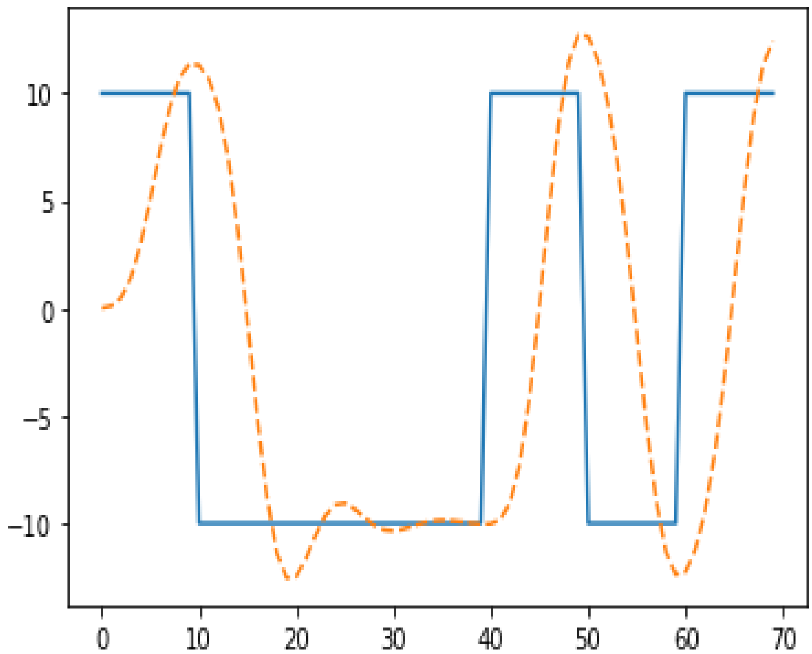
1. For all the parts we have used symbol duration (T) = 0.5s, sampling interval (dt)=0.05s , amplitude (A) =10 (unless mentioned otherwise) , number of samples per symbol (N) = 10. We followed below mentioned steps to get the desired results:
   (a) For Part (a) the following steps were followed:
      - A random bit stream of 7 bits was generated.
      - The aforementioned bit stream was converted to a NRZ-L based scheme.
      - It is then passed through the *channel* provided to us.
      - Cutoff frequency was varied in the butterworth filter and the ISI effect was observed.

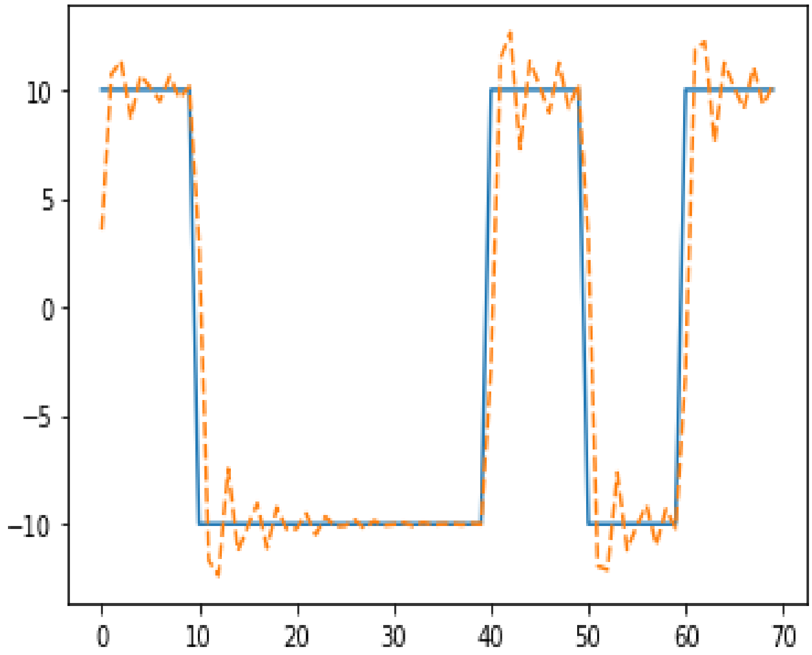
   (b) For Part (b) the following steps were followed:
      - A random bit stream of 3000 bits was generated.
      - The aforementioned bit stream was converted to a NRZ-L based scheme.
      - It is then passed through the *channel* provided to us and the ouput was detected by the matched filter.

   (c) For Part (c) the following steps were followed:
      - For the aforementioned 3000 random bit-stream,cutoff frequency and the noise were varied to observe the effect on the detected bit stream and the bit-error probability.
      - Furthermore, the effect of increasing signal-power was also observed for low cut-off frequencies.

