

# ELECENG 2CI5 Lab 9 Prelab

Raeed Hassan  
hassam41

i.

The frequency at which the average real power delivered to the load is maximized in a series RLC circuit is the resonance frequency,  $f = \frac{\omega}{2\pi} = \frac{1}{2\pi\sqrt{LC}}$ . For the given circuit, the resonance frequency is  $f = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{1 \times 10^{-3} \cdot 1 \times 10^{-6}}} = 5032.9 \text{ Hz}$ .

ii.

	Frequency (Hz)	$Z_s(\Omega)$	$Z_L(\Omega)$	$\tilde{Z}_{total}(\Omega)$	$\tilde{V}_L \text{ (mV)}$	$\tilde{I} \text{ (mA)}$	$\tilde{P}_{avg} \text{ (}\mu\text{W)}$	P delivered by the source ( $\mu\text{W}$ )
Case 1	5032.9	150-31.62j	150+31.62j	300 $\angle 0^\circ$	510.99 $\angle 11.90^\circ$	3.33 $\angle 0^\circ$	833.33	1666.67
Case 2	100	150-1591.55j	150+0.63j	1618.96 $\angle -79.32^\circ$	92.65 $\angle 79.56^\circ$	0.62 $\angle 79.32^\circ$	28.61	57.23
Case 3	500	150-318.31j	150+3.14j	435.12 $\angle -46.41^\circ$	344.81 $\angle 47.61^\circ$	2.30 $\angle 46.41^\circ$	396.13	792.26
Case 4	1 K	150-159.15j	150+6.28j	336.70 $\angle -27.00^\circ$	445.89 $\angle 29.40^\circ$	2.97 $\angle 27.00^\circ$	661.55	1323.10
Case 5	2.5 K	150-63.66j	150+15.71j	303.81 $\angle -9.08^\circ$	496.43 $\angle 15.06^\circ$	3.29 $\angle 9.08^\circ$	812.57	1625.14
Case 6	10 K	150-15.92j	150+62.83j	303.65 $\angle 8.89^\circ$	535.58 $\angle 13.84^\circ$	3.29 $\angle -8.89^\circ$	813.44	1626.88
Case 7	50 K	150-3.18j	150+314.16j	432.10 $\angle 46.03^\circ$	805.68 $\angle 18.45^\circ$	2.31 $\angle -46.03^\circ$	401.70	803.40
Case 8	100 K	150-1.59j	150+628.32j	694.83 $\angle 64.42^\circ$	929.69 $\angle 12.15^\circ$	1.44 $\angle -64.42^\circ$	155.35	310.70
Case 9	500 K	150-0.32j	150+3141.59j	3155.57 $\angle 84.54^\circ$	996.71 $\angle 2.72^\circ$	0.32 $\angle -84.54^\circ$	7.53	15.06
Case 10	1 Mega	150-0.16j	150+6283.19j	6290.18 $\angle 87.27^\circ$	999.17 $\angle 1.37^\circ$	0.16 $\angle -87.27^\circ$	1.90	3.79

iii.

	Frequency (Hz)	Calculated Phase Difference ( $^\circ$ )	Measured Phase Difference ( $^\circ$ )
Case 1	5032.9	0	1.4
Case 2	100	79.32	75.5
Case 3	500	46.41	38.1
Case 4	1 K	27.00	20.8
Case 5	2.5 K	9.08	7.2
Case 6	10 K	-8.89	-6.0
Case 7	50 K	-46.03	-35.7
Case 8	100 K	-64.42	-56.1
Case 9	500 K	-84.54	-83.5
Case 10	1 Mega	-87.27	-87.9

The measured phase difference values were relatively similar to the calculated phase difference values, and followed the same pattern when frequency was changed.

iv.

	Frequency (Hz)	Measured Maximum Power (mW)
Case 1	5032.9	4.02
Case 2	100	0.59
Case 3	500	2.61
Case 4	1 K	3.32
Case 5	2.5 K	3.72
Case 6	10 K	3.82
Case 7	50 K	2.85
Case 8	100 K	1.70
Case 9	500 K	0.26
Case 10	1 Mega	0.08