ECE 333 Green Electric Energy

Quiz 1

***Tuesday, September* 26, 2017**

Closed book, closed notes, calculators and cell phones are not allowed.

Show all you work and always indicate the units, as appropriate.

Duration: 20 minutes

Name: _____ **last 4 digits of your UIN:**_____

Problem 1: [100 points]

Circle the correct answer for each statement below –either True or False or *a*., *b*. or *c*..

(*i*) **[25 points]** Under the assumption that g = 10 m/s^2 , the power to lift up a 1 *kg* mass to a height of 6 *meters* in 2 *seconds* is 30 *Joules/sec*.

True_____ **False**_____

(*ii*) **[25 points]** The voltage levels 115, 138, 161 and 230 *kV* are considered to belong to the extra high voltage (*EHV*) classification.

True_____ **False**_____

(*iii*) **[25 points]** The total *US* installed wind capacity in 2016 is

a. 820 *MW* *b*. 8.2 *GW* *c*. 82 *GW*

(*iv*) **[25 points]** The global *PV* solar capacity installed by the end of 2016 is

a. 3.07 *GW* *b*. 30.7 *GW* *c*. 307 *GW*

Problem 2: [100 points]

Consider a circuit, where a 100–V source, rated at 3,000 VA, supplies a single–phase electric motor. An ammeter on the motor load indicates that the current is 20 A and lags by $\frac{\pi}{3}$ radians with respect its voltage.

(i) **[60 points] Evaluate** the power factor of the motor **load**. **Determine** the average value of the real power drawn by the motor **load**. **Draw** the power triangle of the **load** in the circuit. **Indicate the** real power, the reactive power, and the apparent power of the **load**.

SOLUTION:

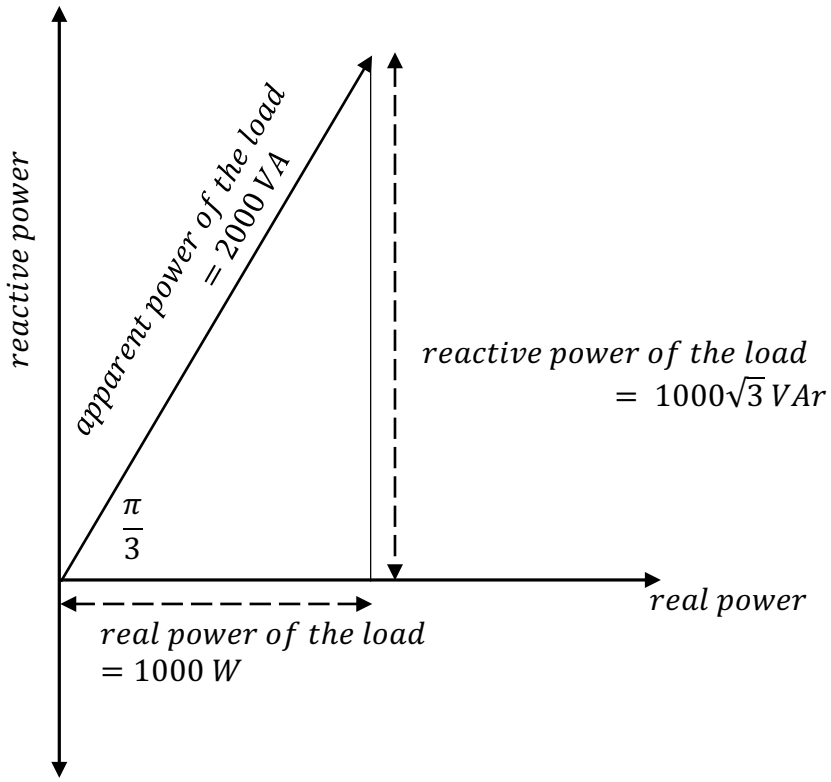
The power factor is calculated as

$$p.f. = \cos\left(\frac{\pi}{3}\right) = 0.5$$

Average value of the real power drawn by the motor load is

$$100\ x\ 20\ x\ 0.5 = 1000\ \text{W}$$

Power triangle of the load



(*ii*) **[40 points]** Assume that the source power factor equals that of the load, and there are no other elements in the circuit. Under these conditions, with the power factor maintained at its specified value determined in (*i*), **determine** the amount of additional load in *W* of the real power that the source can supply without the violation of its 3,000–*VA* rating.

SOLUTION:

Total load that the source can supply without the violation of its 3,000-VA rating is

$$3000\ x\ 0.5 = 1500\ W$$

Since it already supplies $1000\ W$, we subtract $1000\ W$ from $1500\ W$ and obtain

$$1500 - 1000 = 500\ W$$