ECE 3300 ELECTRICAL MACHINERY TEST II TIPS
There will be 3 questions and you are to answer all. BLUE BOOKS REQUIRED. Areas to be covered:

1. Electromechanical Energy Conversion
   (a) Energy Conversion Process
   (b) Linear mechanical Energy at Constant Current – Energy/Force/Torque
   (c) Linear mechanical Energy at Constant flux linkage - Energy/Force/Torque
   (d) Linear System
   (e) Rotating Machines
   (f) Single-Excited Rotating
   (g) Cylindrical Machines

2. DC Machines
   (a) Electromechanical Energy Conversion – Motion Voltage
   (b) Generator and Motor
   (c) Structure – Lap and Wave
   (d) Rotor - Armature Windings
   (e) Stator - Field Windings
   (f) Armature Voltage
   (g) Developed Torque
   (h) DC Generators/ Motors – Separately, Shunt, Series
   (i) Starting
   (j) Speed Control

3. Induction Machines
   (a) Rotating Field
   (b) Induced Voltages
   (c) Modes – Motoring, Generating, Plugging
   (d) Equivalent Circuit
   (e) Equivalent Circuit
   (f) No-load and Blocked-Rotor Tests
   (g) Power Flow
   (h) Classes of Squirrel Cage
   (i) Speed Control
   (j) Starting

Examples

1. A 20-hp, 240-V, 900 rpm series dc motor has a field winding of 33 turns per pole. Its armature resistance of 0.09 Ω and its field resistance of 0.06 Ω. The magnetizing curve expressed in terms of magnetomotive force versus $E_A$ at 900 rpm is given by the following table:

<table>
<thead>
<tr>
<th>$E_A$, (V)</th>
<th>95</th>
<th>150</th>
<th>188</th>
<th>212</th>
<th>229</th>
<th>243</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Phi$, (A.turns)</td>
<td>500</td>
<td>1000</td>
<td>1500</td>
<td>2000</td>
<td>2500</td>
<td>3000</td>
</tr>
</tbody>
</table>

Armature reaction is negligible in this machine.
(a) Compute the motor’s torque, speed, and output power at 33, 67, 100, and 133 percent of full-load armature current. (Neglect rotational losses)

(b) Plot the torque-speed characteristics of this machine.

2. A 300-hp (1 hp = 745.6 W), 440-V, 560-A, 863 rpm shunt dc motor has been tested, and the following data were taken:

   Blocked-rotor test:
   \[ V_A = 16.3 \text{ V exclusive of brushes} \quad V_F = 440 \text{ V} \]
   \[ I_A = 500 \text{ A} \quad I_F = 8.86 \text{ A} \]

   No-load operation:
   \[ V_A = 16.3 \text{ V inclusive brushes} \quad I_F = 8.76 \text{ A} \]
   \[ I_A = 23.1 \text{ A} \quad n = 863 \text{ rpm} \]

   What is this motor’s efficiency at the rated conditions? [Note: Assume that (1) the brush voltage drop is 2 V, (2) the core loss is to be determined at an armature voltage equal to the armature voltage under full load, and (3) stray load losses are 1 percent of full load.]

3. Problem #3.1 pp. 115.
4. Problem #3.5 pp. 117.
5. Problem #3.9 pp. 118
6. Problem #3.11 pp. 120
7. Problem #4.1 pp. 200
8. Problem #4.9 pp. 201
9. Problem #4.15 pp. 202
10. Problem #4.27 pp. 204
11. Problem #5.3 pp. 281
12. Problem #5.13 pp. 284
13. Problem #5.21 pp. 286
14. Problem #5.25 pp. 286