007304

December 2023

B.Tech. (EL) - III SEMESTER

Electromagnetic Fields

(ELPC – 304)

Time : 3 Hours]   [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*

2. *Answer any four questions from Part-B in detail.*

3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART–A

1. (a) What is physical significance of divergence?   (1.5)

    (b) What are the sources of electric field and magnetic fields?   (1.5)

    (c) What is the difference between scalar and vector magnetic potential?   (1.5)

    (d) What are boundary conditions and their significance in electromagnetics?   (1.5)

(e) What is continuity equation? (1.5)

(f) What are null identities? (1.5)

(g) Why are electromagnetic waves called uniform plane waves? (1.5)

(h) Relate the transformation between spherical and cartesian coordinates. (1.5)

(i) What is the difference between magnetization and permeability? (1.5)

(j) What is an electric dipole? Write down the potential due to an electric dipole. (1.5)

PART–B

2. (a) Consider a conducting medium with a conductivity of 58 mhos/m, relative permittivity of 1 and relative permeability of 1. At a frequency of 100 MHz, calculate a) Attenuation constant, b) Phase constant, c) Propagation constant, d) wave velocity and e) skin depth. (10)

(b) Derive an expression for the capacitance of two wire transmission line. (5)

3. (a) State Poynting Theorem and explain the physical significance of each of its terms. (5)

(b) With necessary explanation, derive the Maxwell's equation in differential and integral forms. (10)

4. State and explain Ampere's law. Derive an expression for the magnetic field about a long straight wire carrying a current I. Also derive an expression for energy stored in a magnetic field. (15)

5. (a) A vector field is given by A = 1/r a_r (a) in cylindrical coordinates and (b) in spherical coordinates. Determine A in each case in cartesian form at a point $(1,1,1)$. (5)

(b) Derive Gauss law in point differential form and hence derive Poisson's and Laplace Equations. (10)

6. (a) State and derive Stoke's and Divergence theorems and what is their physical significance? (10)

(b) A vector field is given by A = yzi + xzj + xyk. Show that it is both irrotational and solenoidal. (5)

7. Write short notes on :

(a) Faraday's law of electromagnetic induction.

(b) Skin effect.

(c) Displacement current. (15)

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