

Electrical and Electronic Principles

by Benjamin Newbury-Davies

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Abstract



The tasks completed were completed on the Proteus software on a computer and also using a breadboard in a laboratory setting. To complete the tasks, different circuits were created using different software. The Proteus software circuit was made by using different components from the component search library and then pieced together using wires to complete the full Proteus circuit which was ready for testing. The breadboard circuit was made by using different components from a laboratory, piecing them together to create a full complete breadboard circuit, which was ready for testing. The results from the two completed circuits being tested were similar, with both showing the same pattern which is shown in both the circuits table of results and graphs.

Introduction

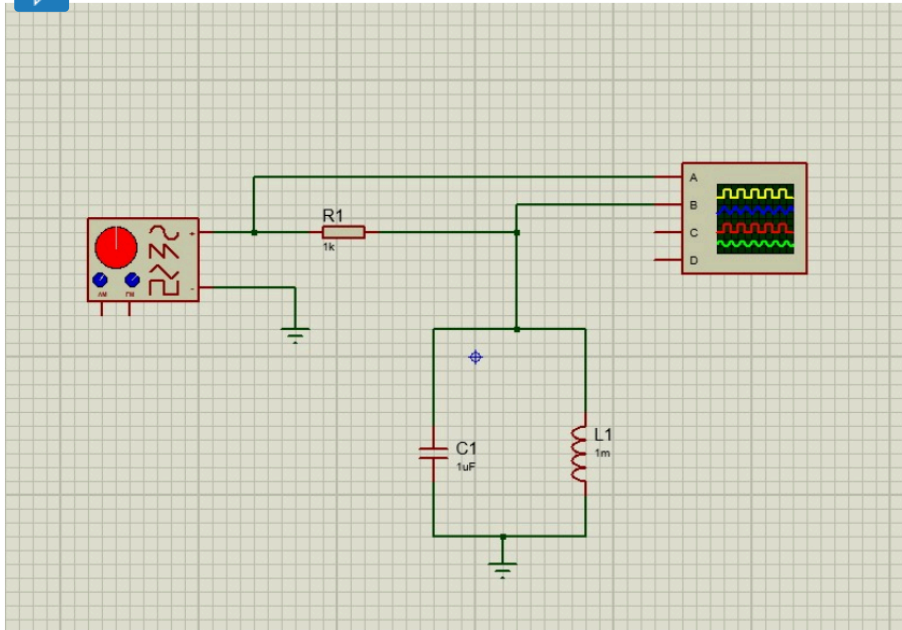
During this experiment, both circuits were created and replicated in the same way but on different software; one on Proteus and one on a breadboard. The aim of the circuits is to test the voltage output when the input frequency is changed (increased), when the voltage in is kept the same throughout all the testing. These circuits shown in the experiment can be found in different places; one place they're found is in power supply and control systems, as they are used to measure and maintain stable voltage and frequency is motors that drive [1].

In this report, the content will be on the explanation and describing of the whole experiment process on both the Proteus circuit and the breadboard circuit. The content will include the simulation steps of the circuits, outlining key steps on how specific results were obtained. Also, the main results are shown and recorded in table and graph form the show the results from the testing. To add, a discussion between the two circuits will be shown showing the similarities and differences between the Proteus and breadboard circuit. To finalize the findings, a conclusion will be set to tie in all the results and information obtained in the testing task.

