EXPERIMENT NO: 9

Aim: Design & draw the resulting waveform of **Comparator Circuit.**
Software: Multisim 14

Theory: The comparator circuit is an electronic decision making circuit that makes use of an operational amplifiers very high gain in its open-loop state, (there is no feedback resistor).

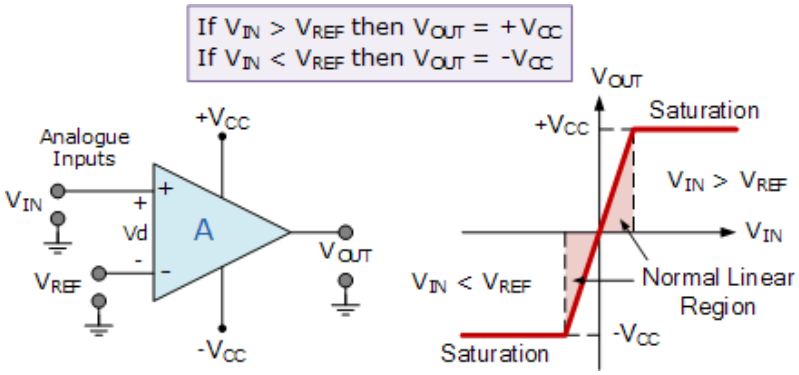
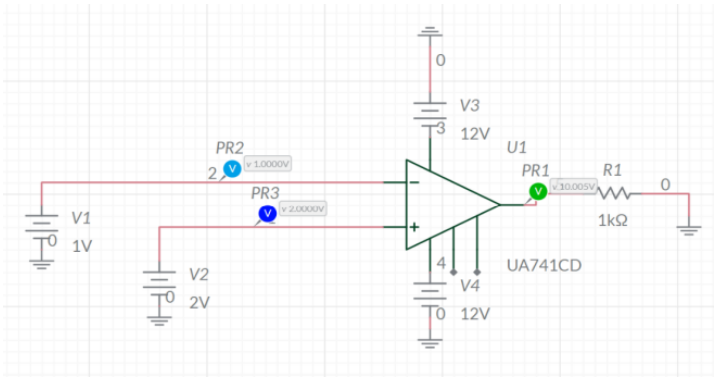


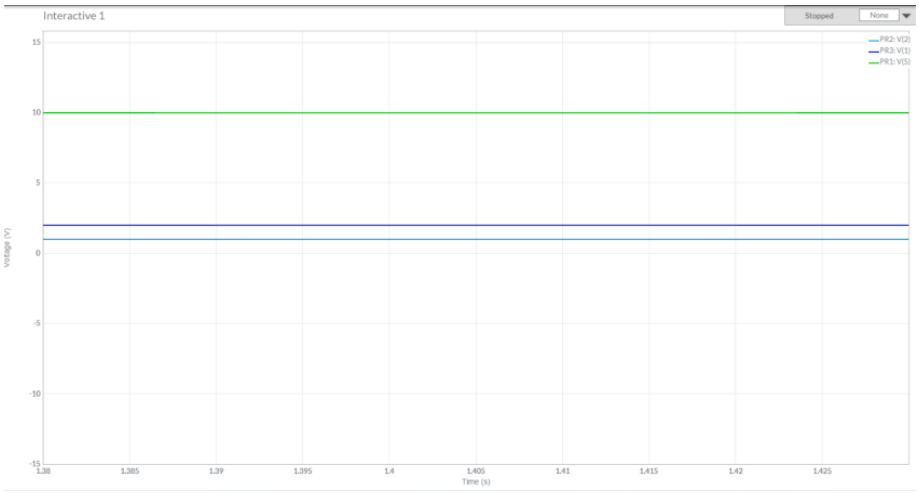
Fig. 1 Input – Output characteristics of Open loop Op-Amp

In this configuration, the op-amp voltage comparator compares the magnitudes of two voltage inputs and determines which is the largest of the two. Depending upon the magnitude of input signals, the output is either +Vcc (Positive power supply) or –Vcc (Negative power supply).

