

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
ELECTRICAL ENGINEERING DEPARTMENT

EE 306 – Term 171

HW # 6: Induction Machines

Due Date:

UT Classes: December 26, 2017

MW Classes: December 27, 2017

Problem 1

A 480-V three-phase two-pole 60-Hz induction motor is running at a slip of 2.5 percent. Find:

- (a) The speed of the magnetic fields in revolutions per minute
- (b) The speed of the rotor in revolutions per minute
- (c) The slip speed of the rotor
- (d) The rotor frequency in hertz

Problem 2

A 50-kW, 460-V, 50-Hz, two-pole induction motor has a slip of 5 percent when operating a full-load conditions. At full-load conditions, the friction and windage losses are 700 W, and the core losses are 600 W. Find the following values for full-load conditions:

- (a) The shaft speed n_m
- (b) The output power in watts
- (c) The load torque τ_{load} in newton-meters
- (d) The induced torque τ_{ind} in newton-meters
- (e) The rotor frequency in hertz

Problem 3

The power crossing the air gap of a 60 Hz, four-pole induction motor is 25 kW, and the power converted from electrical to mechanical form in the motor is 23.2 kW.

- (a) What is the slip of the motor at this time?
- (b) What is the induced torque in this motor?
- (c) Assuming that the mechanical losses are 300 W at this slip, what is the load torque of this motor?

Problem 4

A 3 ϕ , 280 V, 60 Hz, 20 hp, four-pole induction motor has the following equivalent circuit parameters.

$$R_1 = 0.12 \, \Omega, \quad R_2' = 0.1 \, \Omega$$

$$X_1 = X_2' = 0.25 \, \Omega$$

$$X_m = 10.0 \, \Omega$$

The rotational loss is 400 W. For 5% slip, determine

- (a) The motor speed in rpm and radians per sec.
- (b) The motor current.
- (c) The stator cu-loss.
- (d) The air gap power.
- (e) The rotor cu-loss.
- (f) The shaft power.
- (g) The developed torque and the shaft torque.
- (h) The efficiency.