ENGG1300 –Audio Filter Demonstration Semester 1, 2023

Internal Students - Process and Marking Criteria

STUDENT NAME: _____

STUDENT NUMBER: _____

INSTRUCTIONS:

Prior to your demonstration:

Design and test your audio filter circuit during Week 8B and 9B Practical sessions and complete the pre-demonstration calculation sheet.

At your demonstration:

Your demonstration will be conducted under closed book exam conditions. You are permitted only writing materials, Casio Fx-82 or UQ approved and labelled calculator, and completed calculation sheet (see over page). You will not have computer access. When instructed:

1. Construct the audio filter circuit you have designed on the breadboard
2. Use a sinusoidal voltage of approximately 1 volt amplitude (2 volts peak-peak) as the input source V_{in} (the exact value is not important as long as it is accurately recorded). The output port is open-circuit (except for any measurement probes). Vary the input frequency from 30 Hz to 100 kHz, and ***accurately*** record the amplitudes of V_{in} and V_{out}; $|G(\omega)|$; and gain in dB and for each value of frequency on the table on the next page. You should ensure that all the entries of the table are completed.
3. Use the graph at the bottom of the following page to draw a BODE MAGNITUDE PLOT of the transfer function of the filter. Ensure that you correctly label the values on each axis.

NOTE: It is recommended that you first reset the oscilloscope to factory defaults, modify settings for your setup (e.g. you will need to change probe ratios from factory default 10:1 to 1:1), and then connect both oscilloscope channels to a 2Vp-p 1000 Hz sinusoidal signal to ensure all multipliers, probes, connections, settings, etc. are working correctly.

Marking During the Demonstration:

Once you have constructed your circuit (including configuring and connecting the function generator and oscilloscope), ***raise your hand,*** and a tutor will provide you approx. 4 minutes to demonstrate the following:

- Your correctly constructed circuit, including the identification V_{in} and V_{out} terminals; and setup the function generator to display a sinusoid of the appropriate voltage and frequency;
- Your ability to setup the oscilloscope to correctly display V_{in} and V_{out} on the oscilloscope at a specified signal frequency
- Your ability to correctly and accurately measure the amplitude of V_{in} and V_{out}, at a specified frequency, using either the cursor function, or the MEAS function (specified by tutor).
- Your ability to answer technical questions related to the design of your circuit

If you are unable to get your circuit working, you can ask for help from a tutor who will ensure your circuit is correct, setup the function generator with a 1kHz sinusoid as the input, and display V_{in} and V_{out} on the oscilloscope [You will be penalised up to 4 marks as per marking criteria ("circuit construction and setup" criteria). There will be no penalty if the equipment is faulty, and you will have the option to re-sit the exam]. ***If your circuit isn't working after 15 minutes, it is suggested you ask for help.***

MARK SHEET:

Pre-Demonstration Calculations	
Filter Type	/1
Desired Filter Cut-off frequency	/1
Circuit Schematic and design calculations	/4
Practical filter performance	/1

Circuit Construction and Setup [Marked during demonstration]	
(1) Oscilloscope configured correctly for experiment in order to simultaneously show two input channels; probe ratio settings correct. Function generator correctly configured to generate a sinusoid at an appropriate amplitude (≈2VPk-Pk) at sensible frequency. Time/amplitude scale adjusted to make sense of input/output waveforms.	Yes: 2/2
	No: 0/2
(2) Circuit correctly constructed, with V_{out} and V_{in} terminals correctly identified; function-gen and scope leads connected correctly.	Yes: 2/2
	No: 0/2

Measurement method and frequency suggested by tutor (circle one):

Cursor function **MEAS function** **Frequency:_____(Hz)**

Signal Measurement [Marked during demonstration]	
Able to correctly and accurately measure V_{in} and V_{out} amplitudes at required frequency using the measurement method suggested by tutor. Time and amplitude scale must be adjusted appropriately.	3/3
Able to measure V_{in} and V_{out} amplitudes using ***some*** method without any assistance, even if this was not accurate, or not the method suggested by the tutor.	1.5/3
Not able to measure amplitude of V_{in} and V_{out} using any method	0/3

Technical Questions [Marked during demonstration]	
The student is able to correctly and confidently answer technical questions asked by marker	/2

Filter Experimental Results [Marked after Demonstration]**:**	
Results table and bode plot	/4

Total:	**/20**

DEMONSTRATION MARKER (SIGNATURE/DATE): **RESULTS MARKER (SIGNATURE/DATE):**

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Pre-Demonstration Calculations (complete this in advance and bring to your demonstration)

STUDENT NAME: _____
STUDENT NUMBER: _____

What type of filter is required to solve this problem (i.e. high-pass, low-pass, band-pass, band-stop) ? **(1 mark)**

What cut-off frequency did you select for your filter? **(1 mark)**

Sketch a schematic of your filter circuit schematic (clearly labelling the input and output terminals); and provide calculations showing how you chose the component values for your filter, including a derivation of the transfer function and the equation for the cut-off frequency. **(4 marks)**

How effective was the filter at removing the noise from the noisy signals? You should briefly comment on how much quieter the noise was, and whether there was any distortion to the audio track. **(1 mark)**

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Demonstration Result (Complete during your demonstration)

STUDENT NAME: _____
STUDENT NUMBER: _____

Freq. (Hz)	30	100	300	1000	3000	10k	30k	100k
V_{in} (volts)								
V_{out} (volts)								
Gain $\|G(\omega)\|$								
Gain (dB)