

Fakulti: <b>FAKULTI KEJURUTERAAN ELEKTRIK</b>	
Nama Matapelajaran: MAKMAL TAHUN 3 Kod Matapelajaran : SEEL 3742	Semakan : 6 Tarikh Keluaran : 2023 Pindaan Terakhir : 19 Mac 2023

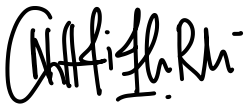



## SEEL 3742

**FAKULTI KEJURUTERAAN ELEKTRIK  
UNIVERSITI TEKNOLOGI MALAYSIA  
SKUDAI, JOHOR**

**ADVANCED ELECTRONIC LAB  
STUDENT PACK**

### ACTIVE FILTER DESIGN

Prepared by : PM.Dr. Norlaili Mat Safri Dr. Zaharah Johari Mdm. Norhafizah Ramli	Certified by : Head of Department Electronics and Computer Engineering (ECE)
Signature :  Stamp : <b>NORHAFIZAH RAMLI</b> Electronic & Computer Engineering Dept Faculty of Electrical Engineering Universiti Teknologi Malaysia 81310 Johor Bahru, JOHOR	Name :  Signature : <b>PROFESOR IR. DR. RUBITA BINTI SUDIRMAN</b> Stamp : Director Department of Electronic and Computer Engineering Faculty of Electrical Engineering Universiti Teknologi Malaysia 81310 UTM Johor Bahru, Johor
Date : 19 Mac 2023	Date : 20/3/2023

# Active Filter Design

## **Project Introduction:**

Filters are circuits that are capable of passing signals within a band of frequencies while rejecting or blocking signals of frequencies outside of this band. A low-pass filter transmits a signal with low frequencies but stops high frequency signals, and vice versa for a high-pass filter. An active filter is designed using operational amplifiers, capacitors and resistors. Active filters are advantages over passive filters such that it eliminates the inductors, which are bulky and expensive especially at low cut-off frequencies. Some of the advantages of an active filter are flexible voltage gain, easy tuning of cut-off frequency, no loading effect, and cost effectiveness since a wide range of economical operational amplifiers are available and no inductor.

## **Project Objectives are:**

1. To design an active filter for Electronics/Biomedical/Telecommunication applications based on the specification.
2. To obtain the magnitude and phase responses of an active filter.
3. To evaluate the functionality and performance of the designed active filter when noise is embedded within an input signal.

## **Project Tasks:**

Your team has been assigned to design an active filter for Electronics/Biomedical/Telecommunication applications with the specification given in Table 1. Based on the type of filter assigned to your team, you have three weeks to design, implement and test the required active filter that comply with the specifications. A technical report supported with the experimental results must be submitted at the end of project time. The collected data, analysis and plots of waveforms (frequency and time domain) and graphs should be well presented and discussed. The report must cover both theoretical and experimental voltage gains, cutoff frequencies, slopes of roll-off, phase angles at cut-off, and the ranges of phase angles. You also need to suggest the possible application of the speaker so that your company can streamdown potential customers.

A technical report supported with the experimental results must be submitted at the end of project time. The collected data, analysis and plots of waveforms and graphs should be well presented and discussed. The report must cover both theoretical and experimental voltage gains, cut-off frequencies, slopes of roll-off, phase angles at cut-off, and the ranges of phase angles. You also need to suggest the possible application of the speaker so that your company can stream-down potential customers.

**Table 1: Project Specifications for Telecommunications/ Electronics**

No.	Type of speakers	Filter parameters			
		Min. order	Min. gain	Cut-off freq	Type*
1	Subwoofers	2 <sup>nd</sup> order	20dB	200 Hz	Bessel
2	Woofers	2 <sup>nd</sup> order	20dB	40 Hz and 1 kHz	band-pass
3	Midranges	2 <sup>nd</sup> order	20dB	300 Hz and 5 kHz	band-pass
4	Tweeters	2 <sup>nd</sup> order	20dB	2 kHz and 20 kHz	band-pass
5	Super tweeters	2 <sup>nd</sup> order	20dB	20 kHz and 100 kHz	band-pass

**Table 2: Project Specifications for Electronics/Biomedical**

No.	Type of speakers	Filter parameters			
		Min. order	Min. gain	Cut-off freq	Type*
1	Notch Filter	2 <sup>nd</sup> order	*	40 Hz	*
2	Notch Filter	2 <sup>nd</sup> order	*	50 Hz	*
3	Notch Filter	2 <sup>nd</sup> order	*	60 Hz	*
4	Bandpass Filter	2 <sup>nd</sup> order	*	800 Hz and 2 kHz	*
5	Bandpass Filter	2 <sup>nd</sup> order	*	1 kHz and 10 kHz	*
6	Bandpass Filter	2 <sup>nd</sup> order	*	2 kHz and 20 kHz	*

\* You may choose any voltage gain or type of filter response (Butterworth, Chebyshev, Bessel) most suitable to design.

**Technical Report Guideline:**

1. The report should use an IEEE journal format. Please download report template from <http://3yearlab.fke.utm.my/> or <http://www.fke.utm.my/facilities/teaching-laboratories/lab>
2. One hardcopy of the report should be submitted to the Advanced Electronics laboratory one week after the last lab's session (4<sup>th</sup> Week). Please make sure to sign the submission form available in the lab.
3. One softcopy of the report in pdf format should be uploaded to a link which will be provided by the course coordinator. Please name the file as labname+year\_group number\_type of filter.pdf. Example: [aelab2023\\_G1\\_Supper Tweeters.pdf](#)