1.

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

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 $\tau_{load}$ in newton-meters

*(d)* The induced torque $\tau_{ind}$ in newton-meters

*(e)* The rotor frequency in hertz

# Homework 12

1. (a) $n = \frac{120f}{P} = \frac{120 \times 50}{6} = 1000\ r/min$

(b) $n_r = (1-s)n_s = (1-3.5\%) \times 1000 = 965\ r/min$

(c) $n_s = n - n_r = 1000 - 965 = 35\ r/min$

(d) $f_r = sf = 3.5\% \times 50 = 1.75\ Hz$

2. (a) $n_m = (1-s)n_s = (1-5\%) \times \frac{120 \times 50}{2} = 2850\ r/min$

(b) output power : 50kW

(c) $\tau_{load} = \frac{P_{out}}{\omega_m} = \frac{50 \times 10^3}{\frac{2\pi \times 2850}{60}} = 167.5\ N \cdot m$

(d) $\tau_{ind} = \frac{P_{conv}}{\omega_m} = \frac{P_{out} + P_{F\&W} + P_{core} + P_{misc}}{\omega_m} = \frac{50 \times 10^3 + 700 + 600 + 0}{\frac{2\pi \times 2850}{60}} = 171.9\ N \cdot m$

(e) $f_r = sf = 5\% \times 50 = 2.5\ Hz$