

Date :
Mid Sem

Time : 2 Hrs. Full Marks 70
Sub.: Electromagnetic Engineering

No. of Students - 119
Sub. No. - EC21006

- Instructions :* 1) ATTEMPT ALL THE QUESTIONS
2) MAKE NECESSARY ASSUMPTIONS WITH JUSTIFICATIONS, IF NECESSARY
3) ATTEMPT ALL THE PARTS OF A QUESTION AT ONE PLACE

10+5+5=20

1. Consider two long line charges with linear charge densities of ρ_l and $-\rho_l$ c/m respectively. The lines are parallel to the z axis and intersects the $z = 0$ plane at $P_1(-s, 0, 0)$ and $P_2(s, 0, 0)$ respectively.

- Obtain the equation for the field lines in $z = 0$ plane
- Also find the equation of the equipotential surfaces in the $z = 0$ plane.
- Draw the field lines and equipotential lines in the $z = 0$ plane.

8+6+6=20

2. A coaxial cable has two concentric cylinders of radii $a < b$. The space between the two cylinders is filled with materials of relative permittivities ϵ_{r1} for $a < r < c$ and ϵ_{r2} for $c < r < b$. If the inner cylinder is held at a potential V_0 with respect to the outer cylinder, determine

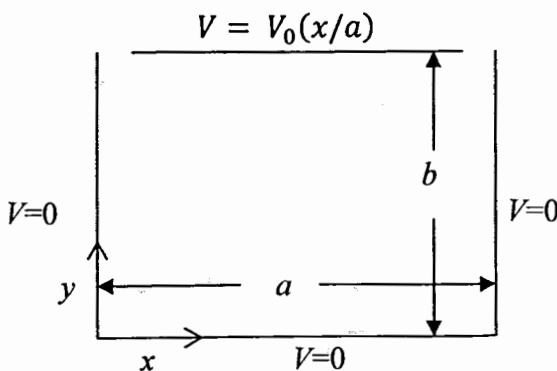
- \vec{D} , \vec{E} and \vec{P} in the two regions
- the free surface charge densities on the cylinders and the boundary surface charge density at the dielectric interface.
- Determine the energy contained in the space between the two concentric cylinders.

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3. The entire region below the $z = 0$ plane is filled with uniform linear dielectric material of susceptibility χ_e . Calculate the force on a point charge q situated at $(0, 0, d)$.

[Hint : If you use Image theory, then for calculating the potential for $z > 0$, assumed the entire bound charge in the dielectric is concentrated at $(0, 0, -d)$.]

4. 15



- Find the electrostatic potential distribution in the rectangular region bounded by the three conducting plates and the top plate. The top plate is separated from the other plates by a thin layer of insulation. The dielectric in the rectangular region is air.