

**(Physics)****Classical Electrodynamics**
 Time Allowed : 3 hrs  
 Max. Marks : 100

 Attempt any **FIVE** Questions, selecting at least **ONE** from each section.  
 All questions carry equal marks
**SECTION I**

- 1- Show that potential due to an arbitrary charge distribution about origin consists of contributions from a MONOPOLE MOMENT, a DIPOLE MOMENT, a QUADRUPOLE MOMENT and so on, and that it can be expressed as

$$V(r) = \frac{1}{4\pi\epsilon_0} \sum_{n=0}^{\infty} \frac{1}{r^{n+1}} \int r'^n P_n(\cos\theta') \rho(r') dv' \quad 20$$

- 2- a) Define ELECTRIC SUSCEPTIBILITY and DIELECTRIC CONSTANT. Establish a relation between them. 8
- b) How field vectors  $\vec{E}$  &  $\vec{D}$  change at interface of two media. 12
- 3- a) What is equation of CONTINUITY? Derive a mathematical expression for it. 10
- b) Find expression  $\rho = \rho_0 e^{-t/t_c}$  for case of electrostatic equilibrium of a conductor where  $\rho$  is volume charge density and  $t_c$  is relaxation time. 10

**SECTION II**

- 4- a) What is MAGNETIZATION and MAGNETIZATION CURRENT? 4
- b) Derive an expression for magnetic induction produced by a magnetized distribution of matter i.e
- $$\vec{B}(\vec{r}) = \mu_0 \vec{M}(\vec{r}) - \mu_0 \nabla \phi(\vec{r}) \quad 16$$
- 5- a) Write MAXWELL EQUATIONS in differential and integral forms (do not derive equations) and give physical significance of each equation. 6
- b) Find out an expression for POYNTING VECTOR. Explain in words each term of this expression. 14
- 6- Define SKIN DEPTH. Discuss in detail the propagation of Plane Monochromatic Waves in conducting media. 2, 18

**SECTION III**

- 7- a) Discuss motion of charged particles in uniform electric and magnetic fields. 16
- b) What are PLASMA OSCILLATIONS? 4
- 8- a) Discuss theory of PN-JUNCTION LASER. 16
- b) Write any Four Applications of LASERS. 4
- 9- Write notes on any Two of following: 10, 10
- a) Pinch Effect
- b) Retarded Vector and Scalar Potentials
- c) Poisson and Laplace Equations