ELG4125: Case Study

- Consider a power station that delivers a source with the voltage, V_s = 275 kV and current, I_s of 1200 A at 60 Hz to a city that is 420 km away from the power station.
- A transformer located 210 km away from the station was proposed to maintain the voltage at 220 kV as the minimum voltage delivered to the city, with a peak current, I_R, of 1000 A.

Midterm 1

- Design this above system taking into consideration the following:
  - Transmission line **characteristics** including efficiency and voltage regulation. Set up **specifications** for the transmission line in terms of conductors (resistance; inductance; capacitance); insulators; towers; etc. You may use tables A.3 and A.4 from the textbook for the above reason.
  - Substation/transformer turns ratio; configuration; and other specifications.
  - Provide appropriate drawings.

Midterm 2

- Based on Midterm 1 assignment provide all protection features to the above transmission system taking into consideration the following facts:
  - Protection against faults and lightning effects.
  - Provide type and rating of protection equipment.
  - Provide appropriate protection zoning.
  - Provide circuit diagrams of the proposed relays.
  - Briefly describe STATCOM (use the Internet).
  - Briefly describe SCADA (use the Internet).

Final Exam

Submit a 10-page portfolio on the day of the final exam.
The portfolio covers the entire case study.

- Basing on the case study: Continue designing the distribution and utilization system to provide electricity to the city. Take into consideration the following:
  - Specifications of the distribution substation including number and type of transformers; configurations; neutral grounding, etc.
  - The proposed topologies of distribution system for various types of loads: high- and low-density areas.
  - Protection system for feeders and laterals with technical specifications.
  - Capacitor banks: Read Example 14.3.
  - Specifications of utilization transformers.
  - Your design ends up with a typical home.
  - **Consider the following Example of a distributer as a problem to solve:**

Example

- A single-phase distribution line 2 km long supplies a load of 120 A at 0.8 pf lagging at its far end and a load of 80 A at 0.9 pf lagging at its midpoint. Both power factors are referred to the voltage at the far end. The impedance per kilometer (go and return) is 0.05 + j0.1 Ohm. If the voltage at the far end is maintained at 230 V, determine the following:
  - Voltage at sending end
  - Phase angle between the voltages at both ends.
  - Basing on current, classify the loads (residential, commercial, or industrial) and identify the protection requirements of the load.
  - Provide appropriate drawing.