

ECE 330 HW 11

IMPORTANT: Please treat HW11 as a homework assignment and please upload your solution by 10 A.M. on April 29th to Gradescope. We expect and trust that you will continue to show academic integrity. It is okay to discuss with fellow students, but you must submit your own solutions. Please continue to use Piazza to ask questions, but do not post solutions/answers on Piazza. Stay Safe!

Problem 1

A three-phase, six-pole, 60 Hz induction motor has an input of 240 kW. It runs at a slip of 0.05. Find the following:

- (a) rotor electrical frequency
- (b) rotor copper loss
- (c) mechanical speed in rpm
- (d) mechanical output in kW

Problem 2

The rotor copper loss of a three-phase, 60 Hz, four-pole induction motor is 3 kW and the rotor frequency $f_r = 6$ Hz. Find the actual mechanical speed of the motor and the mechanical power output in kW.

Problem 3

A 460 V (line-line), 60 Hz, three-phase, wye-connected, 4-pole induction motor is running at rated voltage, current, and speed. The actual machine speed is 1700 rpm. The stator resistance and leakage reactance may be neglected. When the motor runs at no load, the speed is approximately 1800 rpm and the stator line current (magnitude) is 6 A. The rotor resistance referred to the stator, R'_r , is 0.8Ω . The rotor leakage reactance referred to the stator, X'_{lr} , is 2.0Ω .

- (a) What is the frequency of the rotor currents at this operating point?
- (b) What is the rated line current?
- (c) What is the starting line current if started at full voltage?
- (d) What is the rated torque?

Problem 4

Partial answers are given for this question, but credit will only be given for a clear description of the steps; no credit will be given for just having the final answers.

A three-phase synchronous generator driven at 8000 rpm supplies an induction motor at 400 Hz. The induction motor has eight poles and runs at 5800 rpm. Find the following:

- (a) the number of poles in the generator (number of poles = 6)
- (b) the slip of the induction motor ($s = 0.0333$)
- (c) the frequency, f_r , of the rotor current in the induction motor ($f_r = 13.333$ Hz)