r for electric dipole radiation. (8)

4. (a) Calculate the Bremsstrahlung losses for plasma.

(b) Show that $F^{\mu\nu}G_{\mu\nu} = 4 \frac{\vec{E}.\vec{B}}{c}$ where $F^{\mu\nu}$ is field tensor and $G_{\mu\nu}$ its dual. (5+3)

(Material Preparation & Characterization – PHS 103B)

Answer Q1, Q2 and any one from Q3 and Q4

1. Answer any two bits:

(a) What do you mean by quantum dots?

(b) What will happen if low Z material is used instead of high Z material in X-ray production?

(c) Explain the glass transition temperature and melting temperature of a solid.

(d) Describe the difference between X-ray diffraction and neutron diffraction.

2. Answer any two bits:

(a) Explain Zone refining process for material purification in details.

(b) If an X ray beam of wavelength 0.71 Angstrom is diffracted by a cubic crystal of density 1.99 gm/cc, calculate inter-planar spacing of the (200) planes. Also calculate the glancing angle of the X ray for second order reflections from these planes. Given that molecular weight of the material of the crystal is 74.6 amu.

(Continued)

2X2 = 4

2X4 = 8

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

(d) Describe different kind of chemical reactions in CVD process of thin film deposition.

3. (a) What is photoluminescence spectroscopy? Describe the operational principle of a spectrophotometer with a block diagram. What kind of characterization is done by a photoluminescence spectrophotometer? (1+3+1)

(b) What is scanning electron microscope (SEM)? Is there any advantage of SEM over transmission electron microscope (TEM)? (2+1)

4. (a) Show schematically basic components of Scanning Tunneling Microscope (STM) and explain the operational principle of the STM? (2+2)

(b) What is differential thermal analysis? Why does the term 'differential' come? What is the DTA curve? (2+1+1)

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Internal Assessment-10