Winter Quarter 1992
February 21, 1992
George Williams

Average 17.89

1

THIRD MIDTERM

Name (print) David Nott Name (signed) _____

Discussion Instructor (circle): Condella Godfrey-Smith Guilkey Leong Nott Paul

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.

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

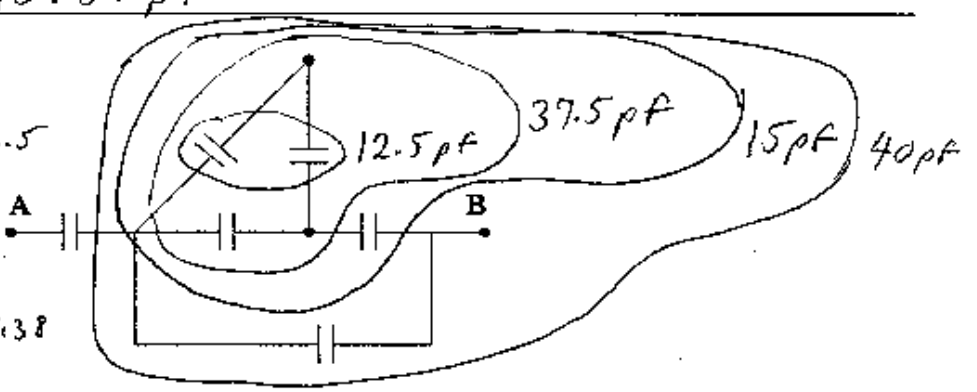
(b) A 375 Ω resistor dissipates power at the rate of 4.40 Watts. Calculate the current.

$P = I^2R \qquad I = \sqrt{\frac{P}{R}} = \sqrt{\frac{4.4}{375}} = .1083\ A$

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

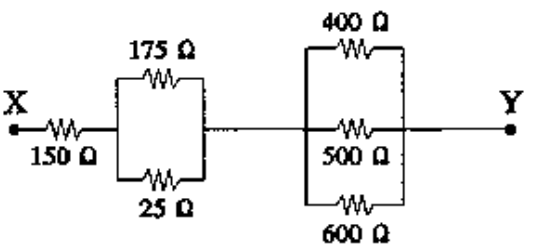
$\frac{1}{\frac{1}{25} + \frac{1}{40}} = 15.38\ pF$

25 in series with 25 → 12.5
12.5 in ll 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.

$R_{eq} = 150 + \frac{1}{\frac{1}{25} + \frac{1}{175}} + \frac{1}{\frac{1}{400} + \frac{1}{500} + \frac{1}{600}} = 150 + 21.9 + 162 = 334\ \Omega$



(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 $6.00 \times 10^{29}\ m^{-3}$.

$V_d = \frac{I}{nqA} = \frac{1.2\ 10^4}{6\ 10^{29}\ 1.6\ 10^{-19}\ (1\ 10^{-2})^2}\ \frac{A}{C\ \frac{m^2}{m^3}} = 1.250\ 10^{-3}\ \frac{m}{s}$