B.Sc. 5th Semester (Honours) Examination, 2019
ELECTRONICS

Course ID : 51712 **Course Code : SH/ELC/502/C-12(T)**

Course Title : Electromagnetics

Time 1 Hour 15 Minutes **Full Marks: 25**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words
as far as practicable.

1. Answer *any three* of the following: 1×3=3

   (a) If $\vec{A} + \vec{B} + \vec{C} = \vec{0}$, the show that $\vec{A} \times \vec{B} = \vec{B} \times \vec{C} = \vec{C} \times \vec{A}$

   (b) What is is Lenz's law?

   (c) What is an electric dipole?

   (d) State the differential from of Gauss law in Electrostatics.

   (e) If $\vec{A} = \hat{\imath} + \hat{\jmath}$ and $\vec{B} = 2\hat{\imath} - 3\hat{\jmath} + \hat{k}$, find $(\vec{A} \times \vec{B})$.

   (f) What amount of energy is stored by a charged capacitor (C) at a potential (V)?

2. Answer *any three* of the following questions: 2×3=6

   (a) State Gauss's divergence theorem.

   (b) Define Poynting rector. How is it related with energy flux?

   (c) What are different modes of radio wave propagation?

   (d) State Faradays Laws of electromagnetic induction.

   (e) What is the flux of electric field in intensity $[\vec{E}(\vec{r})]$?

   (f) What is motional e.m.f.? What type of e.m.f. is it?

3. Answer *any two* of the following questions: 5×2=10

   (a) Starting from Maxwell's equation derive the wave equations for electric $(\vec{E})$ and magnetic $(\vec{B})$ fields in free space.

   (b) How Ampere's circuital law has been modified in Maxwell's equation?

   (c) (i) What do you mean by characteristic wave impedance (Z_o) of a medium? What is the value of this Z_o in free space for a TEM (e.m.wave) wave?

       (ii) Define magnetic scalar potential.

(d) Show that if two coils having co-efficients of self inductance L_1 and L_2 are mutually coupled, then the co-efficient of mutual inductance can be obtained $= k\sqrt{L_1 L_2}$. What is K?

4. Answer *any one* of the following question: 6×1=6

(a) Show that in a homogeneous isotropic dielectric medium of permitiuity ϵ and permeability μ, the velocity of e.m. wave propagation is gien by $v = \dfrac{1}{\sqrt{\mu\epsilon}}$.

(b) What as magnetic dipole? Derive an expression for the force acting on a magnetic dipole placed in a nonuniform magnetic field.

(c) In an airfilled wave guide radio wave is propagating in TE mode. Find out the cut off frequency, phase velocity and the characteristic/wave impedance for the particular case. State the necessary formula for the same.

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