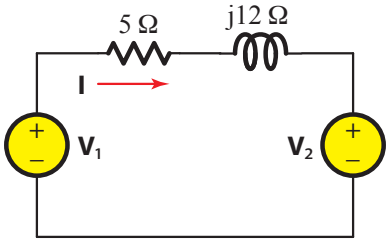
University of Calgary
Department of Electrical and Computer Engineering

ENGG 225 - Fundamentals of Electrical Circuits and Machines
Winter, 2017

Problem Assignment #9

This assignment will not be graded. Solutions are posted on D2L. We encourage all students to attempt these problems as good practice for the final exam!

1. **[2 marks.]** Determine the power for each element, including the sources in the circuit below. Also, state whether each element is delivering or absorbing average power. For this problem, $\mathbf{V}_1 = 260\sqrt{2}\angle 50°$, and $\mathbf{V}_2 = 220\sqrt{2}\angle 30°$.



2. **[2 marks.]** A 60-Hz 220-V-rms source supplies power to a load consisting of a resistance in series with a capacitance. The average power in the load is 2000 W, and the apparent power is 2500 VA. Determine the value of the resistance in Ohms and the value of the capacitance in Farads.

3. **[2 marks.]** A certain motor has an induced armature voltage of 200 V at $n_{m1} =$ 1200 rpm. Suppose that this motor is operating at a speed of $n_{m2} = 1500$ rpm with a developed power of 5 HP. Find the armature current and the developed torque.

4. **[2 marks.]** A permanent magnet DC motor has $R_A = 7\ \Omega$, $V_t = 240$ V, and operates under no-load conditions at a speed of 1500 rpm with $I_A = 1$ A. A load is connected and the speed drops to 1300 rpm. Determine the efficiency of the motor under loaded conditions. Assume that the losses consist solely of heating of R_A and frictional torque loss that is independent of speed.

5. **[2 marks.]** A certain shunt-connected DC motor has $R_A = 1\ \Omega$, a *total* field resistance $R_F = 200\ \Omega$, and $V_T = 200$ V. At a speed of 1200 rpm, the rotational losses are 50 W and $E_A = 175$ V. Find the no-load speed in rpm.

6. **[2 marks.]** A shunt-connected motor delivers an output power of 24 HP at 1200 rpm while operating from a source voltage of 440 V and drawing $I_L = 50$ A. The resistances are $R_A = 0.05\ \Omega$ and the total field resistance is $R_F = 100\ \Omega$. Find the developed torque and motor efficiency.