CIRCUIT DIAGRAM:



OUTPUT:



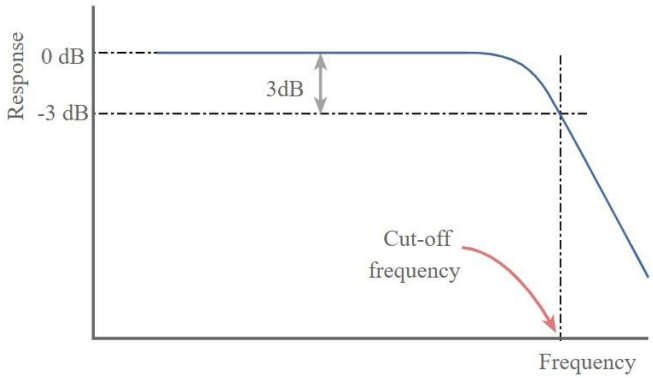
EXPERIMENT NO: 10 (a)

AIM: Design & draw the resulting waveform of Op-amp based active Low Pass Filter.

Software: Multisim 14

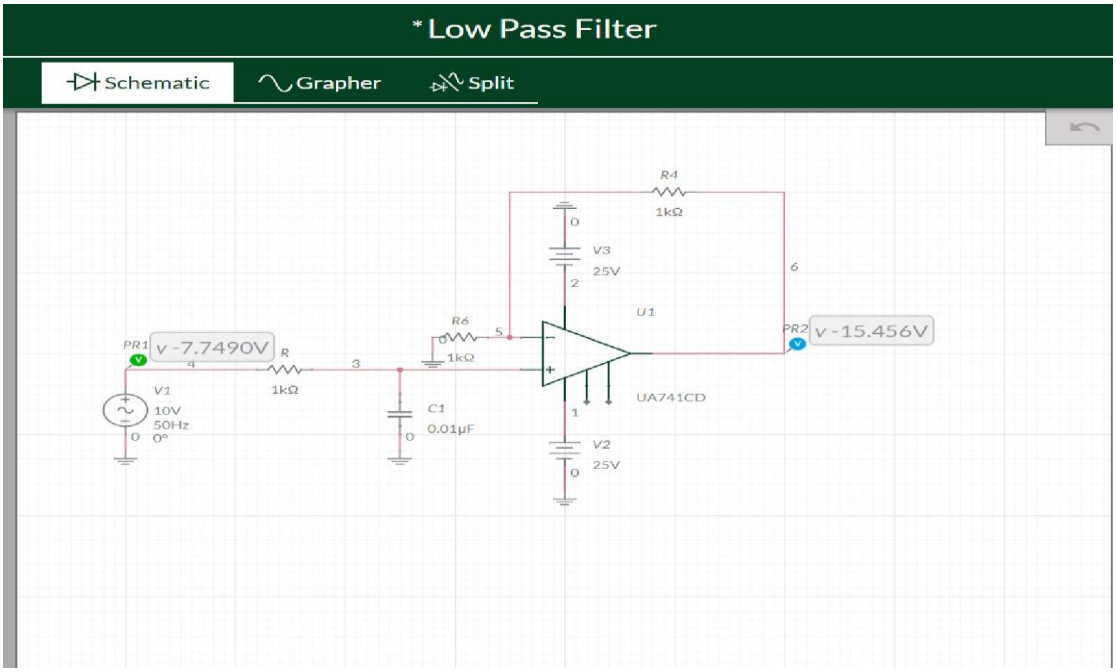
Theory: A low pass filter is a filter that allows (passes) the lower frequencies and rejects those at higher frequencies. These filters are used as hiss filters in audio speakers to reduce the high frequency hiss produced in the system and these are used as inputs for sub woofers.

These are also used in equalizers and audio amplifiers. In analog to digital conversion (ADC) these are used as anti-aliasing filters to control signals. In digital filters these are used in blurring of images, smoothing sets of data signals. In radio transmitters to block harmonic emissions.



In this way, low pass filters are used in many areas of electronic circuit design where the low frequencies are required, but the higher frequencies need to be rejected.

