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Sardar Patel University

Vallabh Vidyanagar - 388120

BSc [Semester- IV]

Subject Physics Course Code No: US04CPHY01

Subject/Course Title: Electromagnetic Theory and Spectroscopy

Thursday, Date 7-04-2016

Time: 10.30 am to 1.30 pm

Total Marks-70

Q-1 Multiple Choice Questions: [Attempt all]

10

- (i) In the formula of Coulomb's law, constant ϵ_0 is called_____.
- (a) Permittivity of free space (b) Permeability of free space
(c) Coulomb's Constant (d) None of these
- (ii) The divergence of \mathbf{E} related with_____.
- (a) Stoke's law (b) Coulomb's law
(c) Gauss's law (d) Ampere's law
- (iii) _____ obeys the superposition principle of electrodynamics.
- (a) Electrostatic force (b) Electric field
(c) Electric potential (d) All of these
- (iv) The magnetic field at distance s from a long straight wire carrying steady current I is _____.
- (a) $B = \frac{2\pi I}{\mu_0 s}$ (b) $B = \frac{2\pi s}{\mu_0 I}$
(c) $B = \frac{\mu_0 I}{2\pi s}$ (d) $B = \frac{\mu_0 s}{2\pi I}$
- (v) The correct relationship in magnetostatics are
- (a) $\mathbf{F}_{\text{mag}} = Q (\mathbf{v} \times \mathbf{B})$ (b) $p = B Q R$
(c) $\mathbf{v} = \mathbf{E}/B$ (d) All of these
- (vi) The divergence of the magnetic field (\mathbf{B}) is equal to _____.
- (a) zero (b) One
(c) Infinite (d) None of these
- (vii) $\lambda_m \times T = \text{constant}$ is _____.
- (a) Wein's displacement law (b) Moseley's law
(c) Bragg's law (d) Biot-Savart law
- (viii) The unit of wave number in spectroscopy is _____ in MKS system.
- (a) cm^{-1} (b) m^{-1}
(c) λ^{-1} (d) No unit
- (ix) The wavelength of X-rays varies between _____ cm to _____ cm.
- (a) 6×10^{-12} to 35×10^{-12} (b) 6×10^{-13} to 35×10^{-13}
(c) 6×10^{-14} to 35×10^{-14} (d) 6×10^{-15} to 35×10^{-15}
- (x) _____ law describe by equation $\mathbf{K}_{\text{max}} = eV = h\nu_{\text{max}} = \frac{hc}{\lambda_{\text{min}}}$.
- (a) Moseley's law (b) Duane-Hunt law
(c) Plank's law (d) None of these

Q-2 Answer any TEN questions in short. 20

- (i) Write any two comments on electric potential.
- (ii) What is the potential at distance r from the centre of a spherical shell of radius R ($r > R$), which carries a uniform surface charge (q). Set the reference point at infinity.
- (iii) Derive Poisson's equation.
- (iv) Prove that magnetic forces do no work.
- (v) State Biot-Savart law.
- (vi) Write and explain: the continuity equation.
- (vii) Explain luminescence method for the production of light for spectroscopic purposes.
- (viii) Explain: The Spinning of electron.
- (ix) Discuss: wave number.
- (x) What are X-rays? List the various methods to produce X-rays.
- (xi) How is the intensity controlled in an X-ray tube?
- (xii) How is the quality controlled in an X-ray tube?

Q-3 Explain the following terms of electrostatics: 10
(a) Electric Field (b) Field Lines (c) Electric Flux and (d) Gauss's law.

OR

Q-3 Obtain formula for the energy of a point charge distribution. 10

- Q-4 (a) Explain the following terms of magnetostatic: 6**
(a) magnetic field (b) magnetic forces and (c) current.
- (b) Explain: ($\nabla \times \mathbf{B}$). 4**

OR

- Q-4 (a) Write a note on: The magnetic vector potential. 6**
(b) Compare: Magnetostatics and Electrostatics (Any four points). 4

- Q-5 (a) Describe: (a) L-S coupling and (b) j-j coupling. 6**
(b) Describe: Line spectra. 4

OR

- Q-5 (a) Compare: (a) Zeeman effect and (b) Stark effect. 6**
(b) Describe: band spectra. 4

- Q-6 (a) Discuss the characteristics of continuous X-ray spectrum. 6**
(b) Explain and derive the Bragg's law of diffraction of X-rays by crystals. 4

OR

- Q-6 (a) Compare: (a) optical spectra and (b) X-ray spectra. 6**
(b) State Moseley's law. Discuss applications of the law. 4

=====WISH YOU ALL THE BEST=====