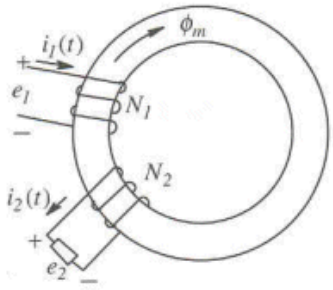
Problem **1** 10 points	A balanced three-phase load is supplied to a balanced three-phase voltage source with a phase voltage of 120 V_{eff} The load draws a total load of 10 kW at a power factor of 0.9. Assuming a wye-connected load, calculate: 1) the rms value of the phase current, 2) the per-phase load impedance, 3) draw a phasor diagram showing all three voltages and currents. Repeat this calculations for a delta-connection load. 4) the rms value of the phase current, 5) the per-phase load impedance, 6) draw a phasor diagram showing all three voltages and currents.

Problem **2** 10 points		Transformer: NI/N2 = 3 Neglecting the winding resistances, leakage inductances and core loss. For winding 1: V = 220 V, f = 50 Hz, the magnetizing current is 1.0 A (rms). For winding 2 : The load exist of a resistor of 0.953 Ω and an inductor of 0.55 Ω in series. Calculate: 1. the amplitude and phase of $\bar{I}_2$ 2. the amplitude and phase of $\bar{I}_1$

Problem 3 10 points	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 Problem 1: The rated torque of this motor is 4 Nm. Plot the steady state torque-speed characteristics for V_a = 100 V en V_a = 60 V. Problem 2: The same motor is operating in steady state with a speed of 300 rad/s. the load is purely inertial with an inertia of 0,04 kg.m^2. at some instant, its speed is to decrease linearly and reverse to 100 rad/s in a total of 4 s. Neglect L_a and friction. Calculate and plot the required current and the resulting voltage v_a that should be e applied to armature terminals of this machine. As intermediate steps, calculate and plot e_a, the required electromagnetic torque T_{em} from the motor, and the current I_a.

The questions:

Question **1** 2 points	1. What are the names of the different powers and what are there quantities? 2. What is the power triangle?
Question **2** 2 points	1. Draw a 'converter pole'. 2. In how many quadrants does is work and with one.
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	1. Describe the operating of a single-phase-power-factor corrected circuit. 2. What is the relation between the supply voltage and dc-bus voltage? 3. 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. 1. What is the average value output voltage without a capacitor? [in V] 2. What is the average value output voltage with an very large capacitor? [in V]