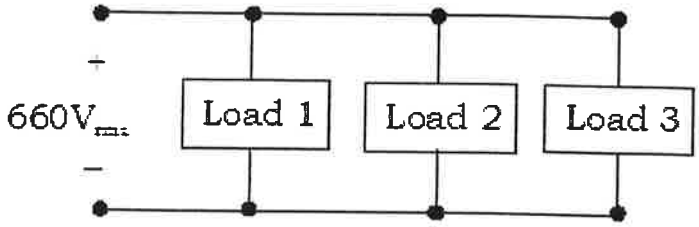
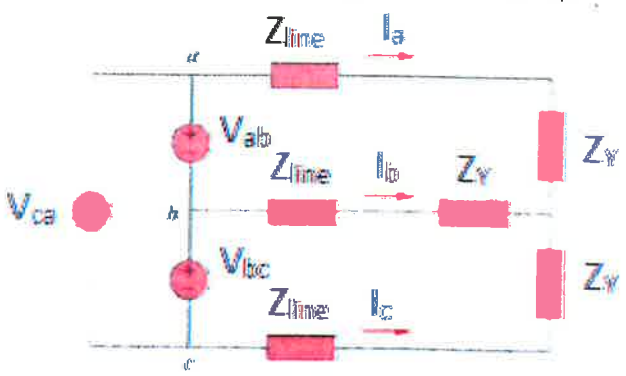
PRAIRIE VIEW A&M UNIVERSITY
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
PRELIMINARY EXAMINATION (SPRING 2017)
POWER ENGINEERING

**1. (20 points)** Three loads are connected in parallel across a 660-V (rms), 60 Hz line as shown in figure below. Load 1 absorbs 18 kW and 10 kVAR. Load 2 absorbs 6 kVA at 0.96-pf lead. Load 3 absorbs 22.4 kW at unity power factor. (a) Find the total complex power, $S_T$, (b) determine the power factor of the combined loads, pf, (c) Calculate the value of the capacitance, C, connected in parallel across the loads that will raise the power factor to 0.9 lagging.




$S_T$ = _____ pf = _____ C = _____

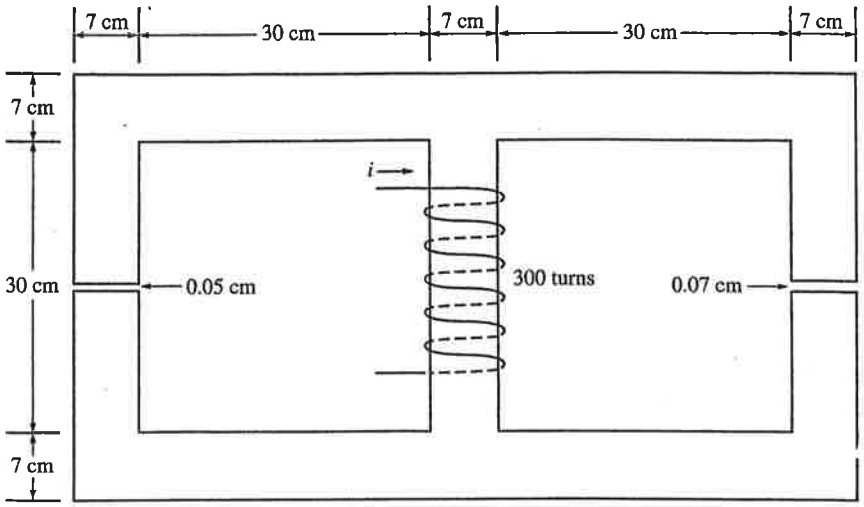
**2. (20 points)** In the circuit shown below, if $\mathbf{V}_{ab} = 210 \angle 30°$ V rms, $\mathbf{V}_{bc} = 210 \angle -90°$ V rms, $\mathbf{V}_{ca} = 210 \angle -210°$ V rms. The transmission line impedance per phase is $Z_{line} = 1+j1\ \Omega$, and load impedance per phase is $Z_Y = 11+j4\ \Omega$, (a) find the magnitude of the line current, $I_a$, (b) determine, $P_{line}$, the total power lost in the transmission line (c) calculate $P_{load}$, the total power dissipated by the three-phase load. (d) What is the total complex power supplied by the three phase source, $S_{3ps}$.



$I_a$ = _____ $P_{line}$ = _____ $P_{load}$ = _____

$\mathbf{S_{3ps}}$ = _____

3- A Ferromagnetic core with a relative permeability of 1500 is shown in Figure below. The dimensions are as shown in the diagram, and the depth of the core is 7 cm. The air gaps on the left and right sides of the core are 0.070 and 0.020 cm, respectively. Because of fringing effects, the effective area of the air gaps is 5 percent larger than their physical size. If there are 800 turns in the coil wrapped around the center leg of the core and if the current in the coil is 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 gap?



4- A 20 kVA, 2500/250 V, 50Hz, single-phase transformer gave the following test result:
Open-circuit test: 250V, 1.5A, and 100 watts measured on the low voltage side
Short-circuit test: 100V, 8A, and 320 watts measured on the on high voltage side
a) Compute the parameters of the equivalent circuits and draw the equivalent circuit of the transformer showing all the values.
b) Calculate the equivalent circuit of the transformer in per unit.

5- The separately-excited dc motor of Fig. X5.4 was operated at no-load and the following data were recorded:

$$\omega_m = 1000\pi/30 \text{ rad/s} \qquad I_a = 0.95 \text{ A} \qquad V_t = 240 \text{ V} \qquad V_B = 150 \text{ V}$$

The field voltage ($V_B$) is unchanged, but the motor is loaded so that it supplies an output power $P_s = 10$ HP at 1000 rpm to a coupled mechanical load. At this load point, determine (*a*) the rotational losses, (*b*) the armature current, (*c*) the terminal voltage, and (*d*) the efficiency. Neglect armature reaction.

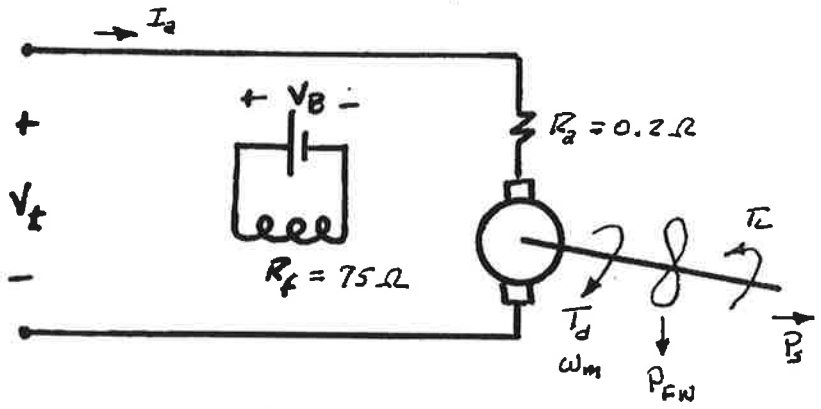



Fig. X5.4