

ECE 320 - Homework #4

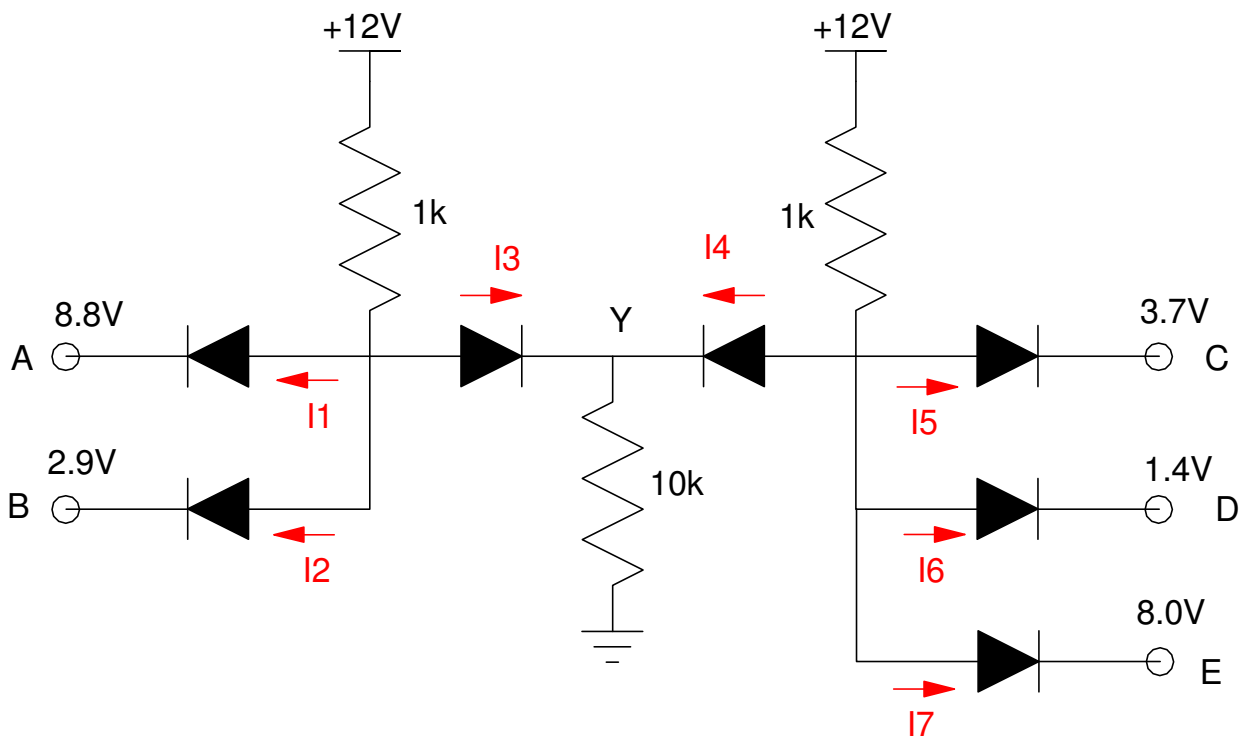
Max/Min Circuits, Clipper Circuits, Transistor Theory. Due Monday, February 6th

Please submit as a hard copy or submit on BlackBoard

Max/Min:

1) Determine the voltages and currents for the following max/min circuit. What function does this circuit implement? $Y = f(A, B, C, D)$