Proteus Circuit

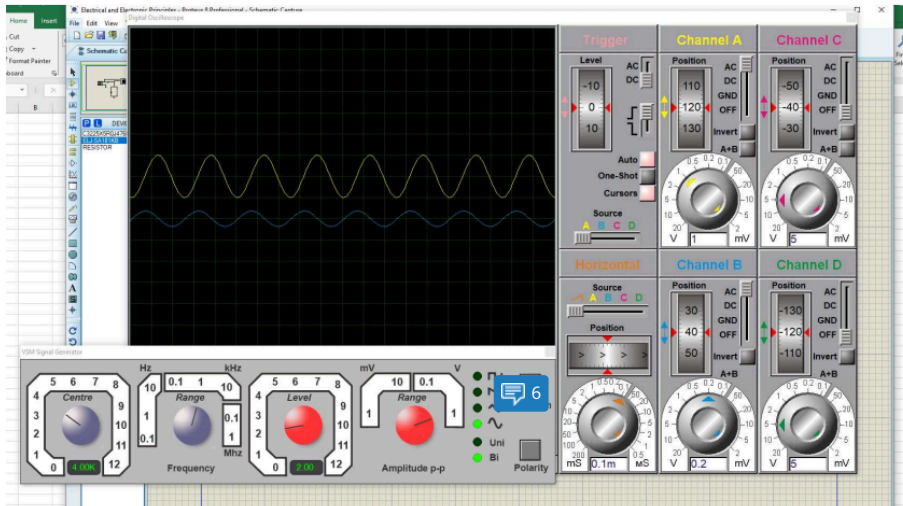


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This is the Proteus circuit ready for testing. On the left is the input frequency which controls how much frequency is running in the circuit; this is increased in the testing to obtain the results, whilst the voltage stays the same throughout the circuit testing, at 2V. This is then connected to the ground. The capacitor and inductor are connected to ground and then connected to the output, which shows the waves of the voltage output when the frequency is increased. The resistor connects the input to the rest of the circuit to keep it stable. The whole circuit is connected by wires to make sure everything will run smoothly and is connected together. When the circuit is running, the frequency input runs frequency through the circuit; the output then shows the voltage output in waves, depending on how much frequency and voltage is in the circuit.

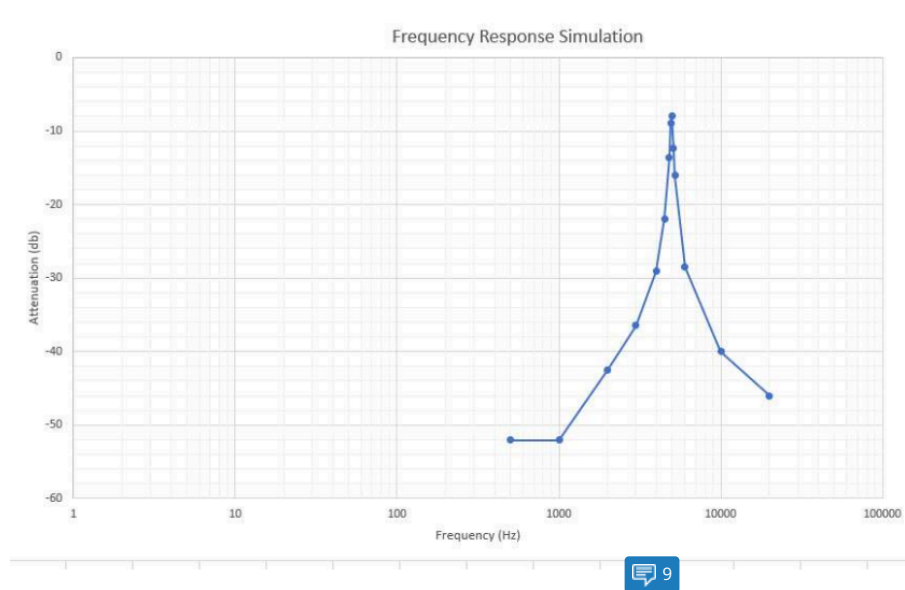


This is an example of the circuit output during testing. This is the output showing the measurement of voltage output (blue line) when the frequency is increased. The frequency starts at 100Hz and finishes at 20,000Hz with the voltage input staying consistent at 2V throughout the testing, as shown below.

