307303

Dec 2018

B.Tech, III SEMESTER

Electromagnetic Fields (ELPC304)

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

Q1 (a) Find the constant b so that the vector V= i(x+3y)+j(y-2x)+k(x+bz) is solenoidal. (1.5)

(b) State and explain Gauss's Law. (1.5)

(c) Prove that the energy of an electrostatic system is equal to 1/2(∫D.E dV), where symbols have their usual meaning. (1.5)

(d) Transform vector A= $5ra_r+2\sin\Phi a_\theta+2\cos\theta a_\Phi$ from spherical to cartesian coordinate. (1.5)

(e) Derive Poisson's Equation. (1.5)

(f) Prove the boundary conditions at the interface of two dielectrics in an electrostatic field. (1.5)

(g) Differentiate between scalar and vector magnetic potentials. (1.5)

(h) Determine the magnetomotive force generated by a multilayer coil of 1000 turns of fine wire carrying a current of 1mA. (1.5)

(i) Define and explain the terms magnetization and permeability. (1.5)

(j) Differentiate between displacement and conduction current density. (1.5)

PART -B

Q2 (a) If a scalar potential is given by Φ=xyz then (i) Determine the potential gradient (ii) Also prove that the vector F= grad Φ is irrotational. (8)

(b) Explain curl, divergence and gradient of a vector/scalar and give their physical significance also. (7)

Q3 (a) Derive an expression for capacitance of a parallel plate capacitor. (3)

(b) If the volume charge density of given charge distribution is given by $\rho=\rho_o(a/r)$ in spherical coordinates, determine the electric flux density and field intensity at any point. Also find the potential V if V=0 at r=0. (12)

Q4 State and derive the Maxwell's equations in differential and integral form. Also give their physical interpretation. (15)

Q5 (a) Derive an expression for the magnetic flux density produced by a current element at any point in space. Hence establish a relationship between the magnetic flux density and magnetic field intensity. (7)

(b) State and Derive Ampere's circuital law. The magnitude of H at a radius of 1 mt from a long linear conductor is 1A/m.Calculate the current in the wire. (8)

Q6 (a) What are magnetic materials. Classify them. List and explain some of the properties of magnetic materials. (8)

(b) State and derive the boundary conditions for the magnetic field at the boundary of two different media. (7)

Q7 Write notes on: (15)

a) Self and mutual inductances

b) Electric and magnetic dipoles

c) Laplacian of scalar and vector.

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