2) Check your results in CircuitLab (or similar program) using 1N4004 diodes



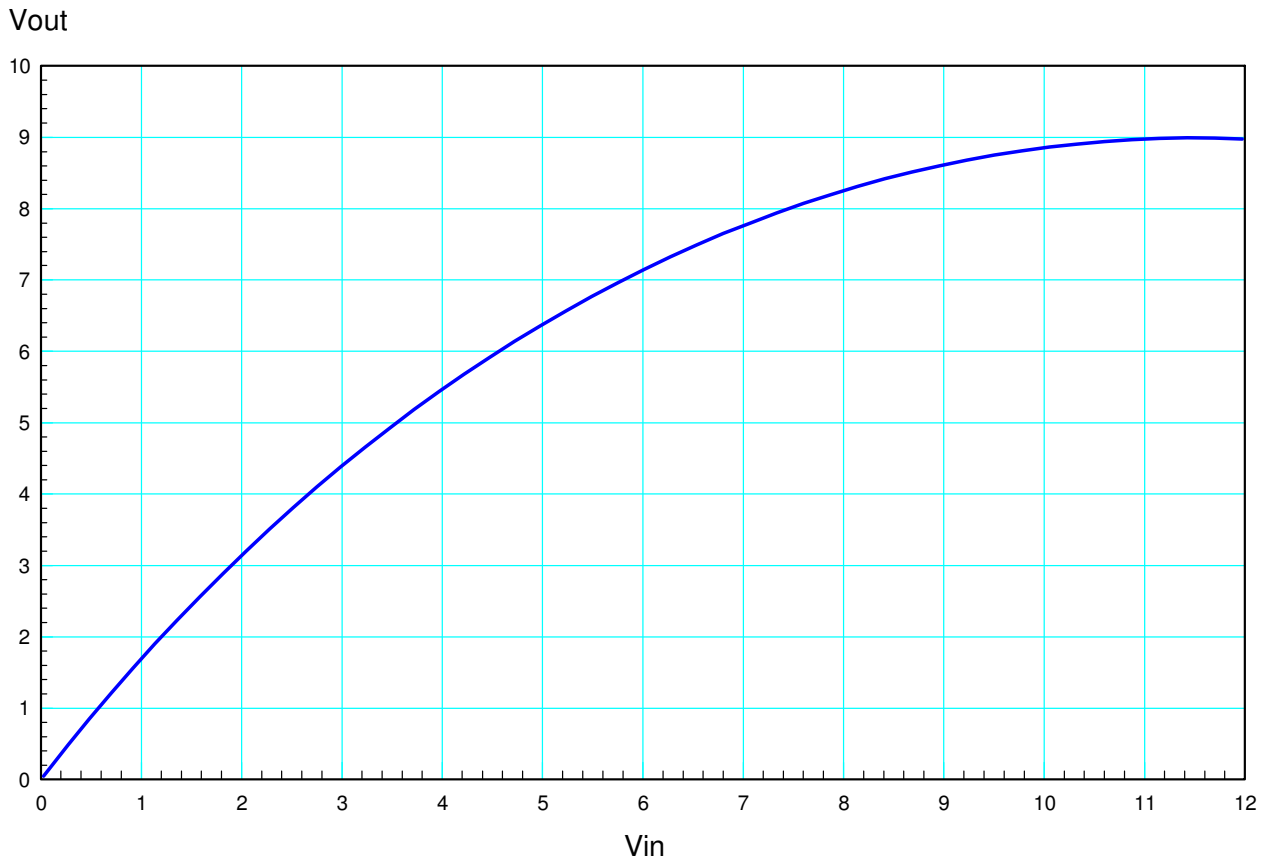
Problem 1-2.

Clipper Circuits:

3) Design a circuit to approximate the following function subject to the following requirements:

- Input: 0 .. 10V, capable of 100mA
- Output: 100k resistor
- Relationship: Graph below, +/- 500mV