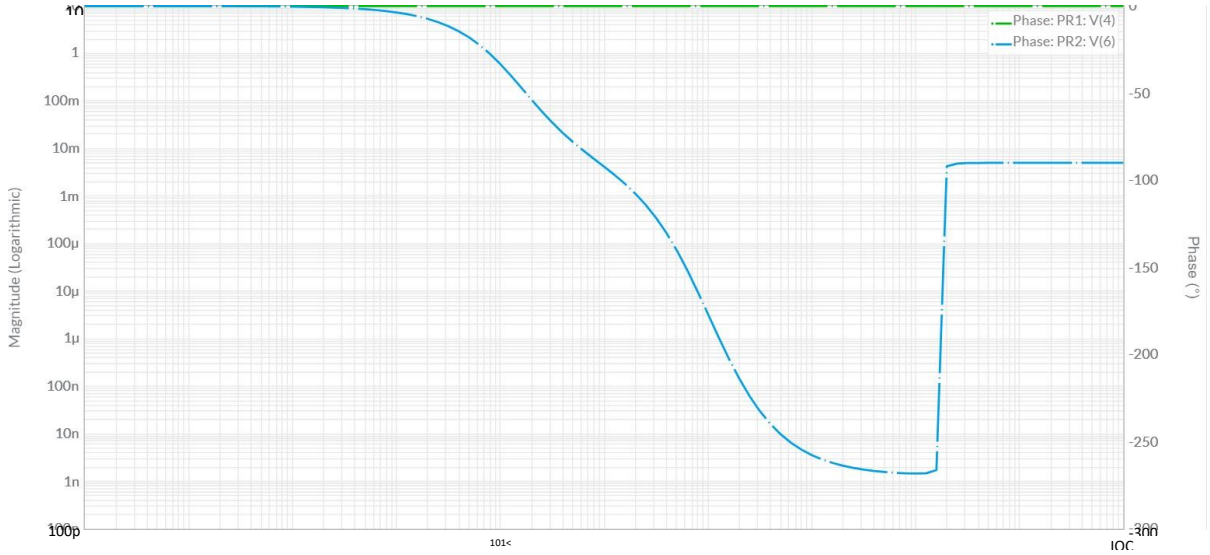
CIRCUIT DIAGRAM:



Magnitude of the voltage Gain= $\{1 + (R_4/R_6)\}$

Cut off frequency $f_c = 1/ 2\pi RC$

OUTPUT:

