

12<sup>th</sup> September 2011

# Title: Complex Power & Power factor improvement

Objective: To ~~clarify~~ familiarize with the concept of complex power, power factor and power factor correction.

Measurements / results:

Note: Value used for load 1 is  $16 \Omega$  and  $89.1 \text{ mH}$

Step	V (volt)	I (A)	P (W)	Q (var)	P.F	$\theta = \cos^{-1}(\text{P.F.})$
6.1a	19.92	0.528	5.7	8.8	0.545	$56.975^\circ$
6.1b	19.69	0.543	10.2	2.9	0.958	$16.665^\circ$
6.1c	19.22	0.968	15.1	10.7	0.814	$35.511^\circ$
6.1d	20.34	0.965	16.3	10.9	0.830	$33.901^\circ$
6.2a	19.38	0.818	15.4	3.7	0.976	$12.578^\circ$
6.2b	19.31	0.883	15.2	7.5	0.897	$26.234^\circ$

Step	Complex (Apparent) power (VA)		
	$S = P + jQ$	$S =  S  \angle \theta$	$S = VI^*$
6.1a	$5.7 + j8.8$	$10.48 \angle 57.1^\circ$	$19.92 \angle 0^\circ \times 0.528 \angle 57.0^\circ = 10.5 \angle 57.0^\circ$
6.1b	$10.2 + j2.9$	$10.60 \angle 15.9^\circ$	$19.69 \angle 0^\circ \times 0.543 \angle 16.7^\circ = 10.7 \angle 16.7^\circ$
6.1c	$15.1 + j10.7$	$18.51 \angle 35.3^\circ$	$19.22 \angle 0^\circ \times 0.968 \angle 35.5^\circ = 18.6 \angle 35.5^\circ$
6.1d	$16.3 + j10.9$	$19.61 \angle 33.8^\circ$	$20.34 \angle 0^\circ \times 0.965 \angle 33.9^\circ = 19.6 \angle 33.9^\circ$
6.2a	$15.4 + j3.7$	$15.84 \angle 13.5^\circ$	$19.38 \angle 0^\circ \times 0.818 \angle 12.6^\circ = 15.9 \angle 12.6^\circ$
6.2b	$15.2 + j7.5$	$16.95 \angle 26.3^\circ$	$19.31 \angle 0^\circ \times 0.883 \angle 26.2^\circ = 17.1 \angle 26.2^\circ$

$$|S| = \sqrt{P^2 + Q^2} \quad \theta = ?$$

6.1a) Voltage across load inductor =  $16.86 \text{ V}$

Current through load inductor =  $0.528 \angle (\cos^{-1} 0.545)$   
 $= 0.528 \angle -56.975^\circ$

$$Z = \frac{V}{I} = \frac{16.86}{0.528 \angle -56.975^\circ}$$

$$= 31.932 \angle 56.975^\circ$$

$$Z_L = j31.932 \sin(56.975^\circ)$$

$$j\omega L = j(0.83843)(31.932)$$

$$j(2\pi(50))L = j(0.83843)(31.932)$$