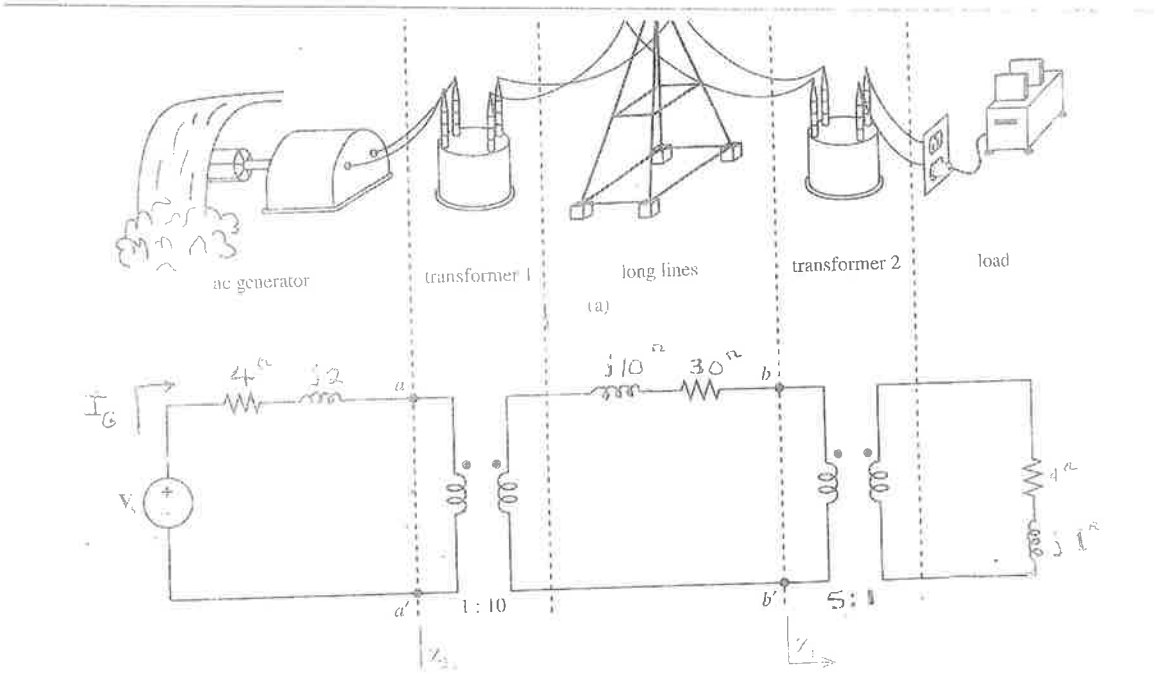
PRELIMINARY EXAM 2019

Power Engineering

1- A single phase power system consists of a 60 Hz generator voltage source V_s with impedance $\mathbf{Z_G} = 4 + j2$ ohms supplying a load $\mathbf{Z_{Load}} = 4 + j1$ ohms through a transmission line of impedance $\mathbf{Z_{line}} = 30 + j10$ ohms. For the circuit shown in the following diagram, determine

(a) Value of the Generator voltage $\mathbf{V_G}$ if the Current $\mathbf{I_G} = 30 + j10$ amps using impedance transfer method ($Z' = a^2 Z_L$)
(b) Value of $\mathbf{I_{line}}$ current



2- In the following circuit with impedances as shown and a generator voltage of 120 volts, determine the values of

a) Total impedance Z_T for the circuit
b) Generator current I_G
c) The real and reactive power supplied to the circuit by the voltage source
d) Power factor at the source.
e) Find K and energy stored in the coupled inductors of figure 2 at t= 1 sec

