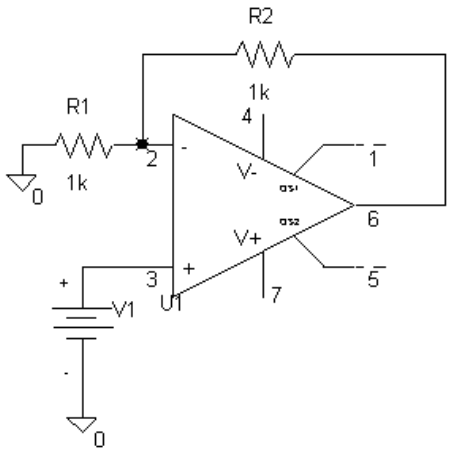
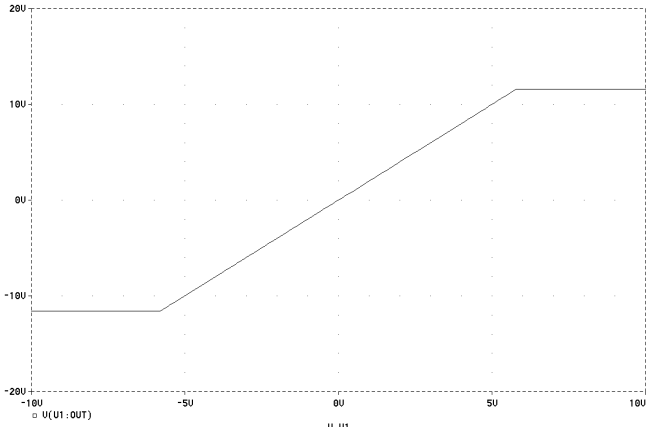
ECE 311 Outcomes Test W03

1. In the circuit at the left, find the voltage at pin 3 and pin 6 of the op amp if V1 = 2V.

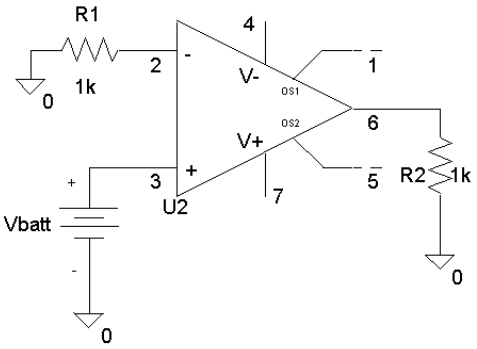


Pin 2 = 2V and pin 6 = 4V.

2. If the rail voltages are ±12 V, sketch the output voltage as V1 varies from –10 to +10 volts.

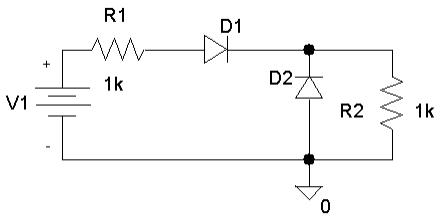


3. If the rail voltages are ±12 V, sketch the output voltage as Vbatt varies from –10 to +10 volts.



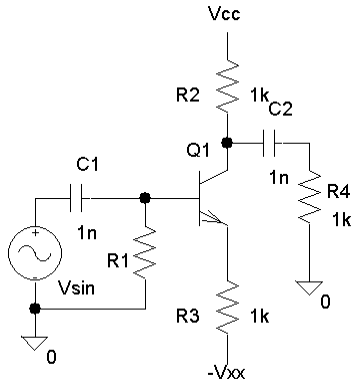
Answer: Output will be at –12V until 0V and then it will switch to +12V.

4. In the circuit at the left, the diodes are ideal and V1 is 10 V. Calculate the currents in D1 and D2.



Current in D1 is 5 mA and zero in D2.

5. In the given transistor circuit, Vcc = 10V, Vxx = -5.7V, calculate I_{CQ} and V_{CEQ}. Assume that β is infinite.



I_{CQ} = 5 mA and V_{CEQ} = 5.7V.

6. Draw the AC model for the transistor circuit (10 pts) and calculate any required AC parameters (5 pts). Assume that I_{CQ} = 1 ma. and β_0 = 100.

Given in class.

7. Describe the three common BJT operating modes in terms of the base-collector and base-emitter diodes and explain in what manner they are used.

Forward Active mode (linear amplifiers): BC reverse biased and BE forward biased

Cut-off mode (logic and switching): BC and BE reverse biased ($I_B = 0$ sufficient)

Saturation mode (logic and switching): BC and BE forward active

8. Draw the CMOS inverter.

See the textbook!!!!!

9. Explain the difference in operation between enhancement and depletion mode MOS devices.

Enhancement-mode devices require a bias voltage (positive V_{GS} for N-channel) in order to conduct current. Depletion-mode devices require a bias voltage (negative V_{GS} for N-channel) to turn them off.

10. You are to design an amplifier that is to deliver 2 Watts into a 16Ω load. If only a single supply is to be used, specify the necessary supply voltage. Assume that the op amps available can come within 1.3 volt of the rail voltage.

$P=(V_{RMS})^2/R = (V_P)^2/(2R)$ or $V_P = (2RP)^{1/2} = (2)(16)(2)^{1/2} = 8V$

To this, 1.3V must be added because the op amp cannot reach the rail voltage. In addition, .7V must be added for V_{BE} of the output transistor. Finally, the total voltage must be doubled because the signal is bipolar so the supply voltage becomes:

$V_{CC} = 2(8+1.3+.7) = 20V$