Freq (Hz)	V in (V)	V out (mV)	V out (V)	A (db)
100	2	0	0	0
500	2	5	0.005	-52.0412
1000	2	15	0.005	-52.0412
2000	2	30	0.03	-36.4782
3000	2	70	0.07	-29.1186
4000	2	160	0.16	-21.9382
4500	2	420	0.42	-13.5556
4800	2	715	0.715	-8.93448
4900	2	800	0.8	-7.9588
5000	2	480	0.48	-12.3958
5100	2	315	0.315	-16.0544
5200	2	75	0.075	-28.5194
6,000	2	20	0.02	-40
10,000	2	10	0.01	-46.0206
20,000	2			

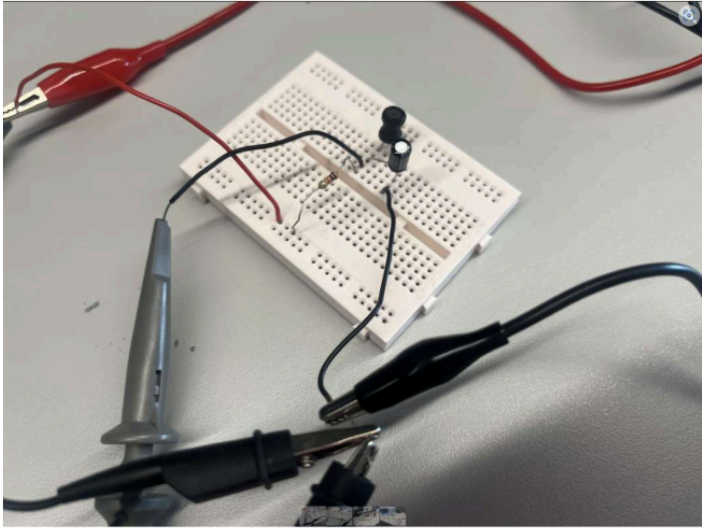
This is the results table for the proteus circuit. As shown in the table, the frequency starts at 100Hz and rises to 20,000Hz in intervals. As shown in the table, the voltage stays

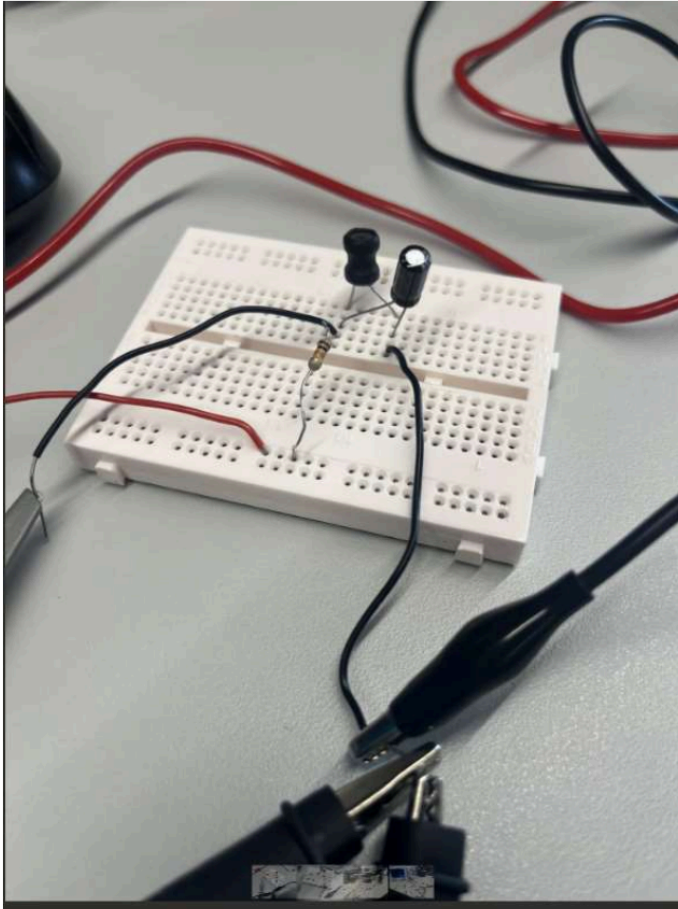
consistent at 2V. The aim of the table and graph is to show the voltage output when the frequency is increased. The A (db) column is calculated using the equation given, $A=20 \times (V_L/V_{LN})$, whilst incorporating my real-life results into the equation. From the Proteus circuit, the table shows as the frequency increases, the voltage out also increases, until it reaches a certain frequency (5000Hz), after this point the voltage out decreases.

