

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

ELECTRICAL ENGINEERING DEPARTMENT

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EE-360

Quiz 6

ser#:

I.D.:

Name:

A 3-phase, Y-connected, 220-V, 10-HP, 60-Hz, 6-pole induction motor has the following parameters in ohms.

$$R_1 = 0.294 \, \Omega, R_2 = 0.144 \, \Omega, X_1 = 0.503 \, \Omega, X_2 = 0.209 \, \Omega, X_m = 13.25 \, \Omega$$

The total friction, windage and core losses may be assumed to be constant at 403 W, independent of load. For a slip of 3%, determine:

- the rotor current, developed torque and developed power.
- the maximum developed torque and the corresponding speed.
- the starting torque and starting current.

Problem 1

EE 360,
Problem Session #5
Induction Motor

-I-

①	$V_1 = \frac{220}{\sqrt{3}} = 127 \text{ V}$ $P_{in} = 3V_1 I_1 \cos \phi = 3 \times 127 \times 77 \times 0.88$ $P_{in} = 25.8 \text{ kW}$	$P_{cu1} = 1033 \text{ W}$ $P_{cu2} = 1299 \text{ W}$ $P_{core} = 485 \text{ W}$ $P_{fdw} = 540 \text{ W}$
	$P_g = P_{in} - P_{cu1} - P_{core} = 25.8 \times 10^3 - 1033 - 485$ $P_g = 24.3 \text{ kW}$	
②	$T_d = \frac{P_g}{\omega_s}, \quad \omega_s = \frac{2\pi n_s}{60}, \quad n_s = \frac{120 \times 60}{P} = \frac{120 \times 60}{4} = 1800 \text{ rpm}$ $\omega_s = \frac{2\pi \times 1800}{60} = 188.5 \text{ rad/sec}$ $T_d = \frac{24.3 \times 10^3}{188.5}$ $T_d = 128.9 \text{ N-m}$	
③	$S = \frac{P_{cu2}}{P_g} = \frac{1299}{24.3 \times 10^3} \Rightarrow S = 0.0534$ $S = 5.34\%$	