

Electrical Power Engineering Fundamentals

Third partial exam (16th December 2019)

Note: Please read the questions carefully. All the information you need is written below. No questions will be answered related with the exam solution

Two balanced three phase loads are connected in parallel:

Load 1: Y connected, $S_1= 3000 \text{ VA}$, $\text{pf}_1= 0.4 \text{ ind}$

Load 2: Δ connected $S_2= 1500 \text{ VA}$, $\text{pf}_2= 0.8 \text{ cap}$

The loads are connected to a three-phase generator by means of a transmission line with impedance $3+9j \Omega$. The magnitude of the line voltage at the load end of the line ($A'B'C'$) is 400 V. The system is positive sequence and the frequency is 50 Hz.

Considering $U_{a'n'}$ as phase origin calculate:

- Phasors line current I_{aT} , I_{a1} , I_{a2} (1.5 pt)
- Impedance per phase of load 1 and load 2. (1.5 pt)
- Draw the one phase equivalent of the system (1 pt)
- Phasor U_{BC} and modulus of the voltage drop across the transmission line (1.5 pt)
- Explain how could the **reactive power of the two loads** be measured with one Wattmeter. Draw a diagram of the system indicating the point of the circuit where you need to connect the Wattmeter and the connections of it. Demonstrate your answer with a phasor diagram. Calculate the reading of the Wattmeter (1.5 pt)
- Calculate the active power absorbed in the transmission line and the complex power delivered by the generator(1.5 pt)
- Explain what element or elements should be added to the system and where should they be connected to minimize the complex power absorbed by the transmission line. Calculate the complex power absorbed by the line in that case (The line voltage at $A'B'C'$ remains constant) (1.5 pt)