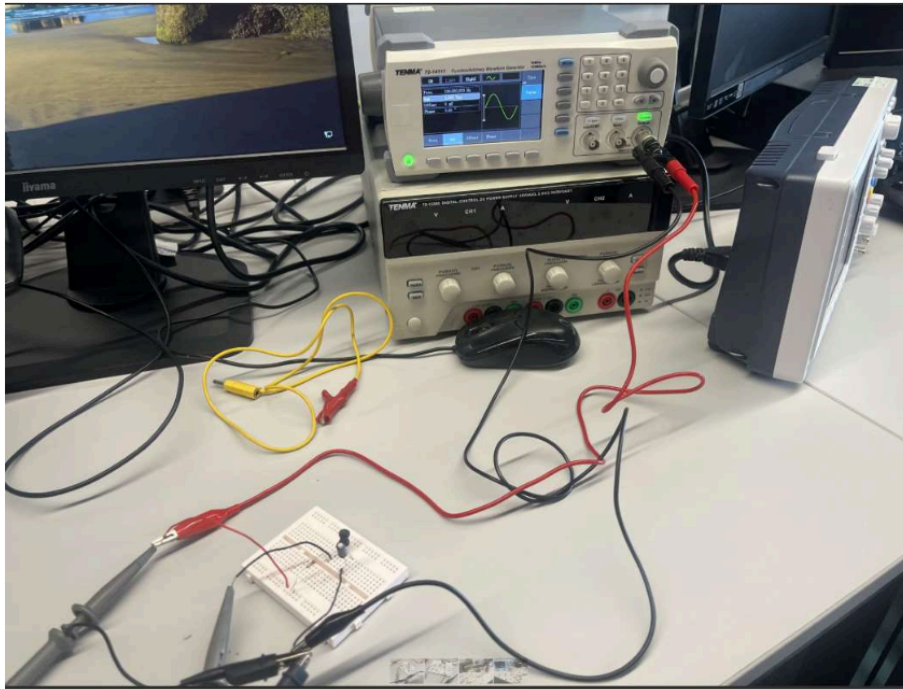


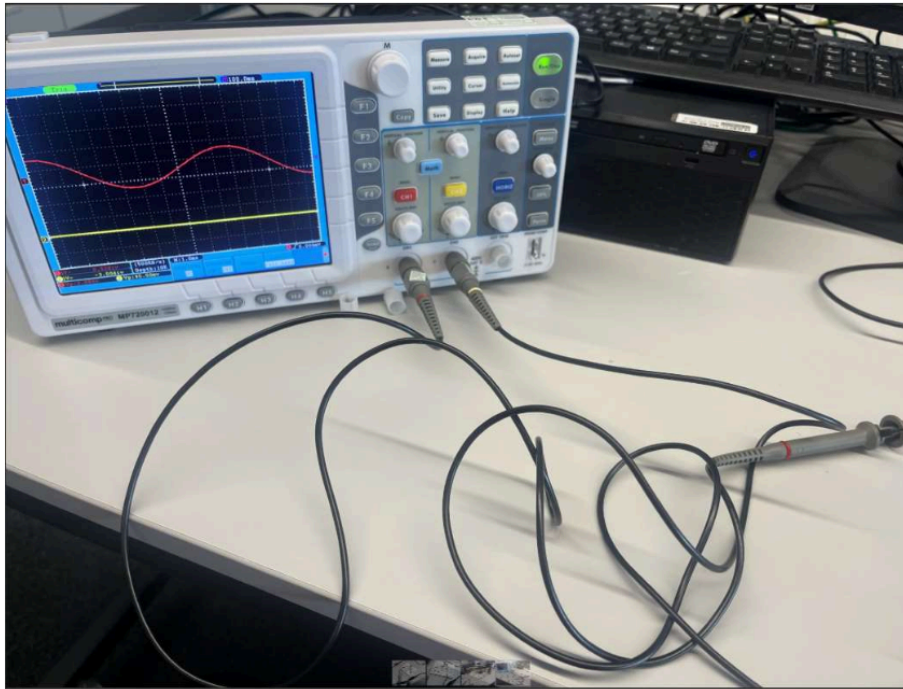
The end result line graph from the results from the table. The graph shows that as the frequency is increased, the voltage output also increases, until a certain frequency (5000Hz) and then the voltage output decreases. The graph is labelled correctly, with the correct axis and graph title to make sure the line graph is easy to read, with the results from the findings clearly set out on the graph. The line of best fit adds detail to the results as it shows the spike increase of voltage output when frequency is increased and then the decline of voltage output after a certain frequency. The resonant frequency is -30 attenuation (db). The voltage output increases as frequency increases, until a certain point, and then voltage output decreases because of the resonant point; this is the peak voltage output as the voltage output has hit its highest point and therefore starts to decrease after it reaches a certain frequency level.

