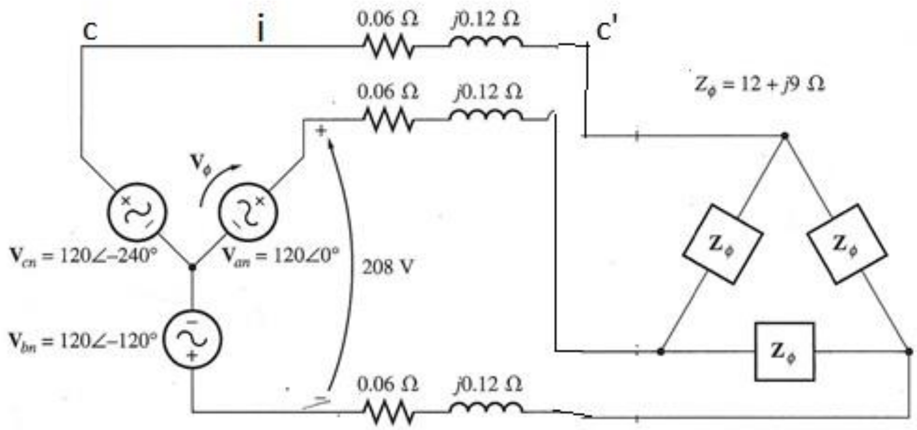
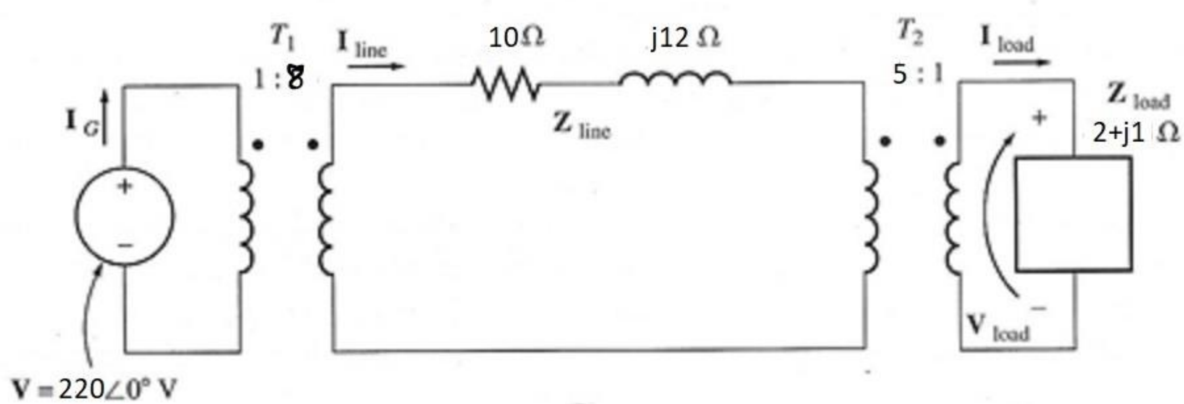
Question 1 (15)

Determine the value of the current i in the c to c' line segment. The load is a balanced Delta load of impedance 12 + j9 ohms. Line impedance is 2 + j3 ohms not 0.06+J0.12 Ω.



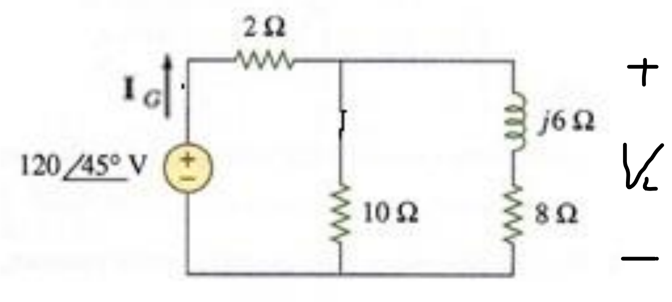
Question 2 (15)

A single-phase power system consists of a 220-V 60 Hz generator supplying a load $Z_{Load} = 2 + j1\Omega$ ohms through a transmission line of impedance $Z_{Line} = 10 + j12\ \Omega$. Having one step up transformer of ration 1:8 and one step down transformer of ratio 5:1. Derive the value of the generator current I_G



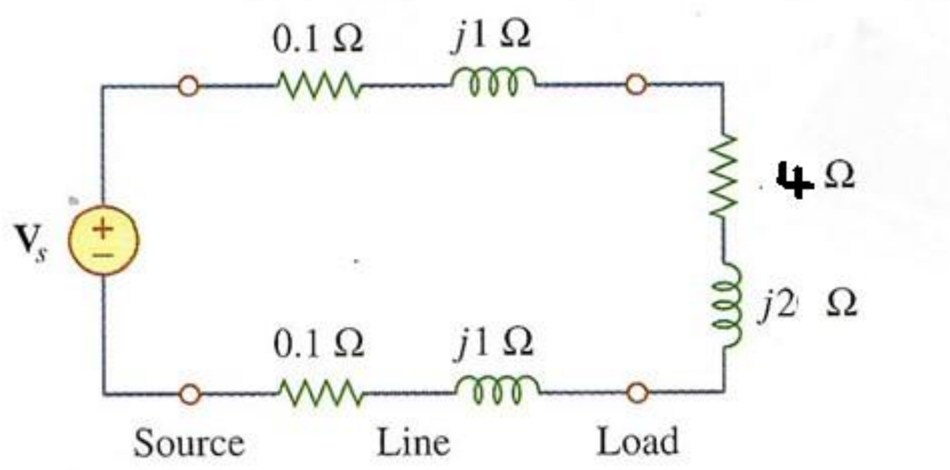
Question 3 (15)

Solve for the current I_G as generated by the voltage source, Power dissipated at 10 Ω resistor, and the load voltage V_L across the 8 +j6 Ω impedance in the following circuit.



Question 4 (15)

A power transmission system is modeled as shown in the following figure
If Vs = 240 V at 0 degrees rms, find the power absorbed by the load.



Question 5 (15)

A permanent magnet DC motor is connected to a 250 Volt (DC) source. Running ’light’ (no mechanical load), it draws negligible current and turns at a speed of 500 Radians/second. The armature circuit of the machine has a resistance of one Ω. Now the machine is loaded so that it is driving a load torque of 200 N-m, still connected to the 250 VDC source.

1. How much current is it drawing?

2. How fast is it turning?

Question 6 (25)

A train is driven by a DC machine with independent electrical excitation. At a speed of 1500 rpm, the following magnetization characteristic has been measured.

EA (V)	50	420	780	950	1120	1180	1260
IF (A)	0	4	8.0	10.0	12.8	14.4	28.8

a) Sketch the equivalent circuit of the DC machine.

b) Why is a voltage induced in the armature when the excitation current is zero?

c) Why does the induced voltage at high excitation currents not increase proportional to the excitation current?

The machine runs at 1500 rpm and the train has a speed of 20 m/s. The armature terminal voltage is 790 V. The current is 50 A. The armature resistance is 0.2Ω.

d) Calculate the product of the motor constant and the pole flux KΦ in this operating point.
e) Calculate the torque.
f) In a train application, how does the load torque change as a function of speed?

The excitation current is halved while the terminal voltage remains constant. It can be assumed that the motor constant K remains constant. After some time, a new steady state situation is reached.

g) Give an estimate of the new speed of the motor (in rpm).