

Answer the following questions in your textbook, starting on p.347.

- 7-1. What are slip and slip speed in an induction motor?
- 7-3. Why is it impossible for an induction motor to operate at synchronous speed?
- 7-4 Sketch and explain the shape of a typical induction motor torque-speed characteristic curve.
- 7-5. What equivalent circuit element has the most direct control over the speed at which the pullout torque occurs?
- 7-9. Why is the efficiency of an induction motor (wound rotor or squirrel cage) so poor at high slips?
- 7-16. Two 480-V, 100-hp induction motors are manufactured. One is designed for 50-Hz operation. and one is designed for 60-Hz operation, but they are otherwise similar. Which of these machines is larger?
- 7-17. An induction motor is running at the rated conditions. If the shaft load is now increased, how do the following quantities change?
- Mechanical speed
 - Slip
 - Rotor induced voltage
 - Rotor current
 - Rotor frequency
 - Synchronous speed

Solve the following problems in your textbook, starting on p.348.

- 7-3 A 480-V three-phase four-pole 60-Hz induction motor is running at a slip of 0.025. Find:
 - The speed of the magnetic fields in revolutions per minute
 - The speed of the rotor in revolutions per minute
 - The slip speed of the rotor
 - 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.
 - How many poles does this motor have?
 - What is the slip at rated load?
 - What is the rotor's electrical frequency at one-quarter of the rated load?
 - What is the speed at one-quarter of the rated load?
- 7-5 A 50-kW 440-V 50-Hz two-pole induction motor has a slip of 6 percent when operating at full-load conditions. At full-load conditions, the friction and windage losses are 520 W, and the core losses are 500 W. Find the following values for full-load conditions:
 - The shaft speed n_m
 - The output power in watts
 - The load torque load τ_{load} in newton-meters
 - The induced torque τ_{ind} in newton-meters
 - The rotor frequency in hertz
- A three-phase 60-Hz two-pole induction motor runs at a no-load speed of 3580 r/min and a full-load speed of 3440 r/min. Calculate the slip and the electrical frequency of the rotor at no-load and full-load conditions. What is the speed regulation of this motor [Equation (4-57)]?

Answers

- 1800-rpm
 - 1755-rpm
 - 45-rpm
 - 1.5-Hz
- 10
 - 6.94-%
 - 708-rpm
 - 1.04-Hz
- 2820-rpm
 - 50-kW
 - 169-N·m
 - 173-N·m
 - 3-Hz
- 0.56-% 0.33-Hz 4.44-% 2.67-Hz 4.1-%