4531/MP3

MAY 2010

Paper III — ELECTROMAGNETIC THEORY

(For those who joined in July 2003 and after)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

All questions carry equal marks.

1. (a) (i) Find the solution of Laplace's equation in spherical polar coordinates. (12)

(ii) State and explain differential form of Gauss law. (8)

Or

(b) What do you understand by electric dipole and quadrapole moments? Obtain expressions for electric potential and field at a point in space due to a dipole as well as due to quadrapole. (20)

2. (a) (i) Derive an expression for electric displacement using Gauss law in a dielectric. (10)

(ii) Obtain the expression for dielectric sphere in a uniform electric field. (10)

Or

(b) (i) Deduce on expression for energy density of an electrostatic field. (10)

(ii) Find the force of a dielectric slab partially introduced in an electric field. (10)

3. (a) (i) Derive an expression for forces on current carrying conductors. (10)

(ii) State and explain Biot-Savart law. (10)

Or

(b) (i) State and explain Ampere's circuital law. (8)

(ii) Obtain an expression for magnetic energy of coupled circuit. (12)

4. (a) For a plane electromagnetic wave incident on a boundary between two non-conducting media, specify the boundary conditions and hence derive the Fresnel's equations. (20)

Or

(b) Discuss the Drude-Lorentz harmonic oscillator model. (20)

5. (a) Derive the Lienard-Wiechert potentials. (20)

Or

(b) Discuss the covariant form of the electromagnetic equations. (20)

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