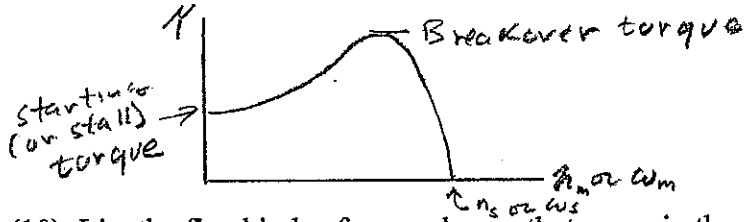
ECE 252 **Introduction to Electrical Engineering** **Quiz 19P**
100 Points **Show your work.** **Practice** Solution

1. (10) Sketch and label the speed-torque curve for a three-phase induction motor.



2. (10) List the five kinds of power losses that occur in three-phase motors.
I^2R copper loss, Eddy current loss, hysteresis loss, friction loss, windage loss

3. (10) Why is it dangerous if the field is removed from a shunt-connected motor?
The flux in the field will decrease toward 0, and the back EMF will be greatly reduced. The armature current and speed of the motor will increase. The motor could burn out or explode.

4. (5) A rheostat in series with a shunt-connected field winding can be used to adjust motor speed.

5. (10) Describe the rotor of a squirrel cage induction motor.
It's a series of aluminum bars shorted together on their ends by circular rings. The space between the bars is laminated iron to contain the flux. No wires are connected to the rotor.

6. (5) Define pull-out torque.
Pull-out torque is the maximum rated torque of the machine.

7. (5) NEMA stands for National Electrical Manufacturers' Association.

8. (5) Give an example of a type of machine that uses slip rings.
Three phase synchronous motor, wound-rotor induction motor

9. (40) The nameplate data for an induction motor is as follows: HP 8, VOLTS 230, PH 3, HZ 60, RPM 1750, POWER FACTOR 87.6, GUARANTEED EFFICIENCY 91.7, DUTY CONT. Find the electrical input power absorbed by the motor under full load, the line current, the output angular velocity, and the torque. What would you expect for the no-load speed of this motor?

$P_{out} = 8\,HP = 8\,HP \times 746\,W/HP = 5.968\,kW$

$P_{in} = P_{out}/\text{efficiency} = 5.968/.917 = 6.508\,kW$

$P = \sqrt{3}\,V I \cos\theta \rightarrow I = P/\sqrt{3}\,V\cos\theta = 6508/\sqrt{3}(230)(.876) = 18.6A$

$\omega = 2\pi \times n_m \times \frac{1\,min}{60\,s} = 2\pi(1750)/60 = 183\,rad/s$

$P_{out} = T\omega \rightarrow T = P_{out}/\omega = 5968/183 = 32.6\,Nm$

RPM is 1750 under load. With no load it will go slightly faster, approaching the synchronous speed of 1800 RPM