# E-YANTRA SUMMER INTERNSHIP

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# GY-87 and Filter Design

## 1  Aim

To understand GY-87 sensor, collect data using it and then filter that data for noise using the complimentary filter. To also understand about the function of Kalman Filter and compare it with complimentary filter.

## 2  Answers

1. **What is GY-87 ? What are some of its features? What is it's benefit over MPU6050?**

   **Ans.** This is a breakout board for the MPU-6050 with a on-board Voltage regulator so it can be used with 5 volt supply. It is a 10 degree of freedom(DOF) device which incorporates a MPU6050 accelerometer and gyroscope chip, a HMC5883L digital compass, and a BMP180 barometer.
   The **MPU6050** devices combine a 3-axis gyroscope and a 3-axis accelerometer on the same silicon together with an onboard Digital Motion Processor (DMP) capable of processing complex 9-axis MotionFusion algorithms.
   The **HMC5883** is a surface mount multi-chip module designed for low field magnetic sensing with a digital interface for applications such as low cost compassing and magnetometry.
   The **BMP180** is the new digital barometric pressure sensor of Bosch Sensortec, with a very high performance, which enables applications in advanced mobile devices, such as smart phones, tablet PCs and sports devices.

   **Features**

   - Acceleration, Gyroscope and Magnetometer
   - 10DOF modules (three-axis gyroscope + triaxial accelerometer and three-axis magnetic field + atmospheric pressure)
   - Build in ultra low noise linear LDO voltage regulator
   - Build-in on board filters, which reduce noise from motor and other high current electronics
   - All sensors connected to I2C bus
   - Build in Logic level converter for I2C
   - Power indicator LED

2. **What are filters and why do we use them in our systems?**

   **Ans.** In signal processing, filters are devices that remove some unwanted components or features from a signal. A filter is a circuit capable of passing (or amplifying) certain frequencies while attenuating other frequencies. Thus, a filter can extract important frequencies from signals that also contain undesirable or irrelevant frequencies.

   The four primary types of filters include the **low-pass filter**, the **high-pass filter**, **the band-pass filter**, and the **notch filter** (or the band-reject or band-stop filter).

   - **Low Pass Filter**
     The low pass filter only allows low frequency signals from 0Hz to its cut-off frequency, fc point to pass while blocking those any higher.

   - **High Pass Filter**
     The high pass filter only allows high frequency signals from its cut-off frequency to infinity to pass while blocking the ones lower than the cutoff frequency..
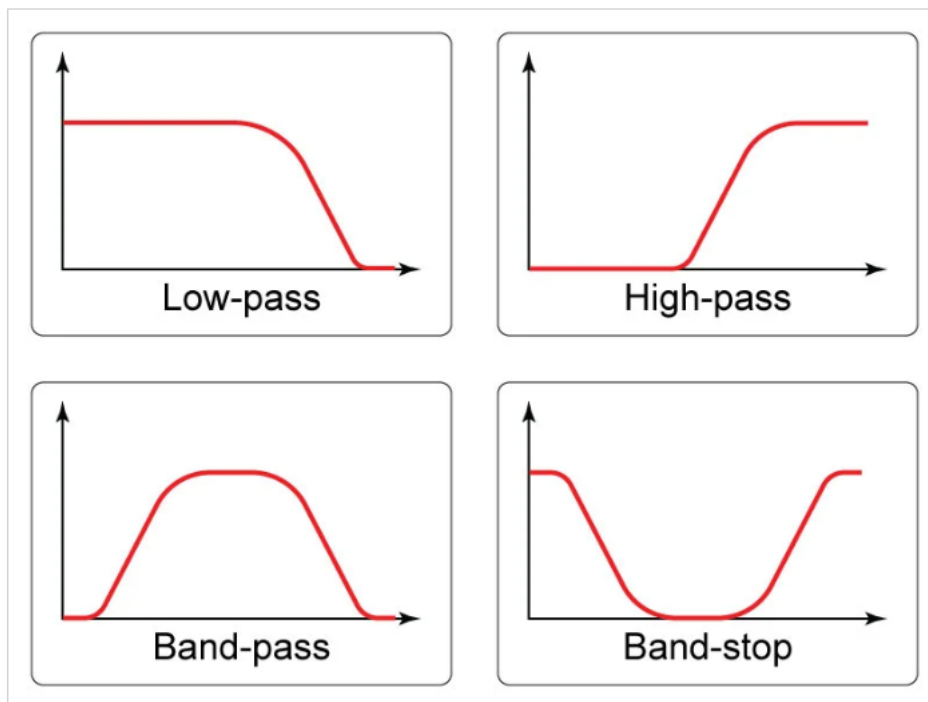


3. What kind of filter will be used for a balance bot system?

4. Why do we use a high pass filter for Gyroscope and a low pass filter for Accelerometer?

5. What is a Kalman Filter and why should we use it instead of a complimentary filter?