

## EC-502(N)

**B. E. (Fifth Semester) EXAMINATION, Dec., 2010**

**(New Scheme)**

**(Electronics & Communication Engg. Branch)**

**ELECTROMAGNETIC THEORY**

**[EC-502(N)]**

*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) Prove that : 10

$$\nabla \times (\nabla \times \mathbf{F}) = \nabla (\nabla \cdot \mathbf{F}) - \nabla^2 \mathbf{F}$$

where  $\mathbf{F}$  is a vector field.

- (b) Explain Coulomb's law and electric field intensity. 10

*Or*

2. (a) State and prove Divergence theorem. 10

- (b) In spherical co-ordinates, a volume charge density

$\rho_v = 10 e^{-2r} \text{ C/m}^2$  is present : 10

- (i) Determine divergence  $\mathbf{D}$ .

- (ii) Check your results by evaluating  $\nabla \cdot \mathbf{D}$ .

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**Unit – II**

- (a) Derive Poisson's equation and Laplace's equation from the Gauss's flux theorem. 10
- (b) Derive the expression for potential and electric field intensity due to dipole. 10

*Or*

- (a) Derive the expression of electric field inside a dielectric. 10
- (b) Each plate of a charged parallel plate capacitor is of area equal to  $0.1 \text{ m}^2$  and carries a charge of  $10 \mu \text{ C}$ . A dielectric of permittivity  $25 \times 10^{-12} \text{ F/m}$  is placed between the plates. Calculate : 10
- Electric field in the dielectric.
  - Components of field in the dielectric due to real charges and due to induced charges.
  - Surface polarization charge density.

**Unit – III**

- (a) Explain Biot-Savart Law. Derive an expression for magnetic field of current carrying loop. 10
- (b) Derive the point form of Ampere's circuit law. 10

*Or*

- (a) A wire  $2.5 \text{ m}$  long is bent : 10
- into a square
  - into a circle

If the current flowing through the wire is  $100 \text{ Amp.}$ , find the magnetising force at the centre of the square and the centre of the circle. 10

- (b) Derive an expression for torque on a current carrying loop in magnetic field. 10

#### Unit – IV

7. (a) Write Maxwell's equations in differential form and derive its integral form from its differential form. 10  
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- (b) Determine the self-inductance of toroid coils. 10

*Or*

8. (a) Determine the self-inductance of solenoid. 10
- (b) Determine an expression for energy stored in magnetic field and energy density. 10

#### Unit – V

9. (a) Derive the equation of uniform plane wave in free-space and dielectric medium. 10
- (b) State and prove Poynting vector theorem. 10

*Or*

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