ELEC 343: Quiz 4
March 26, 2019

Name:__________________________________________   Student ID:__________________________

Close notes and books. Quizzes suspected of cheating and/or turned in late will not be marked. You have 10 minutes to answer the following questions:

Q1 (30pts): Sketch the torque-angle characteristic ($T_e$ vs. $\delta$) of a round-rotor synchronous machine and show or label: motoring and generating regions ($M$ and $G$); stable region of operation; and maximum motoring torque $T_{M_{\text{max}}}$ and maximum generating torque $T_{G_{\text{max}}}$. 

Q2 (40pts): Assume a round-rotor Synchronous Machine with the rotating magnetic field as shown in the two figures below (in the CounterClockWise and ClockWise direction, respectively). The rotor angle is small (about 30 degrees). For each figure circle and show:
(a) (10pts) Show & label the rotor direct magnetic $d$-axis, quadrature $q$-axis, and show the current direction in the field winding using “dot” and “+” in each conductor
(b) (10pts) Show the stator and rotor magnetic poles (circle the appropriate N and S)
(c) (10pts) Identify the mode (Motoring or Generating), show the sign of rotor angle (circle $\delta < 0$ or $\delta > 0$)
(d) (10pts) Show the direction of the torque $T_e$ and $T_m$ by putting appropriate arrow in CW or CCW direction

Q3 (30pts): Assume a 3-phase Stator System is supplied with standard 60Hz AC currents. Circle one number or comment:

a) What would be the most likely nominal motor speed in rpm if the machine has 6 (six) poles?
3750 3600 3450 1850 1800 1750 1250 (1200) 1150 935 900 850 750 720 680

b) What would be the most likely nominal generator speed in rpm if the machine has 7 (seven) poles?
3750 3600 3450 1850 1800 1750 1250 1200 1150 935 900 850 750 720 680

c) What would be the most likely nominal generator speed in rpm if the machine has 8 (eight) poles?
3750 3600 3450 1850 1800 1750 1250 1200 1150 935 (900) 850 750 720 680

d) If the Stator defined in parts a), b) and c) is used for a synchronous motor, which one should be capable of developing the highest maximum torque under otherwise similar design and size (circle one)?

a) b) c) Explain why?

<table>
<thead>
<tr>
<th>Motoring</th>
<th>Generating</th>
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<tbody>
<tr>
<td>Rotor is lagging, ($\delta &lt; 0$)</td>
<td>Rotor is lagging, ($\delta &lt; 0$)</td>
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