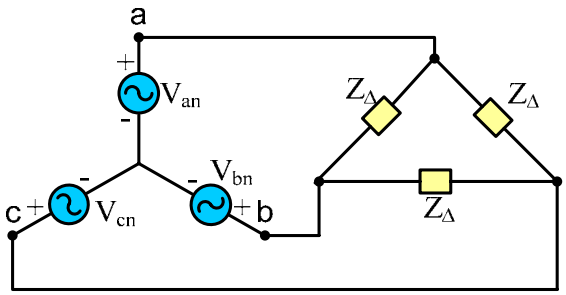
King Fahd University of Petroleum & Minerals
Electrical Engineering Department
EE360: Electrical Energy Engineering

Problem Session 1 **071**

Problem 1:

A Δ-connected load consists of three identical impedances of $Z_\Delta = 20 \angle -30^o\ \Omega$ each and is supplied from a three-phase, 208-V source. (use **Van** = $120\angle 0^o$)Calculate:

(a) magnitudes and angles of each phase voltage and current on the load side.
(b) magnitude and angles of each line voltage and current.
(c) the load power factor
(d) the real, reactive and apparent power taken by the load.



Problem 2:

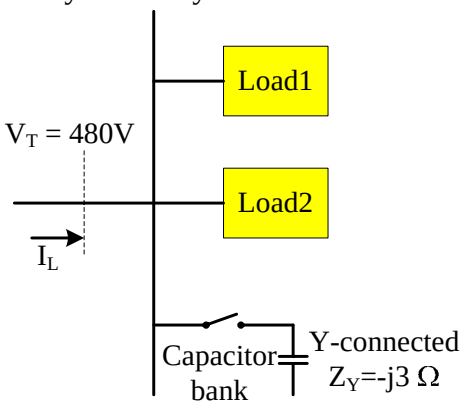
Fig. 2 shows a small 480-V distribution system. The power system supplies a constant line voltage of 480 V, and the impedance of the distribution line is negligible. Load 1 is Δ-connected with phase impedance of $10\angle 30^o\ \Omega$, and load 2 is Y-connected with a phase impedance of $2.5\angle 36.9^o\ \Omega$.

Part I if the switch shown is open, find:

(a) The real and reactive powers of each load.
(b) The total real and reactive powers supplied by the utility.
(c) The power factor of each load and the power factor of the overall system.
(d) The line currents supplied by the utility.

Part II if the switch shown is closed, find:

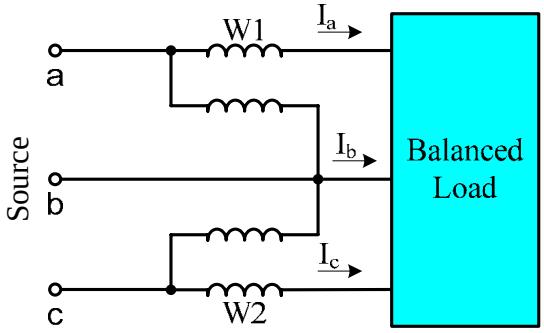
(e) The total real and reactive powers supplied by the utility.
(f) The overall power factor.
(g) The line currents supplied by the utility.



Problem 3:

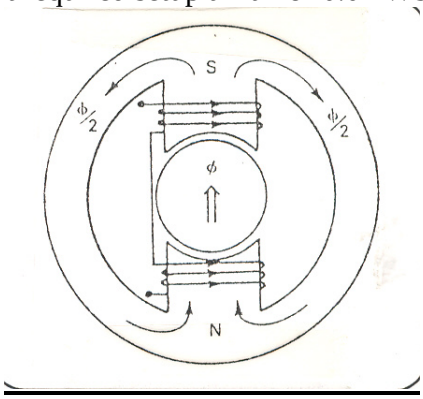
The two-wattmeter method is applied to measure the total power consumed by a three-phase Δ-connected inductive load at 120 V. With the meters connected to line A and C, W1 = 460 W and W2 = 920 W. Find:

(a) the total real and reactive power absorbed by the load.
(b) The total power factor.
(c) The phase current.
(d) The phase impedance of the balanced load.



Problem 4:

The shunt-field winding of a dc two-pole machine has 1200 turns, shown in Figure 4. The magnetic flux path has a net cross-sectional area of 200 cm2. The iron portion has a mean of left and right legs of 20 cm and the center portion of 10 cm, and there are two air gaps, each 0.1 cm in length. The magnetization curve for cast steel may be taken to apply through out the iron circuit. Determine the shunt field current required setup a flux of 0.02 Wb in the air gaps.

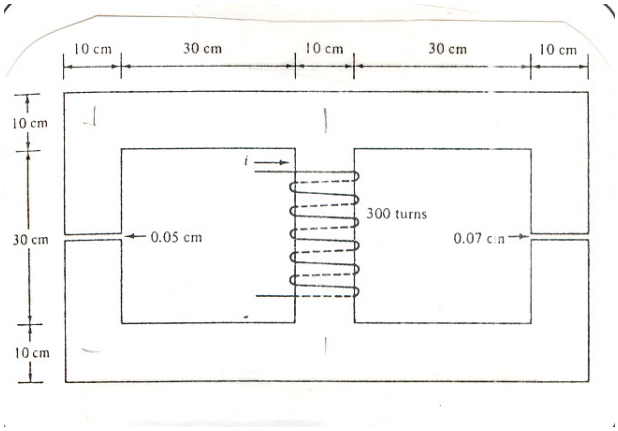


Problem 5:

A ferromagnetic core with a relative permeability of 2000 is shown in Figure 5. The dimensions are shown in the diagram, and the depth of the core is 7 cm. The air gaps on the left and the right sides of the core are 0.05 cm and 0.07 cm, respectively. Because of the fringing effects, the effective area of the air gaps is 5% larger than their physical size. If there are 300 turns in the coil wrapped around the center leg of the core and if the current in the coil 1.0 A:

What is the flux in each of the left, center, and right legs of the core?

What is the flux density in each air gaps?



Problem 6:

The total core losses (hystresis and Eddy currents) for a transformer are found to be 600 W at 30 Hz and 240 V. When the frequency is increased to 50 Hz and the voltage increased to 480 V the total core losses become 1500 W.

Find the hystresis and Eddy current losses for both cases. (Assume V ∝ f B)