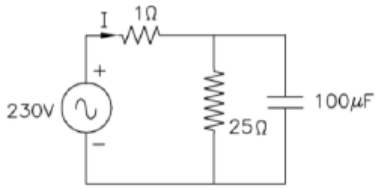
EE2029 Introduction to Electrical Energy Systems

(Tutorial on AC Power)

1. A load consists of a 25 Ω resistor connected in parallel with a 100 μF capacitor. Power is delivered to the load over a short transmission line of resistance 1Ω from a 230 volts source as shown below. Find the apparent power delivered to the load and power factor of the load. Also determine the apparent power supplied by the source. Assume ω = 377 rad/s.

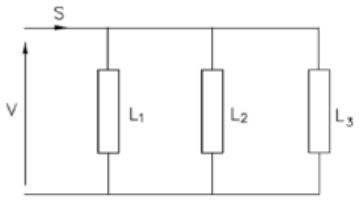


Ans: $|S_{load}|$ = 2686 VA; $|S_{source}|$ = 2794 VA

2. A load connected across a 500 V, 50Hz line draws 25 kW at 0.5 power factor lagging. Determine the current drawn by the load. A capacitor C is now connected in parallel with the load to improve the power factor. What must be the value of C to make the overall power factor 0.95 lagging?

Ans: 448.2 μF

3. The power consumption of loads L1, L2 and L3 connected in parallel as shown below, is respectively 5 kW at 0.8 p.f. lagging, 10 kW at 0.6 p.f. lagging and 15 kW at 0.8 p.f. leading. Determine the total complex power delivered by the source. What is the power factor of the circuit as seen by the source?



Ans: 0.982 lagging

4. A load connected across a 200 V, 50Hz line draws 10 kW at 0.5 power factor lagging. Determine the current delivered by the source.
If a capacitor of 1000μF is connected in parallel with the load, what will be the current drawn from the source? Also, determine the overall power factor of the system (load and the capacitor connected in parallel) as seen by the source.

Ans: 0.902 lagging

5. An industry draws 1500 kW of power at 500V from a substation over a transmission line having a resistance of 0.005Ω and a reactance of 0.01Ω. Determine the current flow from the substation if the power factor of the industrial load is 0.6 lagging. What would be the current flow if the power factor could be improved to unity? Compare the transmission line losses in both the cases. Ignore the voltage drop across the transmission line.

Ans: $|I_1|$ = 5000 A; $|I_2|$ = 3000 A