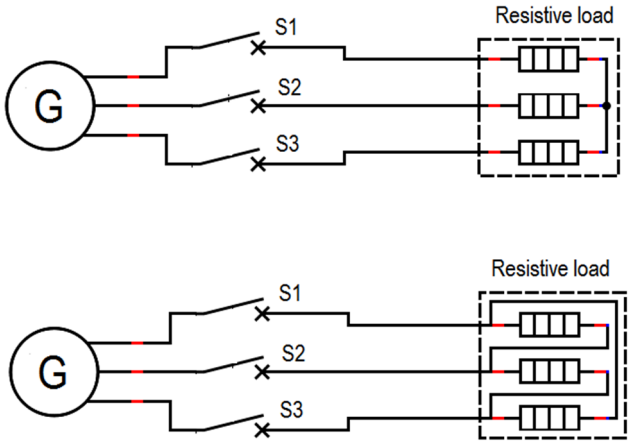
Electric Power Systems 2

Date:
Team (please fill in Your names):

Task 1 Single-phase outage in 3-wire network

Calculate phase currents I_{L1}, I_{L2} , I_{L3}; load (total) active power P and load reactive power Q in simple 3-phase system: generator G – switches (S1, S2, S3) – lines (non-impedance) – load (resistive electric heater). Parameters: phase-to-phase voltage 400 V; load resistance in single phase: 1 kW.

Your calculations should be performed for four cases: star-connected load and delta-connected load (the same resistors – figs.) and for each case: in normal conditions (all closed switches) and in emergency conditions (interruption in L3 phase – switch S3 open, S1 and S2 closed).



Compare and discuss the results – how many times has power changed for normal and emergency conditions (by star and delta connections)? Does work in the interrupted state threatens the equipment (from the current load point of view)?

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Task 2 Reactive power compensation

Get to know with laboratory equipment. Identify load models and their nominal parameters. Think about the physical interpretation of the model. Identify placement of meters. How is reactive power measured (analyse and explain configuration of watt-meters for reactive power measurement)?

For the existing load: does consumer have to pay for reactive power consumption to the DSO (according to Polish energy law)? How much reactive power should be compensated in order not to pay for over-reactive energy consumption? Calculate maximum and minimum amount of reactive power and needed value of capacitance.

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Task 3 Transformer efficiency

Design a measuring system to determine the transformer efficiency characteristics, i.e. the ratio of active power output and input (delivered to the transformer) as a function of the load current. Adjust the equipment, meters and draw a diagram to conduct the experiment.

Read the data plate of the tested transformer. At what parameters can the test be carried out? After checking the system and turning on the power supply by the tutor, collect the measurements, make calculations and draw the characteristic.

At what load current has the maximum efficiency been achieved?

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Task 4 Smart electrical system

Get to know with laboratory model of smart electrical installation in building. Identify load models, sensors, actuators, wiring and other equipment - their location, parameters and possibilities of control. Design own functional system (make project of connection between the devices). Bind selected modules according to instructions. Check the system operations in local mode and in remote mode. Using the software to make revision and change your project.

What are the differences between conventional and smart (intelligent) electrical installation? In witch circumstances smart electrical system will operate in efficient way?