

# ELEC-E8413 POWER SYSTEMS

EXAM 19.12.2016

1. Overcurrent protection of medium voltage distribution lines, including the relay settings.
2. Gas relay in transformer protection.
3. A transformer has the following name plate data: voltages 110/20 kV, rated power 25 MVA, no-load losses 21,8 kW, load losses 121 kW, short circuit impedance 10 %, magnetizing reactive power 0,45 %. Make the equivalent circuit of the transformer (at 20 kV level).
4. Explain different switching overvoltages when interrupting small inductive currents. What are the mitigation means against these overvoltages.
5. A 20 kV overhead line has positive sequence capacitance 10 nF/km and zero sequence capacitance of 4 nF/km. What is the phase-to-phase capacitance of the line per km?
6. The maximum heating of a conductor is 80 degrees, mass 145 kg/km, specific heat capacity 910 Ws/°C kg and resistance 0,673 ohm/km. Compute the maximum 1 second short circuit current.

**Answer only in five questions!**

Answers accepted in English, Finnish and Swedish.

Questions are available only in English.