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Question Paper Code : 71730

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Fourth Semester

Electronics and Communication Engineering

EC 6403 — ELECTROMAGNETIC FIELDS

(Regulations 2013)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define gradient of a scalar field.
2. State divergence theorem.
3. Write the equation for energy stored in electrostatic field in terms of field quantities.
4. What is the practical application of method of images?
5. Define capacitance and capacitors.
6. An infinitesimal length of wire is located at (1, 0, 0) and carries a current $2A$ in the direction of unit vector a_z. Find the magnetic flux density B due to the current element at the field point (0, 2, 2),
7. Define skin depth.
8. Define dielectric strength.
9. Differentiate conduction current and displacement current.
10. List any two properties of uniform plane waves.

PART B — (5 × 13 = 65 marks)

11. (a) Given $D = 2rz^2 a_r + r\cos^2 \varphi a_z$. Prove divergence theorem. (13)

Or

(b) (i) Using gauss law find the electric filed intensity for the uniformly charged sphere of radius 'a' find the E everywhere. (8)

(ii) Derive the equation for scalar electric potential. (5)

12. (a) (i) Derive vector magnetic potential from BiotSavart law. (8)

(ii) Classify the materials based on magnetic properties. (5)

Or

(b) (i) Find the magnetic flux density for the infinite current sheet in the xy plane with current density $K = K_y a_y$ A/m current. (7)

(ii) Derive the equation to find the force between the two current elements. (6)

13. (a) Derive the boundary condition for the E-field and H-filed in the interference between dielectric and free space.

Or

(b) (i) Find the capacitance for a coaxial capacitor with inner radius 'a' and outer radius 'b' with length L. (7)

(ii) Derive the equation for the magnetization for the materials and show that $J_b = \nabla \times m$ and $K_b = m \times a_n$. (6)

14. (a) From the basic laws derive the time varying Maxwell's equation and explain the significance of each equation in detail. (13)

Or

(b) (i) State and derive poynting theorem. (8)

(ii) Explain the transformer emf using Faraday's law. (5)

15. (a) Starting from Maxwell's equation derive the equation for E field in the form of wave in free space. (13)

Or

(b) Explain the condition and propagation of uniform plane waves in good conductors and derive the wave constants. (13)

PART C — (1 × 15 = 15 marks)

16. (a) With relevant examples explain in detail the practicle application of electromagnetic fields. (15)

Or

(b) (i) Find the expression of induction for the co-axial. (8)

(ii) Propose the salient points to be noted when the boundary conditions are applied. (7)

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