MANIPAL ACADEMY of HIGHER EDUCATION
(Deemed to be University under Section 3 of the UGC Act, 1956)

Reg. No.										

DEPARTMENT OF SCIENCES, I/III SEMESTER M.Sc (P/C/M/G)
END SEMESTER EXAMINATIONS, NOVEMBER 2018

SUBJECT: ELECTROMAGNETISM [CODE- 5103]
(REVISED CREDIT SYSTEM-2017)

Time: 3 Hours Date: 22 November 2018 MAX. MARKS: 50

Note: (i) Answer **ALL** questions
(ii) Draw diagrams, and write equations wherever necessary

1. (a) Consider a point charge ***q*** held a distance ***d*** above an infinite grounded conducting plane. Using the concept of image problem, estimate the potential in the region above the plane. Also calculate the induced surface charge on the conductor.
(b) Derive Gauss's law in the presence of dielectrics. What are linear dielectrics?
[6+4]

2. (a) Using the concept of multipole expansion, derive the expression for scalar potential due to an arbitrary localized current distribution.
(b) Quantitatively describe the effect of magnetic field on atomic orbits. **[5+5]**

3. (a) Write down equations of electrodynamics before Maxwell. Explain how Maxwell fixed the Ampere's law by introducing the displacement current.
(b) What is Gauge transformation? Explain Coulomb and Lorentz Gauges.
(c) Derive Lorentz force law in potential form. **[4+3+3]**

[P.T.O]

4. (a) Consider an obliquely incident plane wave of frequency $\boldsymbol{\omega}$, and is approaching the interface from the left. Derive the expressions for reflected and transmitted waves. Also derive expressions for the reflection and transmission coefficients.
   (b) In the context of conductors, derive the expression for skin depth. **[5+5]**

5. (a) What are retarded potentials? Derive the expressions for scalar and vector potentials in terms of retarded terms.
   (b) Consider a wire loop of radius $\boldsymbol{a}$ around which we drive a sinusoidal current, at frequency $\boldsymbol{\omega}$. Derive the expressions for electric and magnetic fields. **[4+6]**