DEGREE IN COMPUTER ENGINEERING

PHYSICS **EXERCISES CH 8**

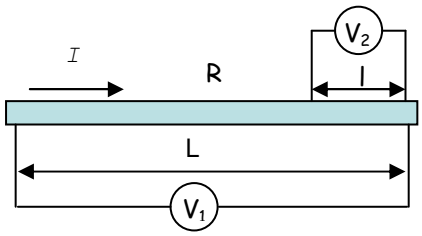
Electric current and circuits.

1. A Cu wire of diameter 1 mm and length 80 m is welded to a Fe wire of the same diameter and length 70 m. The current intensity along them is 2 A.

a) Find the electric field in each conductor.
b) What is the potential difference between the ends of each wire?
Nota: $\rho_{Cu} = 1{,}7 \times 10^{-6}\ \Omega$cm, $\rho_{Fe} = 1{,}0 \times 10^{-5}\ \Omega$cm.

2. A tungsten wire of resistivity $5.5 \times 10^{-8}\ \Omega$m and cross-section 1 mm^2 carries a current of 1 A.
a) Find the speed of the electrons knowing that the number of electrons per cubic meter is 8.4×10^{28} m^{-3}.
b) Determine the current density in the conductor.
c) Find the magnitude of the electric field in the conductor.

3. In the figure attached, the voltmeter V_1 measures a voltage drop of 240 V when a Cu wire of length L, constant cross-section and resistance R carries a current of intensity I. At what distance from the end of the wire would we have to connect the voltmeter V_2 so that it measures a voltage drop of 40 V?

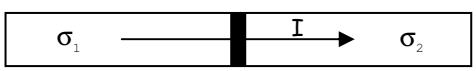


4. A wire of some unknown material has 15 times the resistance of a Cu wire of the same dimensions. Find the length of a wire of the same material so that the resistance is the same as the one of a Cu wire of length 2 m, supposing that both wires have the same diameter.

5. The uniform electric field established in a Fe wire of radius 0.01 mm and length 1 m has a magnitude of 1.1 V/m. The temperature of the wire is 110ºC and its resistance at that temperature is 461.5 Ω.

a) Find the resistivity at the same temperature.
b) Find the current density in the wire.
c) Which is the total current intensity along the wire?

6. A wire with a homogeneous cross-sectional area S = 3 mm^2 carries a stationary current I = 2 A. The wire consists on two parts made of different conductors as show in the figure. The electric conductivities of these conductors are $\sigma_1 = 9 \times 10^7$ S/m and $\sigma_2 = 5 \times 10^6$ S/m. Find the magnitude of the electric field on each conductor.



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ANSWERS

1. a) $E_{Cu} = 4.3 \times 10^{-2}$ V / m $E_{Fe} = 0.25$ V / m

b) $\Delta V_{Cu} = 3.4$ V $\Delta V_{Fe} = 17.5$ V

2. a) $v_d = 7.44 \times 10^{-5}$ m/s b) $j = 10^6$ A/m^2 c) E = 0.055 V/m

3. l = L/6

4. l =13.33 cm

5. a) $\rho = 1.45 \times 10^{-7}$ Ωm b) J = 7.59×10^6 A/m^2 c) I = 2.38 mA

6. $E_1 = 7.4 \times 10^{-3}$ V/m $E_2 = 0.133$ V/m