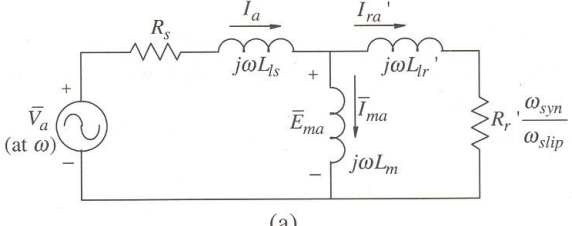| Problem **1**	Calculate the equivalent-circuit parameters of a transformer, if the following open circuit and short-circuit test data is given for a 60 Hz, 50-kVA, 2400:240 V, distribution transformer:
10 points	open-circuit test with high-side open: $V_{OC} = 240$ V, $I_{OC} = 5.0$ A, $P_{OC} = 400$ W, short-circuit test with low-side shorted: $V_{SC} = 90$ V, $I_{SC} = 20$ A, $P_{SC} = 700$ W.

Problem **2**	Consider a permanent-magnet dc-motor with the following parameters: $R_a = 0.35$ Ω, $L_a = 1.5$ mH, $k_T = 0.5$ Nm/A, $k_E = 0.5$, V/(rad/s), $J_m = 0.02$ kgm^2 The motor is driving a load at speed of 1,500 rpm. The load is purely inertial with an inertia of 0.04 kgm^2. The motor is slowing down to 750 rpm, while the current is kept at 10 A. Calculate: a) Braking torque b) Power loss in the armature c) Energy loss while braking d) Energy recovered to the voltage source.
10 points	

Problem 3	 (a) In a 2-pole, 208 V (line-to-line, rms), 60-Hz, motor, $R_s = 0.5$ Ω, $R'_s = 0.45$ Ω, $X_{ls} = 0.6$ Ω, and $X'_{lr} = 0.83$. The magnetizing reactance $X_m = 28.5$ Ω. This motor is supplied by its rated voltages. The rated torque at the slip s = 0.04. At the rated torque and slip, calculate: a) equivalent impedance b) the input rms current, c) the power factor, d) the rotor power loss, e) the speed of the rotor in rpm.
10 points	

The questions:

Question **1** 2 points	What are the names of the different powers and what are there quantities? What is the power triangle?
Question **2** 2 points	Explain the working of a simple controlled rectiefier. How do you calculate the output voltage of a single phase controlled rectifier? How do you calculate the output voltage of a three phase controlled rectifier?
Question **3** 2 points	A Crane on the board of the ship is driven by a DC motor: 1. In how many quadrants operates the crane ? 2. In which quadrant can a thyristor rectifier operate ? 3. Draw the scheme for a converter for more quadrant operation based on thyristor technology and supplied from a one phase network. 4. How are converters connected to achieve four quadrant operation.
Question **4** 2 points	Describe the operating of a single-phase-power-factor corrected circuit. What is the relation between the supply voltage and dc-bus voltage? Plot the switching current in the inductor (i_L).
Question **5** 2 points	An single phase rectifier with diodes is connected to a source of 230 V / 50 Hz, the load is a resistor. What is the average value output voltage without a capacitor? [in V] What is the average value output voltage with an very large capacitor? [in V]