EECS113LA Fall 2004 **Lab Quiz** Name: Solutions

11-30-2003 ID no.:

Sec: Peter Burke 3:30 to 4:50 pm

1	2	3	4	5	Total
/10	/10	/10	/10	/10	/50

DO NOT BEGIN THE EXAM UNTIL YOU ARE TOLD TO DO SO.

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PROBLEM ONE:

10 points

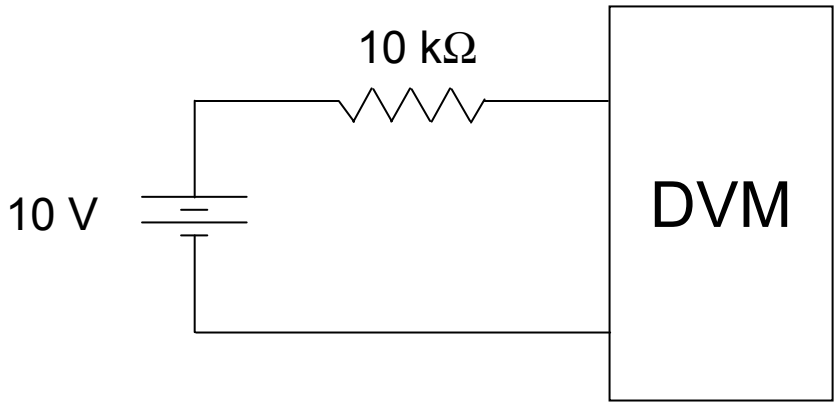
The sheet resistance of a semiconductor is found to be 1 Ω/square using the four-point probe technique. The wafer thickness is 1 mm.

What is the resistivity in units of μΩ-cm?

$$\rho = R_{square} t = 1 \frac{\Omega}{sq.} x 1mm = 1\Omega - mm = 10^{-3}\Omega - m = 10^{5}\mu\Omega - cm$$

PROBLEM TWO:

10 points



For the circuit shown above, the DVM reads a value of 9.99 V.

What is the input impedance of the DVM?

$$V_{DVM} = \frac{R_{DVM}}{R_{DVM} + 10k\Omega} 10V$$

$$\Rightarrow R_{DVM} = \frac{10V}{\frac{10V}{V_{DVM}} - 1} 10k\Omega = 9.99M\Omega \approx 10M\Omega$$

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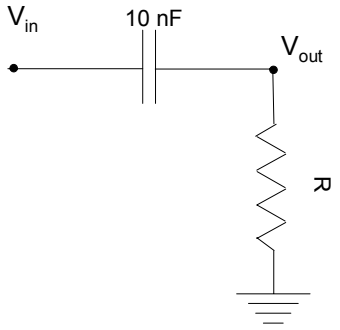
PROBLEM THREE:

10 points

You are given a 10 nF capacitor and a box of resistors of various values.

Design a high pass filter using these components such that $| V_{out}/V_{in} | = 0.71$ at 1 kHz.
Draw your circuit labeling V_{in}, V_{out}, and any component values below.



$$\frac{V_{out}}{V_{in}} = \frac{\omega RC}{\sqrt{1+(\omega RC)^2}} = 0.71$$

$$\Rightarrow \omega RC = 1$$

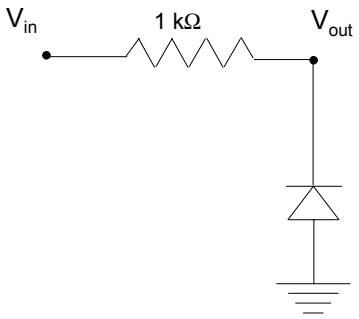
since

$$\frac{1}{\sqrt{1+(1)^2}} = \frac{1}{\sqrt{2}} = 0.71$$

$$\Rightarrow R = \frac{1}{\omega C} = \frac{1}{2\pi f C} = \frac{1}{2\pi(1000Hz)(10x10^{-9}F)} = 16k\Omega$$

PROBLEM FOUR:

10 points

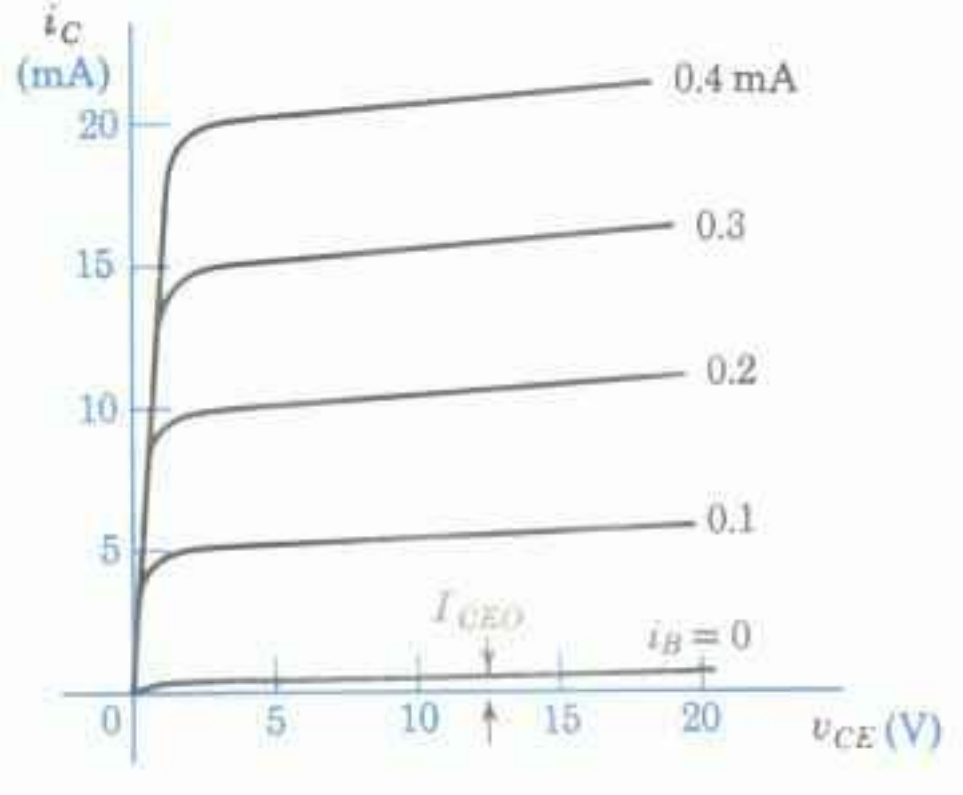


For this circuit, V_{in} = + 10 V.

Approximately what is V_{out}? Hint: The diode is reverse biased.

Answer:
Since the diode is reversed biased, it carries almost no current. Therefore, no current flows through the resistor. Therefore there is no voltage drop across the resistor. Therefore $V_{out}=V_{in}$. Therefore V_{out} = + 10 V.

PROBLEM FIVE:
10 points



A hypothetical lab report for EECS170A is turned in with a graph like that above for lab 6.

Approximately what is the β value for this BJT?

$$\beta = \frac{I_c}{I_b} = \frac{5mA}{0.1mA} = 50$$