

## TD4 – Three-Phase System

### Exercise 1:

On a network (230 V / 400 V, 50 Hz) without a neutral, three identical capacitive receivers are connected in a star configuration. Each receiver consists of a resistance  $R = 20 \Omega$  in series with a capacitance  $C = 20 \mu\text{F}$ .

1. Determine the complex impedance of each receiver. Calculate its modulus and argument.
2. Determine the RMS value of the line currents, as well as their phase shift with respect to the phase voltages.
3. Calculate the active and reactive powers consumed by the three-phase receiver, as well as the apparent power.

### Exercise 2

Three single-phase, purely resistive receivers are connected in a delta configuration to a 220/380V 50Hz network. Under 380V, they each consume 5.7 kW.

1. Calculate the current in each receiver and the current in a line wire.
2. The receiver connected between phases 2 and 3 is disconnected. Determine the various line currents.
3. The three receivers are now connected in a star configuration. Calculate the total active power and compare it to the total active power in the case of a delta connection.

### Exercise 3

A three-phase 220/380V 50Hz installation includes:

- A motor with a useful power of 8 kW, an efficiency of 85%, and a power factor of 0.8.
- A set of 60 lamps rated 220V 100W each.

1. How are the lamps connected?
2. Calculate the line current and the power factor of the whole system.
3. Calculate the capacitance of capacitors connected in a delta configuration that improves the power factor to unity.

### Exercise 4

Two balanced three-phase receivers are supplied by a 220/380V 50Hz network. Motor  $M_1$  is inductive. Receiver  $M_2$  is capacitive such that  $P_2 = 3750\text{W}$  and  $\cos\varphi_2 = 0.866$ . The total active power measured using two wattmeters is:  $P_a = 12100\text{W}$  and  $P_b = 6900\text{W}$ .

1. Calculate  $P_t$ ,  $Q_t$ ,  $\cos\phi_t$ , and the line current  $I_t$ .
2. Calculate  $P_1$ ,  $Q_1$ , and  $\cos\phi_1$ .
3. Each line wire has a resistance  $r = 0.48 \Omega$  and a reactance  $l\omega = 0.22 \Omega$ . Calculate the line-to-line voltage drop at the supply point.