

# EE230: Experiment 10

## ECG Amplifier Design

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April 2, 2018

## 1 Overview of the experiment

### 1.1 Aim of the experiment

The aim of this experiment is to design a ECG machine that can record out ECG signal.

### 1.2 Methods

We assembled the circuit according to the Lab manual. We checked each path and finally observed the ECG.

## 2 Design

To design a ECG system we need :

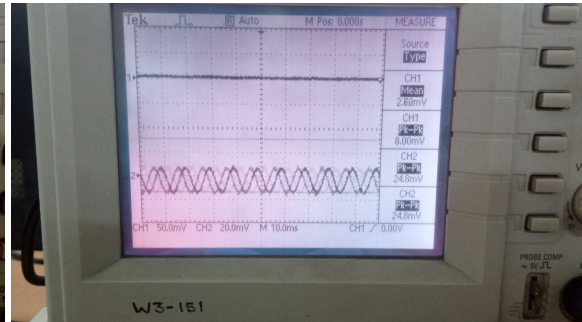
- Instrumentation amplifier
- Offset (DC) Cancellation Circuit
- The Driven-Right Leg Circuit
- Gain and Low pass filter
- Notch filter

### 3 Experimental results

#### 3.1 Instrumentation amplifier

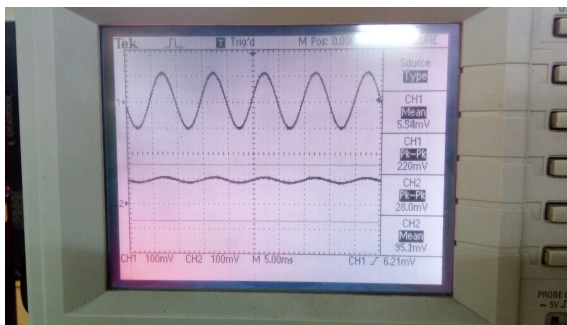


Differential mode



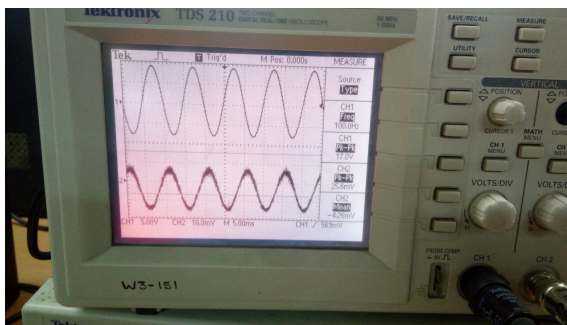
Common mode

#### 3.2 Offset (DC) Cancellation Circuit

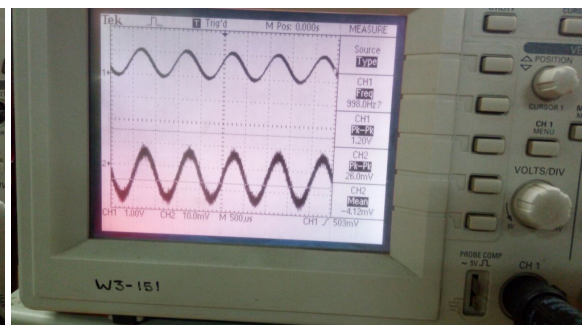


We can easily see that even if the input signal had some offset (as mean is non zero) then also the offset for the output was zero (mean of the output is 0). This happens as the cutoff frequency is 0.3 Hz.

#### 3.3 Gain and Low pass filter

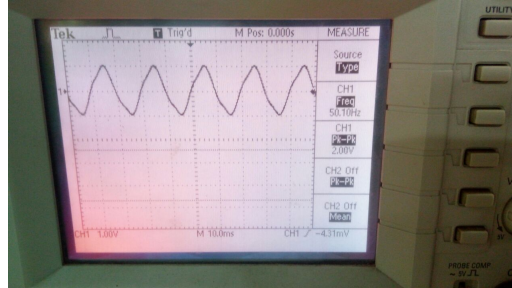


At low frequency

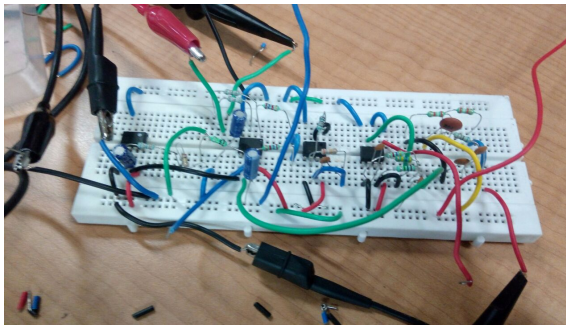


At high frequency

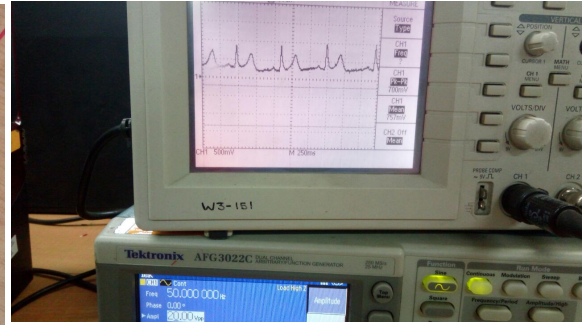
### 3.4 Notch filter



## 4 ECG



Circuit



Output of ECG system

## 5 Inference

Debugging was the major problem in this experiment as ECG comprised was of 4-5 parts each having a complicated circuit.

To solve the debugging problem we tried to check each part separately as it was easier to debug a smaller circuit.

Space management on the breadboard was also a major problem as it was a big circuit. To solve this problem we placed the opamps in closely.

There was a lot of noise as we had used long wires. To remove it we used a shorter wire.

If I do this experiment again I would try to make my breadboard circuit neater by using smaller wires and doing better space management. This would reduce noise in that circuit, hence produces a better ECG.