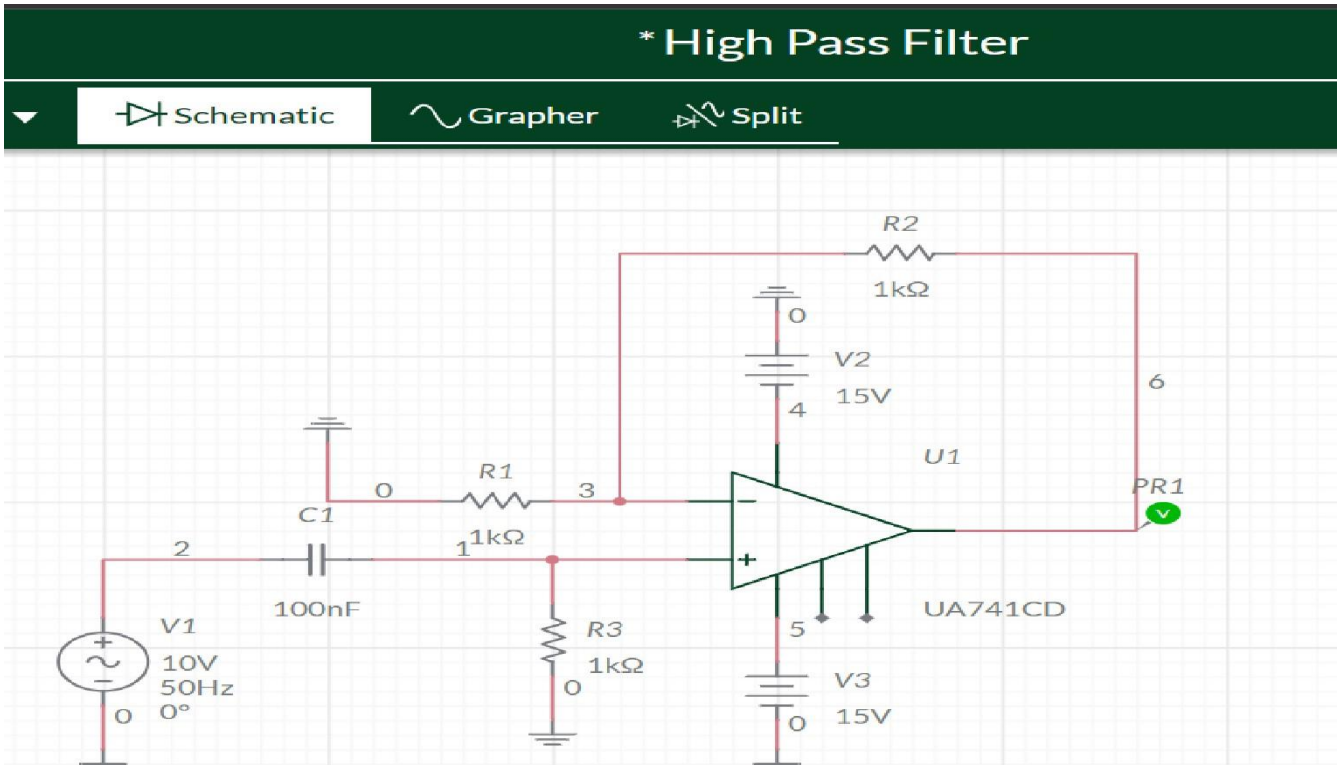


EXPERIMENT NO: 10 (b)

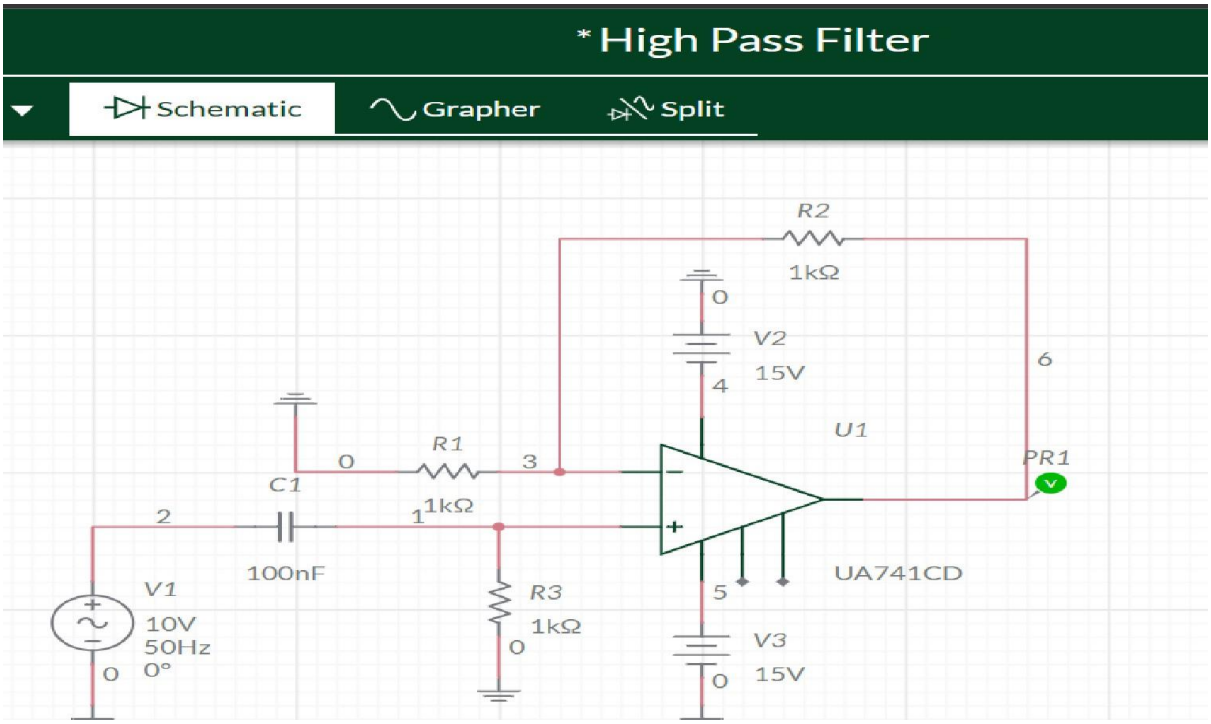
AIM: Design & draw the resulting waveform of Op-amp as High Pass Filter.

Software: Multisim 14

CIRCUIT DIAGRAM:



OUTPUT:



EXPERIMENT NO: 10 (c)

AIM: Design & draw the resulting waveform of Op-amp as Band Pass Filter.

Software: Multisim 14

Theory: A Band Pass Filter is a circuit which allows only particular band of frequencies to pass through it. This Pass band is mainly between the cut-off frequencies and they are f_L and f_H, where f_L is the lower cut-off frequency and f_H is higher cut-off frequency.

The centre frequency is denoted by 'f_C' and it is also called as resonant frequency or peak frequency.

The f_L value must always be less than the value of f_H. The pass band of the filter is nothing but the bandwidth. The gain of the filter is maximum at resonant or centre frequency and this is referred as total pass band gain. This pass band gain is denoted by 'Amax'.

