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INEL 4151 Problemas sugeridos para el primer parcial

1. Point charges $Q_1 = 5\ \mu C$ and $Q_2 = -4\ \mu C$ are placed at (3,2,1) and (-4,0,6), respectively. Determine the force on $Q_1$.

2. A ring placed along $y^2 + z^2 = 4$, $x = 0$ carries a uniform charge of $5\ \mu C/m$. (**a**) Find **D** at P(3,0,0). (**b**) If two identical point charges Q are placed at (0,-3,0) and (0,3,0) in addition to the ring, find the value of Q such that **D** = 0 at P.

3. A volume charge distribution $\rho_v = 5xyz\ nC/m^3$ exists in the region defined by $0 \le x \le 2$, $-1 \le y \le 3$, $0 \le z \le 4$. Calculate the total charge in the region.

4. Plane $x + 2y = 5$ carries charge $\rho_S = 6\ nC/m^2$. Determine **E** at (-1, 0, 1).

5. A uniform line charge density of 10 nC/m is positioned at x = 0, y = 2, while another uniform line charge density of -10 nC/m is positioned at x = 0, y = -2. Find **E** at the origin.

6. Determine the charge density due to each of the following electric flux densities:
   a. $\mathbf{D} = 8xy\ \mathbf{a}_x + 4x^2\ \mathbf{a}_y\ C/m^2$
   b. $\mathbf{D} = 4\rho \sin\phi\ \mathbf{a}_\rho + 2\rho \cos\phi\ \mathbf{a}_\phi + 2z^2\ \mathbf{a}_z\ C/m^2$
   c. $\mathbf{D} = (2\cos\theta)/r^3\ \mathbf{a}_r + (\sin\theta)/r^3\ \mathbf{a}_\theta\ C/m^2$

7. Given a 3.00 mm radius solid wire centered on the z-axis with an evenly distributed 2.00 C of charge per meter length of wire, plot the electric flux density $D_\rho$ versus radial distance from the z-axis over the range $0 < \rho < 9$ mm.

8. Determine the charge density at the point P(3.0 m, 4.0 m, 0.0) if the electric flux density is given as $\mathbf{D} = xyz\ \mathbf{a}_z\ C/m^2$.

9. Con el siguiente código en MatLab podemos graficar la magnitud del campo electric versus distancia radial para un punto de carga:

```
Q = 1e-9;                          % point charge
eo = 8.854e-12;                    % permitivity
r = 0.1:0.01:10;                   % radial distance
Er = Q ./ (4 * pi * eo * r .^ 2); % electric field
semilogx(r,Er);
title('Escriban su titulo aqui');
ylabel('electric field intensity (V/m)');
xlabel('radial distance (m)');
```

   Incluyan copia de la gráfica generada con su propio titulo en su asignación.

10. Two point charges Q = 2 nC and Q = -4 nC are located at (1, 0, 3) and (-2, 1, 5), respectively. Determine the potential at P(1, -2, 3).

11. A circular disk of radius a carries charge $\rho_S = 1/\rho$ C/m$^2$. Calculate the potential at (0, 0, h).

12. The electric field intensity in free space is given by

$$E = 2xyz\,\mathbf{a}_x + x^2z\,\mathbf{a}_y + x^2y\,\mathbf{a}_z \text{ V/m}$$

   Calculate the amount of work necessary to move a 2 $\mu$C charge from (2, 1, -1) to (5, 1, 2).

13. The length of a piece of jumper wire used on a protoboard is 5.0 cm. Assuming AWG-20 (with a wire diameter of 0.812 mm) copper wire, (a) determine the resistance for this length of wire. (b) Determine the power dissipated in the wire for the 10 mA of current.

14. The potential field in a material with $\varepsilon_r = 10.2$ is $V = 12xy^2$ (V). Find **E**, **P**, **D**.

15. A parallel plate capacitor with easily removable dielectric has a capacitance of 48 nF with the dielectric in place and drops to 12 nF without the dielectric. Determine the relative permitivity of the dielectric.