



Electrical Power Engineering Fundamentals

Third partial exam (3rd May 2018)

Three balanced three phase loads are connected in parallel:

Load 1: Y connected, with an impedance of $400+j300 \Omega$ per phase,

Load 2: Δ connected with an impedance of $2400-j1800 \Omega$ per phase

Load 3: Absorbs 172.8 kW and 2203.2 kVAr

The loads are fed from a distribution line with an impedance of $2+16j$ and the magnitude of the line voltage at the load end of the line (A'B'C') is 72 kV and the $f=50$ Hz.

- Calculate the impedance per phase of Load 3
- Draw the one phase equivalent of the system.
- Calculate the magnitudes of the phase and line currents absorbed by each load and the total line current absorbed by the whole system as a phasor.
- Calculate the voltage drop across the distribution line and the line voltage (phasor) at the sending end of the line (ABC).
- Calculate the complex power absorbed by the system, by the distribution lines and by the loads.
- Calculate the percentage of the apparent power that is absorbed by the loads (i.e. the efficiency of the system).
- Would it be possible to improve the efficiency of the system by compensating the reactive power? (Explain your answer). Calculate the values of the elements that must be connected to the system and where should they be connected obtain the higher possible efficiency. Draw a diagram indicating the layout of the system.
- Considering that the line voltage at the loads remains unchanged after the compensation calculate the new efficiency of the system.