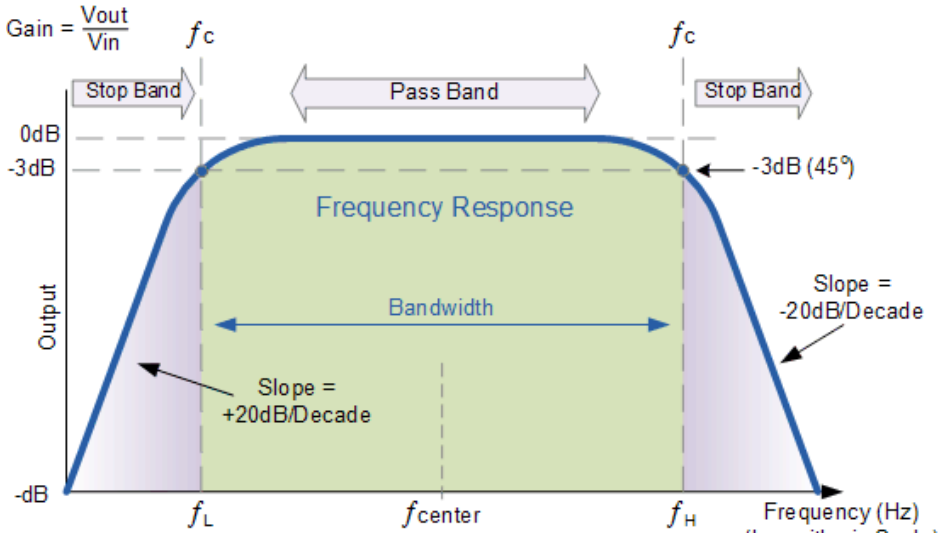
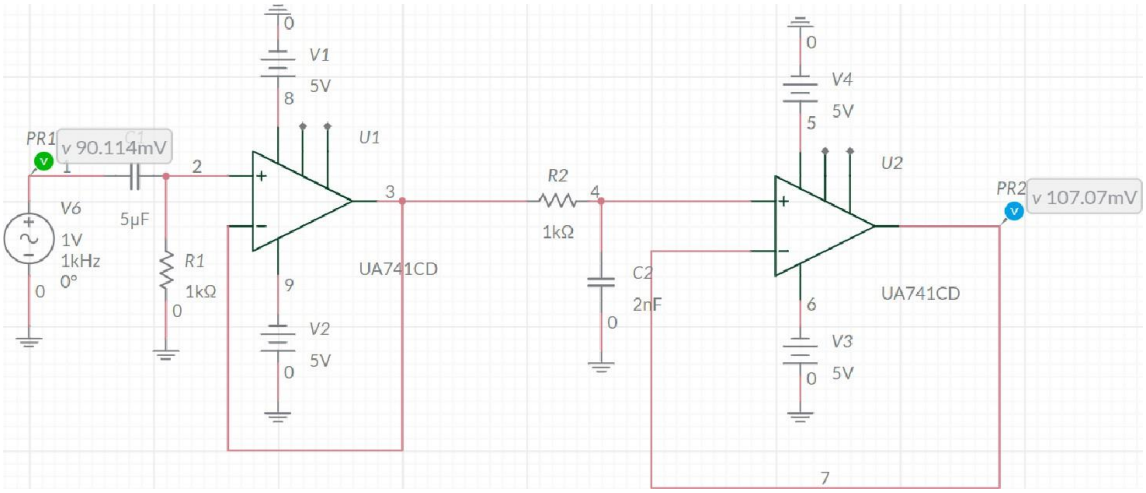
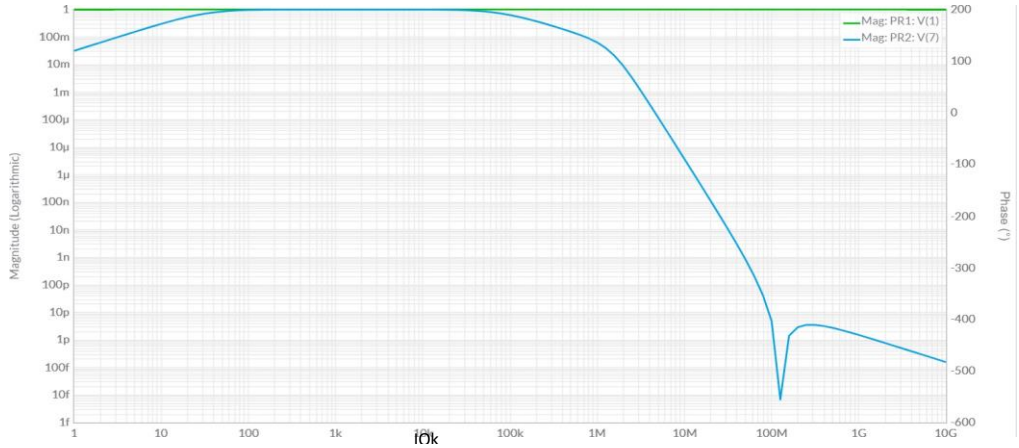