4) Check your design in CircuitLab



Problem 3 - 4

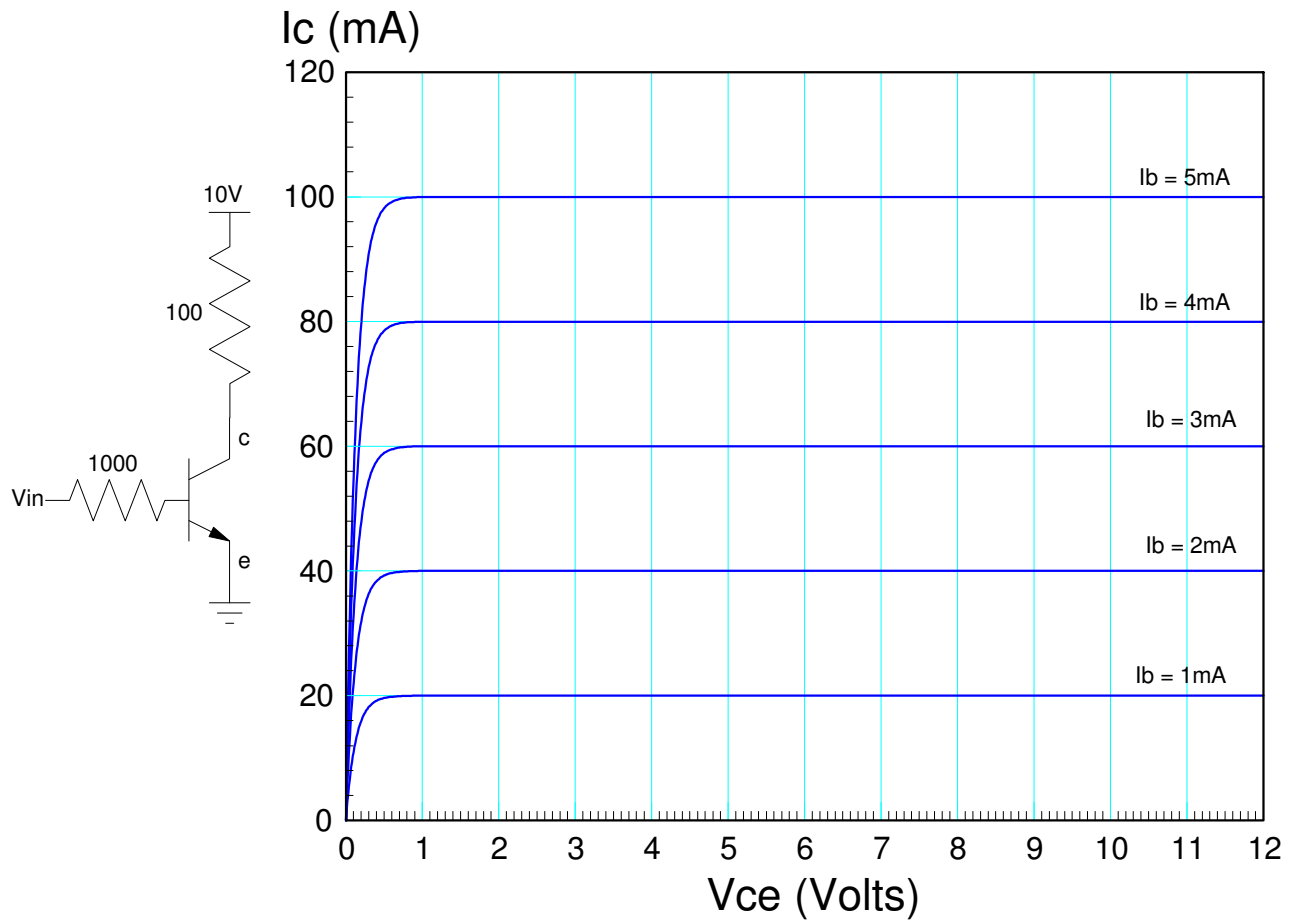
5) Design a circuit which meets the following requirements:

- Input: -10 .. +10V, capable of 100mA
- Output: 1k resistor
- Relationship:

$$V_{out} = \begin{cases} +4.5V & V_{in} > +4.5V \\ V_{in} & \text{otherwise} \\ -5.5V & V_{in} < -5.5V \end{cases}$$

Transistors

- 6) Determine the current gain, β , for the transistor show below. Also label the off, active, and saturated regions.
- 7) Draw the load-line and determine the Q-point for
- $V_{in} = 0V$
 - $V_{in} = 3V$
 - $V_{in} = 6V$



Problem 6 - 7

Lab (over)

Lab: Please include a photo of your circuit to receive credit for problems 8-10

8-10) Build the following circuit with your electronics kit.

- Measure V_{ce} and I_c for $100 < R_b < \text{infinity}$.
- Determine the operating point for each condition and the current gain for your 3904 transistor
- Draw the load line on the graph below and mark each point you measured

R_b	I_b	V_{ce}	I_c	Current Gain (I_c/I_b)	Operating Region (off / active / saturated)
1k br - bl - re					
10k br - bl - or					
100k br - bl - ye					
1M br - bl - gr					
infinity					