Breadboard Circuit









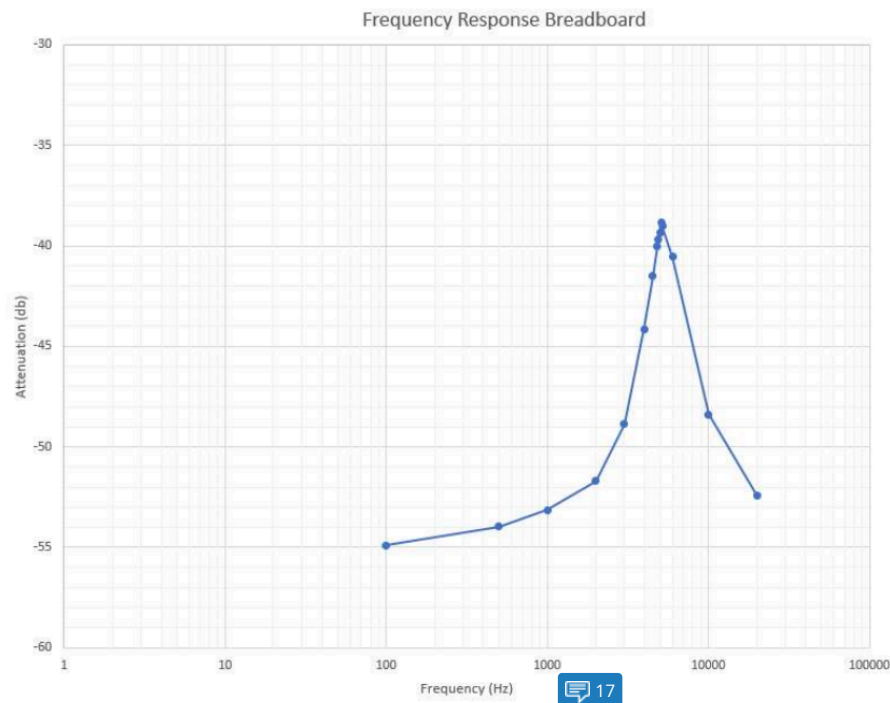
This is the final setup of the breadboard circuit. The breadboard circuit is set up with the same concept as the Proteus circuit. The resistor, capacitor, and inductor are all connected, with the ground and power connections also connected. The voltage input is connected and also the frequency input. To add, the voltage output is also connected. As shown, when the circuit is running, the voltage input is the same for each frequency (2V), the frequency is then increased, and the voltage output is measured. The frequency starts at 100Hz and finishes at 20,000Hz with the voltage input staying consistent at 2V throughout the testing, as shown below.