Fig. 8 BAND PASS FILTER RESPONSE

CIRCUIT DIAGRAM:



OUTPUT:



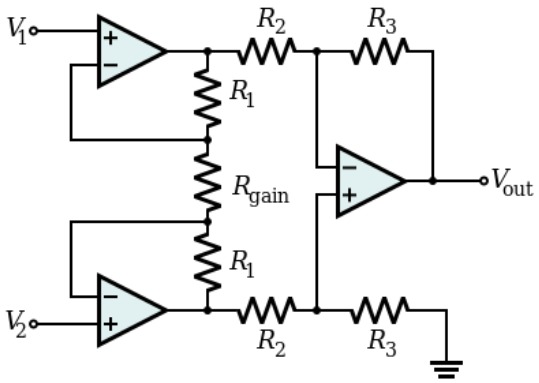
EXPERIMENT NO: 11

AIM: Design & draw the resulting waveform of an Instrumentation Amplifier using 3 Op-amps.

Software: Multisim 14

Theory: An instrumentation is a type of differential amplifier that has been cascaded with input buffer amplifiers, which eliminate the need for input impedance matching and thus make the amplifier particularly suitable for use in measurement and test equipment. Additional characteristics include very low DC offset, low drift, low noise, very high open-loop gain, very high commonmode rejection ratio (CMRR), and very high input impedances.

Instrumentation amplifiers are used where great accuracy and stability of the circuit both short and long-term are required.

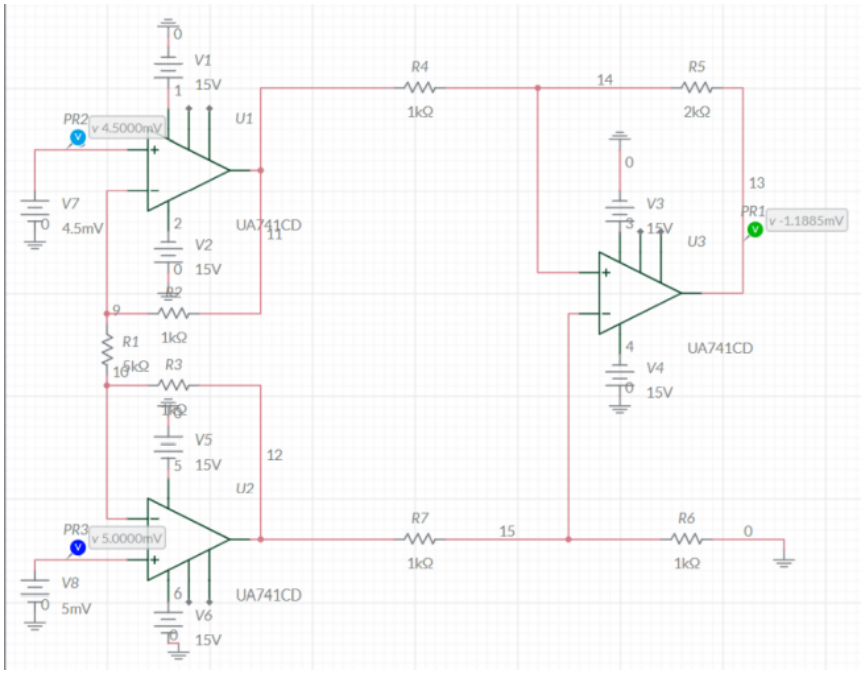


Overall gain:

$$A_v = \frac{V_{out}}{V_2 - V_1} = \left(1 + \frac{2R_1}{R_{gain}}\right)\frac{R_3}{R_2}$$

Fig. 11 INSTRUMENTATION AMPLIFIER

CIRCUIT DIAGRAM:



OUTPUT: