THIRD MIDTERM

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Discussion Section # 

REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

(a) A copper rod, with circular cross section, has a radius of 1.200 cm. If it carries a current of 47,500 A, calculate the current density.

\[ J = \frac{I}{A} = \frac{4.75 \times 10^4}{\pi (1.2 \times 10^{-2})^2} \frac{A}{m^2} = 1.050 \times 10^8 \frac{A}{m^2} \]

(b) A 375 Ω resistor dissipates power at the rate of 4.40 Watts. Calculate the current.

\[ P = I^2 R \]

\[ I = \sqrt{\frac{P}{R}} = \sqrt{\frac{4.4}{375}} = 0.1083 \ A \]

(c) Calculate the equivalent capacitance between points A and B. All C's are 25 pf.

\[ \frac{1}{25} + \frac{1}{25} = 15.38 \ \text{pF} \]

25 in series with 25 → 12.5
12.5 in 11 with 25 → 37.5
37.5 in series with 25 → 15
15 in parallel with 25 → 40
40 in series with 25 → 15.38

(d) Calculate the equivalent resistance between X and Y.

\[ R_{eq} = 150 + \frac{1}{25} + \frac{1}{175} + \frac{1}{25} = 150 + 21.9 + 162 = 334.2 \]

(e) Calculate the drift velocity for a current of 12,000 A in a copper rod with square cross section 1.00 cm on a side. Take the charge carrier density as 6.00 × 10^{29} m^{-3}.

\[ V_a = \frac{I}{n q A} = \frac{1.2 \times 10^4}{6 \times 10^{29} \times 1.6 \times 10^{-19} (1 \times 10^{-2})^2} \frac{A}{C} \frac{m^2}{m^3} = 1.250 \times 10^{-3} \frac{m}{s} \]