The Ohio State University
Department of Electrical Engineering

EE 341

Energy Conversion

Homework Set # 8

Print Your Name

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Solve the following problems:

1. 7-2, 7-4 (page 443), and 7-7 (page 444)

7-2 A 220-V three-phase six-pole 50-Hz induction motor is running at a slip of 3.5 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

7-4. A three-phase 60-Hz induction motor runs at 715 r/min at no load and at 670 r/min at full load.

(a) How many poles does this motor have?

(b) What is the slip at rated load?

(c) What is the speed at one-quarter of the rated load?

(d) What is the rotor's electrical frequency at one-quarter of the rated load?

7-7. A 208-V four-pole 60-Hz Y-connected wound-rotor induction motor is rated at 15 hp. Its equivalent circuit components are

$R_1 = 0.220\ \Omega$ $R_2 = 0.127\ \Omega$ $X_M = 15.0\ \Omega$

$X_1 = 0.430\ \Omega$ $X_2 = 0.430\ \Omega$

$P_{mech} = 300\ \text{W}$ $P_{misc} \approx 0$ $P_{core} = 200\ \text{W}$

For a slip of 0.05, find

(a) The line current I_L

(b) The stator copper losses P_{SCL}

(c) The air-gap power P_{AG}

(d) The power converted from electrical to mechanical form P_{conv}

(e) The induced torque τ_{ind}

(f) The load torque τ_{load}

(g) The overall machine efficiency

(h) The motor speed in revolutions per minute and radians per second