Summary-

Task 1.1- This task involved using a simple IR emitter and a photo detector to measure current and voltage when connected to a 5V power source. First, the emitter was set up in circuit with multiple resistors ranging from 100 Ohm – 5000 Ohm. This was used to determine the best resistance value when setting up the circuit including the emitter and detector. The resistors used alongside the detector ranged from 100 Ohm to 10000 Ohm. The voltage and current of the detector circuit were then measured and recorded.

Task 1.2- A detector circuit was then implemented alongside the IR emitter circuit using a 741 op-amp and the appropriate resistors and materials. The current and voltage of the detector circuit were then measured and recorded.

Task 2- An inverting and noninverting op amp circuit were then constructed using multiple resistors, a 741 op amp and voltage sources. The Vin and Vout were measured to determine the voltage drop in the system.

Task 3- Finally, a comparator was constructed using resistors, voltage sources and a 319 op amp. The Vin and Vout were measured once again and the data was recorded accordingly.

Data Tables-

Table 1: Task 1.1

V_E	I_E	R_E
3.71 V	37 mA	98.8 Ω
3.77 V	19.1 mA	197.3 Ω
3.8 V	12.8 mA	296 Ω
3.8 V	7.62 mA	496 Ω
3.8 V	6.38 mA	596 Ω
3.8 V	5.49 mA	693 Ω
3.8 V	3.87 mA	989 Ω

Table 2: Task 1.1

V_D	I_D	R_D
2.57 V	26 mA	98.8 Ω
3.01 V	15.4 mA	195 Ω
3.10 V	15 mA	206 Ω
4.8 V	4.9 mA	971 Ω
5 V	2.6 mA	1920 Ω
5 V	2.3 mA	3134 Ω
5 V	1 mA	5000 Ω

Table 3: Task 1.2

V_D	I_D	R_D
2.2 V	21.9 mA	98.8 Ω
3.88 V	19.7 mA	197.6 Ω
12.04 V	25.0 mA	496 Ω
16.57 V	17.0 mA	989 Ω
18.0 V	9.07 mA	1990 Ω
17.42 V	7.05 mA	2500 Ω
18.2 V	6.12 mA	2980 Ω

Table 4: Task 2(Inverting)

V_i	V_{out}
0.75 V	-.75 V
1.50 V	-1.49 V
2.25 V	-2.24 V
3.00 V	-2.99 V
3.75 V	-3.74 V
4.50 V	-4.5 V
5.25 V	-5.26 V
6.00 V	-6.00 V

Table 5: Task 2 (Noninverting)

V_i	V_{out}
0.75 V	1.49 V
1.50 V	2.94 V
2.25 V	4.56 V
3.00 V	6.10 V
3.75 V	7.37 V
4.50 V	8.60 V
5.25 V	9.65 V
6.00 V	11.61 V

Table 6: Task 3

V_i	V_{out}
0.75 V	0.18 V
1.50 V	0.18 V
2.25 V	0.18 V
3.00 V	1.15 V
3.75 V	5.11 V
4.50 V	5.11 V
5.25 V	5.11 V
6.00 V	5.11 V

Sample Calculations-

One equation that was needed was the voltage formula used in table 1 which is seen in figure 1 (most calculations were done in prelab).

Ex: 37 mA * 98.8 Ohm = 3.71 V

Figure 1 (Voltage Formula)

$$V = IR$$

The next equation needed was the inverting amplifer formula to check the values in table 4, this formula is seen in figure 2.

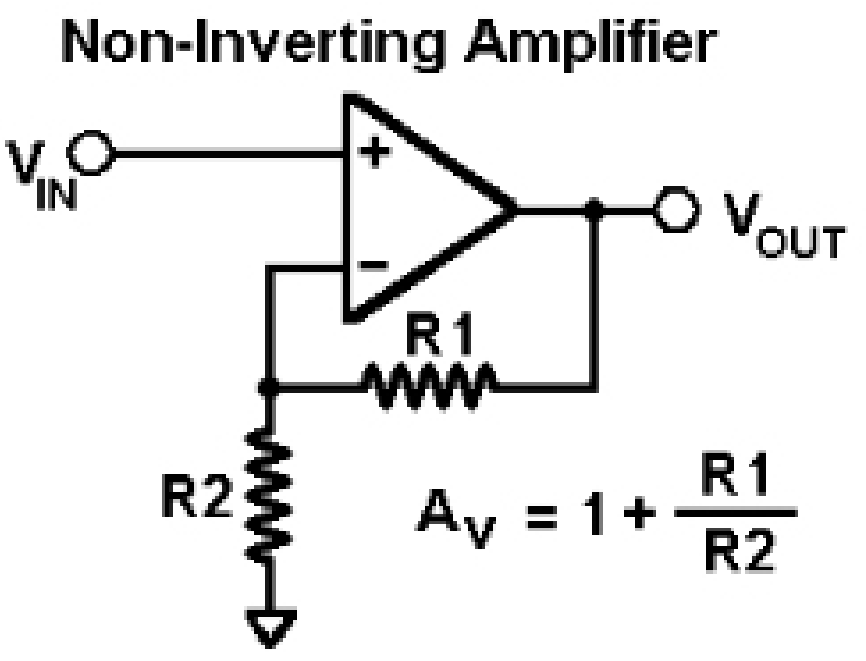
Ex: -(-.75 V) / .75 V = 1 V

Figure 2 (Inverting Amplifier Formula)

$$\text{Gain (Av)} = \frac{V_{out}}{V_{in}} = -\frac{R_f}{R_{in}}$$

Ex: 1 + (1.49 V/ .75 V) = 3 V

Figure 3 (Noninverting Amplifer Formula)



Discussion-