

**University of Saskatchewan
Department of Electrical Engineering
EE 313.3 Electrical machines I
Midterm Examination**

Instructor: N. Chowdhury

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- Marks** 1. The open-circuit characteristic data of a dc shunt generator taken at 1400 r.p.m. are shown below:

Field current (A)	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
Term. voltage (V)	92	165	237	303	349	382	415	438	456	469

- 2 (a) Draw the open-circuit characteristic curve of the dc generator at 1400 r.p.m.
- 4 (b) Determine the no-load terminal voltage of the dc generator at 1200 r.p.m. if the field circuit resistance is adjusted to 220 ohms.
- 9 (c) Determine the generated voltage, terminal voltage and power output of the generator at 1200 r.p.m. when it delivers 120 A to a load. The shunt field resistance is 220 ohms and the armature circuit resistance is 0.15 ohm. Neglect armature reaction.
- 12 2. A 20-hp, 440-V, 500-rpm dc shunt motor has rotational losses of 800 W at rated speed. The armature-circuit resistance is 0.5 ohm and the field resistance is 250 ohms. Rotational losses of this machine are proportional to the square root of its speed. Calculate the armature current and efficiency of the motor when it is driving a mechanical load at 425 rpm while delivering rated output at rated voltage.
- 10 3. A 200-hp, 480-V, dc series motor draws a line current of 280 A at rated output. The speed of the motor at the rated output is 450 rpm. The total resistance of the armature and the series field winding is 0.12 ohm. Determine both the speed and electromagnetic torque when the load changes so that it draws a line current of 200 A. Neglect saturation and armature reaction.
- 6 4. Show that, for a given electromagnetic torque, the speed of a dc series motor varies as a linear function of its terminal voltage. Make necessary assumptions.
- 3 5. List the essential elements involved in a conventional electromechanical energy conversion process.
- 4 6. List the conditions that have to be satisfied for voltage buildup in a self-excited dc generator.
- 5 7. Why is it difficult to achieve sparkless commutation in a dc machine?
- 5 8. What steps are usually taken to improve the commutation in a dc machine?

THE END