**Lab 9: Power Amplifers**

U.C. Davis Physics 116A

**INTRODUCTION**

The purpose of this first lab is to become familiar with the various classifications of power amplifiers and their performance characteristics.

1. **Class A Amplifier**

Make the amplifier shown in figure 1. Use the following components:

* *VCC*= +15V
* *RC* = 1k
* *RE* = 1k
* *R1* = 10k
* *R2* = 1k
* *Cin* = 10F
* *Cout* = 10F
* *vin* = 1 kHz, 2 Vpp
* *Q1* is a 3904

Figure 1: Class A BJT Amplifier

Detemine the voltage gain and the phase shift of the output. Sketch the input and output waveform. Determine the Q point for this configuration.

**2 . Class B Amplifier**

Remove *R1* from the previous circuit. What is *VB*? Determine the Q point for this configuration and sketch the waveform. Determine the region of linearity, the gain for that region, and discuss the non-linearities observed.

1. **Class A-B Amplifier**

Replace *R1* in the circuit shown in figure 1. Now adjust *VCC* while monitoring *VB*. Adjust *VCC* to get *VB* values of 1.0, 0.5 and 0.25 V. Sketch the waveforms, discuss the regions of linearity, the gain for those regions, and how circuit should be classified for each setting.

1. **Push-Pull Amplifier**

Make the amplifier shown in figure 2. Use the following components:

* *VCC*= +/-5V
* *RC* = 1k
* *R1* = 10k
* *R2* = 1k
* *Cin* = 10F
* *Cout* = 10F
* *vin* = 1 kHz, 2 Vpp
* *Q1* is a 3904 npn
* *Q2* is a 3906 pnp

Figure 2: A Push-Pull Amplifier

Sketch the input and output waveforms. Determine the Voltage gain and comment about the regions of linearity.

Plug the output into input 1 of the speaker on the project board. Ground input 2 of the speaker.

1. **Darlington Pair Configuration (Optional)**

Wire two npn transistors in a common collector Darlington pair configuration. Be careful not to blow out these transistors. The second transistor is drawing a bit a power. Use the following components:

* *VCC*= +10V
* *RC* = 0 – no collector resistor
* *RE* = 100 
* *R1* = 10k
* *R2* = 1k
* *Cin* = 10F
* *Cout* = 10F
* *vin* = 1 kHz, 100 mVpp
* *Q1* is a 3904 npn
* *Q2* is a 3904 npn

Determine the voltage gain. Now hook up the speaker. Does this give more volume that the previous setup?