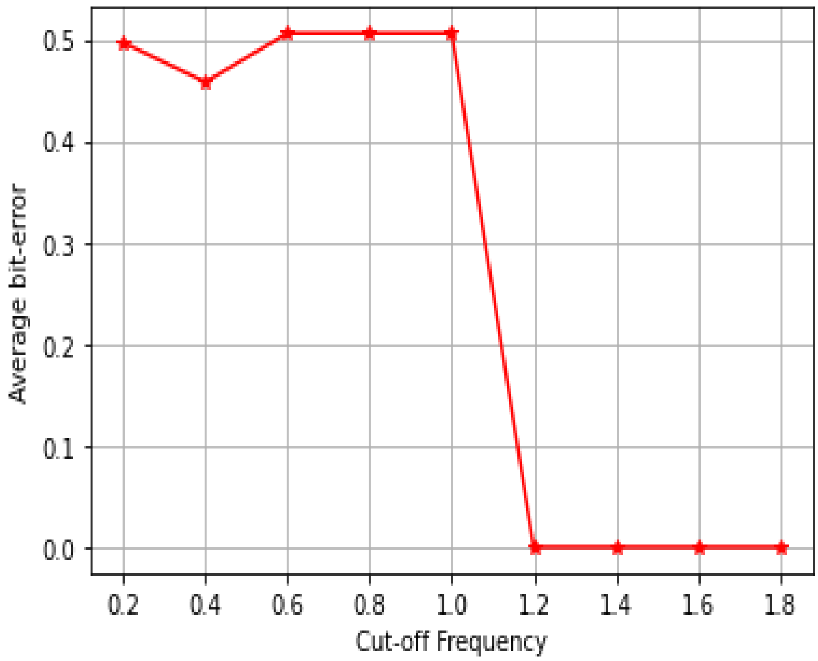
2. **Observations and Conclusion:**
   - For part (a) :We observed that as the cut-off frequency changed from 1 to 5 the output of the channel aligned more towards the original signal and the Inter Symbol Interference reduced significantly when cut-off frequency increased.
     - For fcut=1Hz:



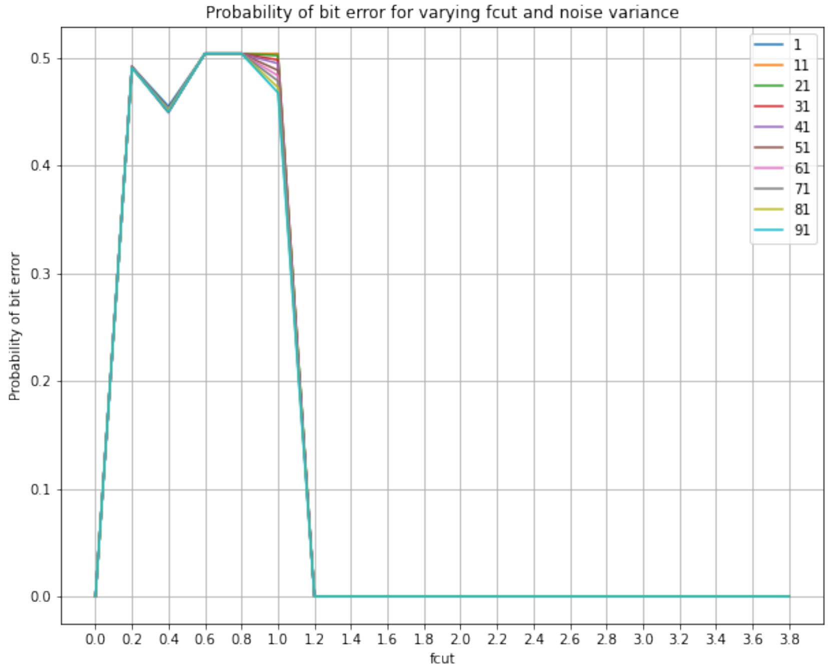
- For fcut=5Hz:




- For part (b) : The Average bit-error was calculated by varying cut-off frequency from 0.2 to 1.8 and we observed that when cut-off frequency is greater than 1.2Hz the average bit-error is almost negligible and on increasing the cut-off frequency the average bit-error rate comes out to be zero.




- For part (c) : Here we changed noise variance from 1 to 100 in steps of 10 and for each values of variance we took different values of cut-off frequency to find the value for which probability of bit-error reduces to zero.




From the above graph we can conclude that the **ideal cut-off frequency is 1.2Hz** and for any value of frequency more than this the signal is detected correctly signifying that as **SNR increases the bit-error probability reduces**. So, to notice the effect of increasing signal power we chose fcut=1.2Hz and obtained the following: