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Roll No. .....

EC–502

B. E. (Fifth Semester) EXAMINATION, Dec., 2011

(Electronics and Communication Engg. Branch)

ELECTRO-MAGNETIC THEORY

(EC – 502)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt *one* question from each Unit. All questions carry equal marks.

Unit – I

1. (a) (i) Prove that : 5

$$E = -\nabla\phi$$

(ii) Prove that : 5

$$\nabla \times \nabla\phi = 0$$

(b) Derive an equation for electric field from an infinite line charge. 10

Or

2. (a) An unknown vector V satisfies the equation :

$$v\,(a \cdot v) + a \times (a \times v) = b$$

where a and b are known vectors and angle between a and b is acute (less than 90°). Find $a \cdot v$ and also solve for v. 10

(b) Explain Gauss's law and gradient of a scalar. 10

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Unit – II

3. (a) Obtain the expression of the equation of continuity for steady currents. 10

(b) Show that at a boundary between two dielectrics the tangential component E and normal component of D must be continuous. 10

Or

4. (a) Define current density. Derive expression of conduction current density and convection current density. 10

(b) Obtain the expression of energy stored in an electrostatic field. 10

Unit – III

5. (a) Derive an expression for magnetic field at a point on the axis of a current carrying solenoid of radius R and N turns/metre. 10

(b) Derive the point form of Ampere's circuit law. 10

Or

6. (a) Derive an expression for Lorentz force on straight and long current carrying conductors in magnetic field. 10

(b) A wire 2·5 m long is bent : 10

(i) into a square

(ii) into a circle

If the current flowing through the wire is 100 amp, find the magnetising force at the centre of the square and the centre of the circle.

Unit – IV

7. (a) Write Maxwell's equations in differential form and derive its integral form from its differential form. 10

(b) Determine mutual inductance between straight long wire and a square loop. 10

Or

8. (a) Obtain the Maxwell's equation for harmonically varying field. 10

(b) Determine the self-inductance of toroid coils. 10

Unit – V

9. (a) What do you understand by circular polarization ? 10

(b) State and prove Poynting vector theorem. 10

Or

10. Derive the Fresnel reflection equation and Fresnel transmission equation for a perpendicular polarized incident wave, the reflection from a dielectric interface. 20

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