Physics 517/617 Experiment 4B
Transistors II

Basic Experiment - Physics 517/617

1) The following circuit is an AM radio. If you look closely you will also note that it's just an L-C circuit in series with three common emitter amplifiers. Complete the design of the radio by choosing R1, R2, R3, R4, R5, and R6 so that the transistors are properly biased and provide reasonable gain.

![Circuit Diagram]

This circuit uses a different biasing scheme that the one used in the previous lab. The resistors R1, R3, and R5 are the bias resistors. Choose them such that 1 to 10 μA flows into the base of each transistor.

The other three resistors (R2, R4, and R6) determine the gain of each amplifier stage. Choose these resistors to give each transistor stage a gain of about 50 (assume the β of the transistors is 150).

2) Our laboratory, being in the middle of the building, is in a very poor location for receiving AM signals. A master antenna has been set up by running a wire to the outside of the building. Connect the black lead of your coil to this master antenna.

The above guidelines are very rough and may need fine tuning. Check to see if each of your transistors is biased properly. If there is no sound from your earphone even after biasing your transistors you might want to remove the L-C circuit and replace it with your function generator in order to debug the circuit.

With this radio you will be able to receive only one radio station, WRFD 880 KHz. The reasons for this will become clear below.
3) Obtain a FFT frequency spectrum of the raw antenna wire attached to the oscilloscope. You should be able to identify several local radio stations.

4) With your radio tuned to an AM station (record which one) obtain frequency spectrums at the collector of the first stage. Additionally obtain a frequency spectrum of the final output state. Explain these frequency spectra in terms of the workings of a radio.

5) When you write up this lab include the following:

- A description of the radio in terms of basic building blocks (e.g. detector, amplifier, demodulator).
- A description of demodulation.

Horowitz and Hill, *Art of Electronics* is a useful reference book for this.

*No additional work is required for Physics 617*