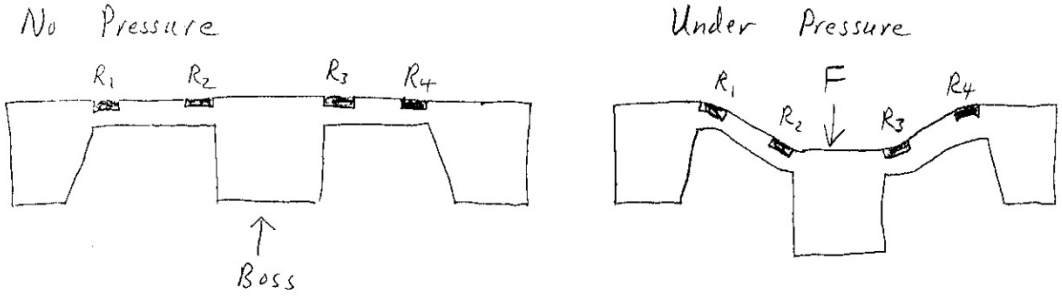
Homework Assignment #7 ELEC 5760/6760 Due: Fri 10/28/22

1) Estimate the depth in the ocean that the static pressure is 50% due to the water depth and 50% due to the air pressure above the water. Use 1G = 9.8 m/s^2 and 1 g/cm^3 for the density of sea water, and 1 atm for the air pressure.

2) A MEMS submarine is being used to monitor the cooling fluid in an industrial transformer. The transformer fluid (liquid) has a density of 2 g/cm^3. The sub is in motion and measures the total pressure (1960.1 Pa) and the static pressure (1960 Pa) that it experiences, using gage pressure sensors. For 1 G = 9.8 m/s^2, estimate the velocity of the sub in mm/s?

3) For the sub in (2), what is the depth of the sub in mm, ignoring atmospheric pressure?

4) For the pressure sensor diaphragm shown below, the four identical P-type piezoresistors have a gauge factor of +180:



a. Under pressure, is each resistor in compression or tension?
b. Under pressure, has each resistor increased or decreased in resistance?

5) Estimate the acceleration level of a shock event (in G's) of a 1 Kg object falling 10 m onto a hard surface where it completely stops moving 10 ms after initial impact. (1 G = 9.8 m/s^2)