Freq (Hz)	V in (V)	V out (mV)	V out (V)	A (db)
100	2	3.6	0.0036	-54.89
500	2	4	0.004	-53.98
1000	2	4.4	0.0044	-53.15
2000	2	5.2	0.0052	-51.7
3000	2	7.2	0.0072	-48.87
4000	2	12.4	0.0124	-44.15
4500	2	16.8	0.0168	-41.51
4800	2	20	0.02	-40
4900	2	20.8	0.0208	-39.66
5000	2	21.6	0.0216	-39.33
5100	2	22.8	0.0228	-38.86
5200	2	22.4	0.0224	-39.02
6000	2	18.8	0.0188	-40.54
10,000	2	7.6	0.0076	-48.4
20,000	2	4.8	0.0048	-52.4

This is the results table for the breadboard circuit. As shown in the table, the frequency starts at 100Hz and rises to 20,000Hz in intervals. As shown in the table, the voltage stays consistent at 2V. The aim of the table and graph is to show the voltage output when the frequency is increased. The A (db) column is calculated using the equation given,

$A = 20 \times (V_L / V_{LN})$ incorporating my real-life results into the equation. From the breadboard circuit, the table shows that as the frequency increases, the voltage out also increases, until it reaches a certain frequency (5200Hz). After this point the voltage out decreases.

When the breadboard circuit results are compared to the proteus circuit results, it shows that the breadboard circuit had a higher resonant frequency than the proteus circuit. The breadboard circuit output voltage output started to decrease after 5200Hz, but the proteus circuit voltage output started to decrease after 5000Hz. This is because the breadboard circuit has a higher component tolerance than the proteus circuit as the breadboard circuit uses real life components, which have parasitic characteristics which change frequency [2].



This is the end result line graph from the results from the table. The graph shows that as the frequency is increased, the voltage output also increases, until a certain frequency (5200Hz) and then the voltage output decreases. The graph is labelled correctly, with the correct axis and graph title to make sure the line graph is easy to read, with the results from the findings clearly set out on the graph. The line of best fit adds detail to the results as it shows the spike increase of voltage output when frequency is increased and then the decline of voltage output after a certain frequency. The resonant frequency is -40 attenuation (db). The voltage output increases as frequency increases, until a certain point, and then voltage output decreases because of the resonant point; this is the peak voltage output as the voltage output has hit its highest point and therefore starts to decrease after it reaches a certain frequency level.

Conclusion

In this experiment, the findings show that the breadboard frequency input gives more of a frequency input to the circuit before the voltage output drops, compared to the proteus

circuit. The breadboard circuit gives a frequency input of 5200Hz, which is the highest point of frequency input before the voltage output starts to decrease. Comparing this to the proteus circuit, the proteus circuit gives a highest frequency input of 5000Hz before the voltage output starts to decrease. The breadboard circuit gives a more accurate set of results as it is tested with real life equipment meaning the oscilloscope acts as a load, helping with frequency response [3].

References



- [1] M. H. Rashid, Power Electronics: Circuits, Devices and Applications, 4th ed. Upper Saddle River, NJ, USA: Pearson, 2014.
- [2] P. Horowitz and W. Hill, The Art of Electronics, 3rd ed. Cambridge University. Press, 2015.
- [3] A. S. Sedra and K. C. Smith, Micro electric Circuits, 7th ed. New York, NY, USA: Oxford University. Press, 2015.

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GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

56/100

PAGE 1

PAGE 2



Comment 1

Abstract:

It would be preferable to include a concise description of the anticipated results in the abstract for better clarity.

PAGE 3



Comment 2

It is better to have table of content.

PAGE 4



Comment 3

It is better to number each heading

It is better to have
sub-heading where ever required.



