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Question Paper Code : 80120

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fourth Semester

Electronics and Communication Engineering

EC 8451 – ELECTROMAGNETIC FIELDS

(Common to Electronics and Telecommunication Engineering)

(Regulation 2017)

Time : Three hours

Maximum : 100 marks

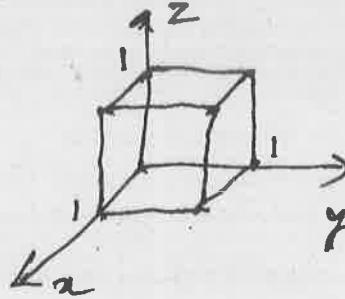
Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write Stoke's theorem in integral form.
2. Define infinitesimal volume element in spherical polar coordinates.
3. Write coulomb's law.
4. Find the energy of a uniformly charged spherical shell of total charge q with a radius R .
5. Write Lorentz force equation.
6. Find the magnetic field a distance s from a long straight wire carrying a steady current I .
7. What is meant by displacement current?
8. Write electromagnetic boundary conditions.
9. What is meant by Brewster's angle?
10. Define phase velocity and group velocity.

PART B — (5 × 13 = 65 marks)

11. (a) Check the divergence theorem using the function $V = y^2\hat{i} + (2xy + z^2)\hat{j} + (2yz)\hat{k}$ and the unit cube situated at the origin.

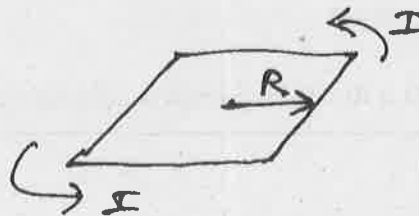


Or

- (b) Write the infinite small displacement, surface and volume elements in spherical and cylindrical coordinates.
12. (a) Find the electric field a distance Z above the center of a square loop of side ' a ' carrying uniform line charge λ .

Or

- (b) Derive the expressions for the energy of a (i) point charge distribution (ii) continuous charge distributions.
13. (a) Find the magnetic field at the center of a square loop, which carries a steady current I . Let ' R ' be the distance from center to side (fig.). Find the field at the center of an n -sided polygon, carrying a steady current I . Again, let R be the distance from the center to any side. Find the formula in the limit n (number of sides) tends to infinity.



Or

- (b) Define (i) the mutual inductance between two circuits, and (ii) self inductance of a single coil. Also explain how the self inductance of a wire-wound inductor depends on its number of turns.

14. (a) Write Maxwell's equations in differential form and integral form. Examine them and give its physical interpretation.

Or

- (b) Derive wave equations for electric and magnetic fields.
15. (a) Derive Poynting theorem.

Or

- (b) Analyse the wave reflection and transmission at normal incidence at the boundary between two linear media.

PART C ← (1 × 15 = 15 marks)

16. (a) A 1.8 KHz wave propagates in a medium characterized by $\mu_r = 1.6$, $\epsilon_r = 25$ and conductivity $\sigma = 2.5$ s/m. The electric field intensity in the region is given by $\vec{E} = 0.1e^{-\alpha z} \cos(2\pi ft - \beta z) \hat{i}$ V/m. Determine the attenuation constant, propagation constant, intrinsic impedance, phase velocity, skin depth, and wave length of the wave.

Or

- (b) Two grounded conducting planes ($y=0$ and $x=0$) are intersecting at 90° . A charge of 100 nC is placed at (3, 4, 0). Find the electric potential and electric field intensity at (3, 5, 0).