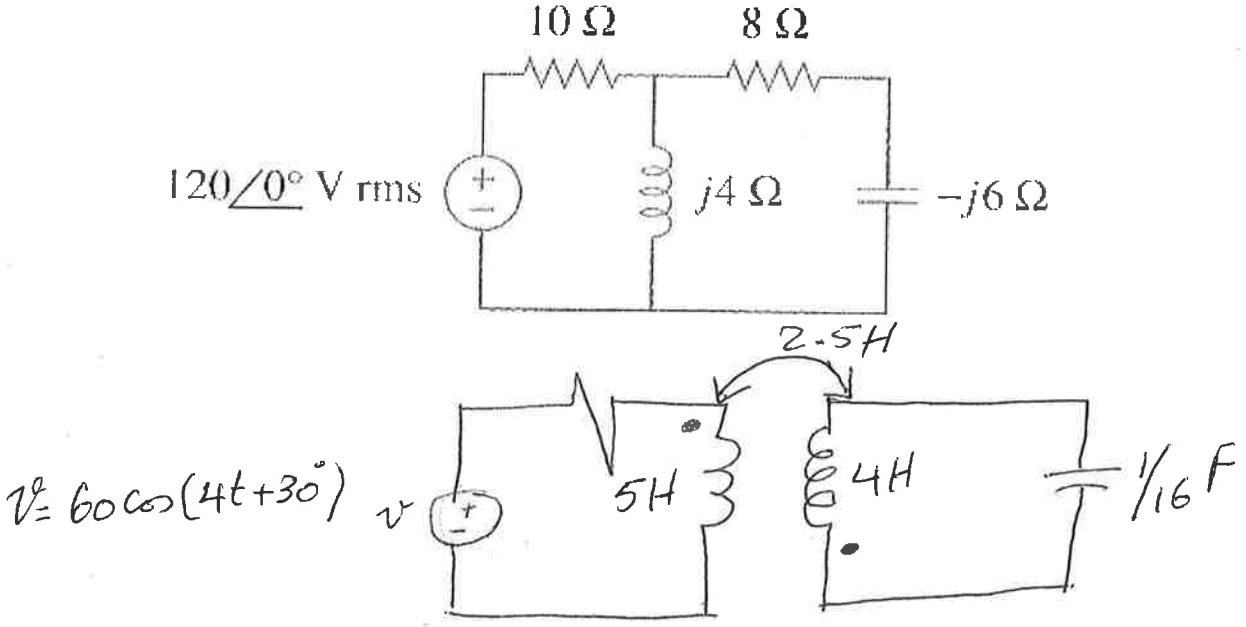
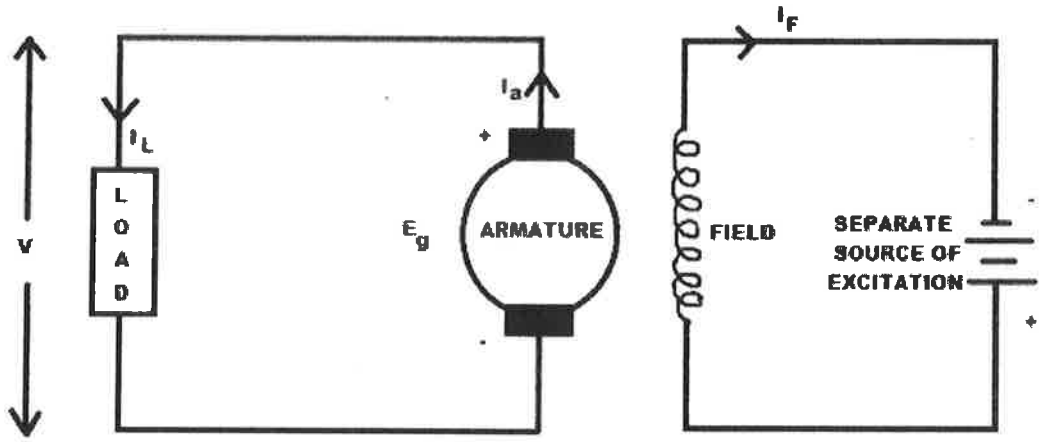


figure 2

3- A separately excited D.C. generator has armature circuit resistance of 0.3 ohm and the total brush-drop is 4 V. When running at 1200 r.p.m., it delivers a current of 110 A at 250 V to a load of constant resistance. If the generator speed drop to 900 r.p.m., with field-current unaltered,

f) find the current delivered to load.

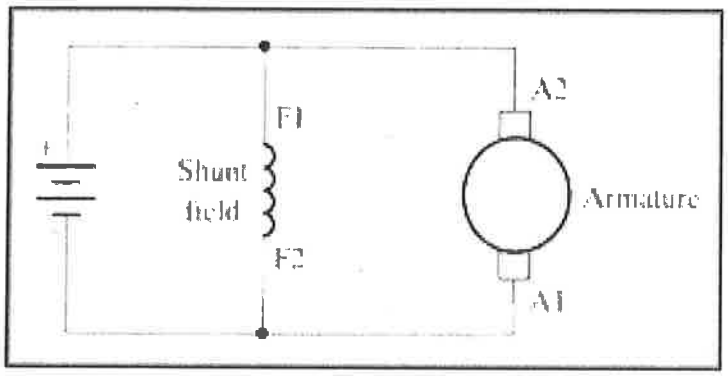
g) with what load resistance will the current be 110 amp, at 900 r.p.m.?



Separately excited DC generator

4- A 4-pole, 220 V, wave connected shunt motor gives 1200 kW when running at 1200 r.p.m. and drawing armature and field currents of 50 A and 1.0 A respectively. It has 580 conductors. Its resistance is 0.1 Ω . Assuming a drop of 2 volt per brush, find (a) total torque (b) useful torque (c) useful flux / pole (d) rotational losses and (e) efficiency.

5-



5- A 50-h.p. (37.3 kW), 480-V d.c. shunt motor running light as shown in problem 2 takes a current of 5 A and runs at a speed of 800 r.p.m. The resistance of the armature circuit (including brushes) is 0.5Ω and that of the shunt field circuit 300 Ω. Determine when the motor is running at full load (i) the current input (ii) the speed. Determine the armature current at which efficiency is maximum. Ignore the effect of armature reaction.