Department of Electrical Engineering

Transmission Line Models-Worked Problems **Student name:**

- *Manually solve all problems!*
- *Write a MATLAB® code to solve the problems and verify your manual calculations!*
- *Turn in your manual solution along with the MATLAB® code plus the code results for 15 points added to your Exam1 grade. It must be attached to the Exam!*

1. A single-circuit 60-Hz high voltage power transmission line is 370 km (230 mi) long. The conductors are ***Rook*** with **flat horizontal** configuration and 7.25 m (23.8 ft.) conductor spacing. The load on the line is 125 MW at 100% power factor. Use attached Tables A3 to A5 to determine;

   a. The sending end voltage Vs
   b. The sending end current Is
   c. The sending end power Ps
   d. The percentage voltage regulation
   e. The transmission efficiency

Hint: All calculations are done at conductor temperature of 50^0C

2. Given that Ds for the ***Rook*** conductor is 0.0327 ft., and its resistance is $0.1603\Omega/mi$,determine;

   a. The phase inductance of the transmission line in mH/mi
   b. The line series impedance z in Ω/mi
   c. The line capacitance C_n
   d. The line shunt admittance y in Ω^{-1}/mi
   e. Compare the parameters obtained to the tabulated values

3. Repeat Problem (1) using the per-unit system. (Hint: Use 125 MVA and 215 kV as base values and then determine both the base current and base impedance)

4. A single-circuit 60-Hz high voltage power transmission line is 181 km (112.5 mi) long. The conductors are ***Dove*** with **flat horizontal** configuration and 7.25 m (23.8 ft.) conductor spacing. The load on the line is 70 MW at 100% power factor. Use attached Tables A3 to A5 to determine;

   a. The ABCD constants of the line
   b. The sending end voltage Vs
   c. The sending end current Is
   d. The sending end power Ps
   e. The percentage voltage regulation
   f. The transmission efficiency

5. Find the equivalent-π circuit **(equivalent to the long TL model)** for the power transmission line given in problem (1) and compare it with the **nominal-π circuit model** (Hint: calculate the % difference of the equivalent series impedance shunt reactance from the **nominal-π circuit** values. Please discuss your results!

6. A short 3-phase, 34-kV power transmission line delivers a load of 10-MW at a power factor of 0.9 lagging and 34-kV. If the series impedance of the line is 10+j15 Ω / *phase* calculate;

   a. The ABCD constants
   b. The sending end voltage Vs
   c. The sending end current Is
   d. The percentage voltage regulation
   e. The transmission efficiency