ECE 431 Homework #4 (Due – Wednesday March 04 2020)

Problem 4.1

The single-phase equivalent-circuit parameters for a three-phase induction motor in ohms-per-phase are

R_1=0.2 Ω, R_2'= 0.24 Ω, X_1= 1, X_2= 0.8, Ω, X_m= 80 Ω, R_c=300 Ω

For a slip of 3.5 percent, and a terminal voltage of 460 V, line-line, calculate:

a. The motor phase current and input real and reactive power
b. The mechanical output power and the power dissipated in the rotor. You may assume that the motor friction and windage losses are 300 W
c. The motor core loss and the motor efficiency

Problem 4.2

You have been asked to assess the suitability of an induction motor with the following parameters:

3-phase, 480V, 60Hz, 1170 rpm,
R_1=0.5 Ω, R_2'= 0.5 Ω, X_1= X_2'= 1 Ω, X_m= 100 Ω, R_c=300 Ω

The motor is required to drive a load given by $T_{load} = 150 + 0.5\ \omega_m$ Nm.

Use Thevenin equivalent and neglect mechanical losses in the motor.

a) Will the motor start?
b) What is the starting current?
c) At what speed and slip will it run?
d) What is the efficiency?
e) At what power factor will it operate?