Comment 4

no comment



Comment 5

It would have been better with page number

PAGE 5



Comment 6

caption should be added for the figure, so the reader will
get an idea about the figure



Comment 7

caption should be added for the table, so the reader will get an idea about the table

PAGE 6



Comment 8

the equation is wrong



Comment 9

caption should be added for the figure, so the reader will get an idea about the figure



Comment 10

It would have been better if left alignment or justified alignment is used.



Comment 11

caption should be added for the figure, so the reader will get an idea about the figure



Comment 12

caption should be added for the figure, so the reader will get an idea about the figure



Comment 13

caption should be added for the figure, so the reader will get an idea about the figure

PAGE 11



Comment 14

caption should be added for the figure, so the reader will get an idea about the figure

PAGE 12



Comment 15

caption should be added for the table, so the reader will get an idea about the table



Comment 16

equation is wrong



Comment 17

caption should be added for the figure, so the reader will get an idea about the figure



Comment 18

The conclusion of a report is a critical section that summarises the key findings, implications



Comment 19

It is advisable to include more references from peer-reviewed journals.

GRADING FORM: EEP

BENJAMIN NEWBURY-DAVIES

55.90

ENGAGEMENT WITH LITERATURE

Marks for engagement with literature skills will be gained through the use of information collected from appropriate reference material embedded in mainly the introduction, but also in the discussion and conclusion sections of your report. This reference material should be used to explain concepts and to support arguments in the discussion of your results.



Poor engagement with essential reading. report includes a small number of relevant references. However, the references are not used enough throughout the report to support the explanation of resonance, attenuation, Q factor, and practical measurement errors. Overall, the literature engagement is limited and needs more developed use of technical sources to support the analysis.

1.9

KNOWLEDGE AND UNDERSTANDING

Marks for knowledge and understanding skills will be given for the accuracy of your description of the concepts and principles of resonance and how this relates to the experimental setup used.



Knowledge of the basic underlying concepts and principles is accurate with a good understanding of resonance. The results are identified for both simulation and breadboard connected results. key equations for resonant frequency, and Q factor are either missing written. The attenuation

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formula is wrongly written. The report also states that the resonant frequency is “–30 attenuation” or “–40 attenuation,” but resonant frequency should be given in Hz, not dB.

COGNITIVE AND INTELLECTUAL

Marks for cognitive and intellectual skills will be given for the quality and validity of your interpretation of the experimental results gathered. You should consider the differences between the simulated and experimental and explain possible causes for them.



Limited attempt at evaluation of the underlying concepts and principle of resonance circuit. Correctly mentioned that the practical circuit peaks at a slightly higher frequency than the simulated circuit. It gives a reasonable explanation that practical components have tolerances and parasitic characteristics, which may shift the frequency response. No calculation on theoretical resonant frequency, percentage error, bandwidth or Q factor. Overall, the comparison is present, but the interpretation needs much more numerical evidence

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PRACTICAL SKILLS

Marks for practical skills will be given for your use of the available tools, models and techniques to explain your results and their relationship to the theory of the concepts.



Good application of a range of basic tools and techniques in circuit design. Both the simulation and practical circuits were built. The graphs are useful, but they should be larger, clearer, and should show attenuation in dB against logarithmic frequency with properly labelled axes and units.

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TRANSFERABLE SKILLS FOR LIFE

Marks for transferable skills for life and professional practice will be given for the structure, coherence, presentation and overall quality of



The report demonstrates a satisfactory level of structure and coherence, with the inclusion of figures, tables, and photographs providing useful supporting evidence. The overall presentation is clear and generally easy to follow. However, the report does not fully adhere to the required structure, as separate sections for theory, simulation setup, results, discussion, and Q-factor comparison are not clearly defined. In addition, some of the writing is repetitive and informal, which reduces the overall professionalism of the report. Greater attention to organisation, technical language, and proofreading would improve readability and strengthen the quality of the presentation. It is evident from the coursework that the student demonstrates the ability to design circuits using Proteus, measure the output, analyse the circuit, and present the findings in a report.

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