

**University of Jordan
School of Engineering
Electrical Engineering Department**

**EE 219
Electrical Circuits Lab**

**EXPERIMENT 5 REPORT & PRE-LAB
CAPACITIVE REACTANCE**

Section # _____ Group # _____

Student Name

ID

- 1.**
- 2.**
- 3.**
- 4.**

EXPERIMENT 5 CAPACITIVE REACTANCE

Note: Use MATLAB to quickly perform theoretical calculations by defining a vector of frequencies then using array arithmetic.

PROCEDURE A - AC-EXCITED SERIES RC CIRCUIT

Table 1

AC Source Frequency (Hz)	V_S (peak) (V)		V_S period T (ms)		V_C (peak) (V)		$\angle V_C$ with V_S (Lag = negative)	
	Theory	Meas.	Theory	Meas.	Theory	Meas.	Theory	Meas.
50	4							
100	4							
200	4							
300	4							
500	4							
700	4							
1100	4							
2000	4							

Table 2

AC Source Frequency (Hz)	V_R (peak) (V)		$\angle V_R$ with V_S (Lead = positive)		V_R period T (ms)		I and $\angle I$ (mA) = V_R/R	
	Theory	Meas.	Theory	Meas.	Theory	Meas.	Theory	Meas.
50								
100								
200								
300								
500								
700								
1100								
2000								

6. Can we just subtract the magnitudes of $|V_S| - |V_C|$ to obtain the magnitude $|V_R|$? Why or why not?

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7. What is the relationship between the periods T of the two signals V_S and V_R ?

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Table 3

AC Source Frequency (Hz)	$X_C = V_C / I $ (peak/peak) (k Ω)		$ Z = V_S / I $ (peak/peak) (k Ω)		$\angle Z = \angle V_S - \angle I$ (degrees)	
	Theory	Meas.	Theory	Meas.	Theory	Meas.
50						
100						
200						
300						
500						
700						
1100						
2000						

10. Using the *measured* values in Table 3, plot (**by hand**) the following figures using the graph paper attached at the end of the report: (1) X_C and $|Z|$ on the same plot versus source frequency; (2) $\angle Z$ versus source frequency; (3) V_C and V_R on the same plot versus source frequency.

11. For the above plots, state your conclusions under the plot?

Table 4

AC Source Frequency (Hz)	$ S $ (mVA)	$\angle S$ (degrees)	P (mW)	Q (mVAR)	PF value	PF lead or lag
	Measured	Measured	Measured	Measured	Measured	Measured
50						
100						
200						
300						
500						
700						
1100						
2000						

13. Using the values in Table 4, plot (**by hand**) the following figure using the graph paper attached at the end of the report: P and Q on the same plot versus source frequency.

14. For the above plot, state your conclusions under the plot?

15. At what frequency the real power P is maximum? Why?

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16. At what frequency the magnitude of the reactive power $|Q|$ is maximum? Why?

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PROCEDURE B - AC-EXCITED PARALLEL RC CIRCUIT

Table 5

AC Source Frequency (Hz)	$V_{R'}$ (peak) (V)		$\angle V_{R'}$ with V_s (Lead = positive)		$V_R = V_C \approx V_S$ (peak) (V)		$\angle V_R$ with V_s (degrees)	
	Theory	Meas.	Theory	Meas.	Theory	Meas.	Theory	Meas.
160					4		0°	0°
320					4		0°	0°
800					4		0°	0°
1100					4		0°	0°
1600					4		0°	0°
2200					4		0°	0°
3500					4		0°	0°
6500					4		0°	0°

Table 6

AC Source Frequency (Hz)	I (peak) (mA) = $V_{R'}/R'$		$\angle I$ with V_s (Lead = positive)		I_R (peak) (mA) = V_R/R		$\angle I_R$ with V_s (degrees)	
	Theory	Meas.	Theory	Meas.	Theory	Meas.	Theory	Meas.
160							0°	0°
320							0°	0°
800							0°	0°
1100							0°	0°
1600							0°	0°
2200							0°	0°
3500							0°	0°
6500							0°	0°

Table 7

AC Source Frequency (Hz)	$I_C = I - I_R$ (mA) (magnitude (peak) and phase (degrees)) (phasor subtraction)	
	Theory	Measured
160		
320		
800		
1100		
1600		
2200		
3500		
6500		

Table 8

AC Source Frequency (Hz)	$B_C = I_C / V_C $ (peak/peak) (mS)		$ Y = I / V_S $ (peak/peak) (mS)		$\angle Y = \angle I - \angle V_S$ (degrees)	
	Theory	Meas.	Theory	Meas.	Theory	Meas.
160						
320						
800						
1100						
1600						
2200						
3500						
6500						

9. Using the *measured* values in Table 8, plot (**by hand**) the following figures using the graph paper attached at the end of the report: (1) B_C and $|Y|$ on the same plot versus source frequency; (2) $\angle Y$ versus source frequency; (3) I_C and I_R on the same plot versus source frequency.

10. For the above plots, state your conclusions under the plot?

Table 9

AC Source Frequency (Hz)	$ S $ (mVA)	$\angle S$ (degrees)	P (mW)	Q (mVAR)	PF value	PF lead or lag
	Measured	Measured	Measured	Measured	Measured	Measured
160						
320						
800						
1100						
1600						
2200						
3500						
6500						

12. Using the values in Table 9, plot (**by hand**) the following figure using the graph paper attached at the end of the report: P and Q on the same plot versus source frequency.

13. For the above plot, state your conclusions under the plot?

14. At what frequency the real power P is maximum? Why?

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15. At what frequency the magnitude of the reactive power $|Q|$ is maximum? Why?

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