Q1) Textbook Problem 4.13

Q2) Textbook Problem 4.14

Q3) Textbook Problem 4.27

Q4)

A 10-hp 120-V 1000 r/min shunt dc motor has a full-load armature current of 70 A when operating at rated conditions. The armature resistance of the motor is $R_A = 0.12\ \Omega$, and the field resistance R_F is 40 Ω. The adjustable resistance in the field circuit R_{adj} may be varied over the range from 0 to 200 Ω and is currently set to 100 Ω. Armature reaction may be ignored in this machine. The magnetization curve for this motor, taken at a speed of 1000 r/min, is given in tabular form below:

E_A, V	5	78	95	112	118	126	130
I_F, A	0.00	0.80	1.00	1.28	1.44	2.88	4.00

(a) What is the speed of this motor when it is running at the rated conditions specified above?

(b) The output power from the motor is 10 hp at rated conditions. What is the output torque of the motor?

(c) What are the copper losses and rotational losses in the motor at full load (ignore stray losses)?

(d) What is the efficiency of the motor at full load?

(e) If the motor is now unloaded with no changes in terminal voltage or R_{adj}, what is the no-load speed of the motor?

(f) Suppose that the motor is running at the no-load conditions described in part *(e)*. What would happen to the motor if its field circuit were to open? Ignoring armature reaction, what would the final steady-state speed of the motor be under those conditions?

(g) What range of no-load speeds is possible in this motor, given the range of field resistance adjustments available with R_{adj}?

Q5)

The magnetization curve for a separately excited dc generator is shown in the figure below.The generator is rated at 6 kW, 120 V, 50 A, and 1800 r/min and is shown in Figure P8-8. Its field circuit is rated at 5A. The following data are known about the machine:

$$R_A = 0.18\,\Omega \qquad V_F = 120\text{ V}$$
$$R_{adj} = 0 \text{ to } 40\,\Omega \qquad R_F = 20\,\Omega$$
$$N_F = 1000 \text{ turns per pole}$$

Answer the following questions about this generator, assuming no armature reaction.

(a) If this generator is operating at no load, what is the range of voltage adjustments that can be achieved by changing R_{adj}?

(b) If the field rheostat is allowed to vary from 0 to 30 Ω and the generator's speed is allowed to vary from 1500 to 2000 r/min, what are the maximum and minimum no-load voltages in the generator?

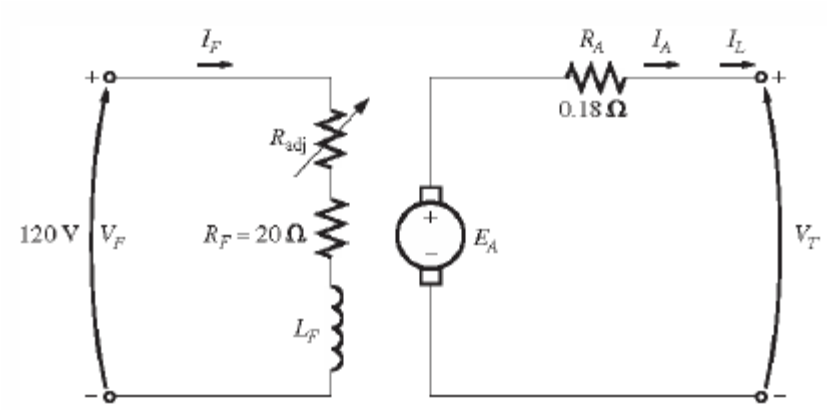
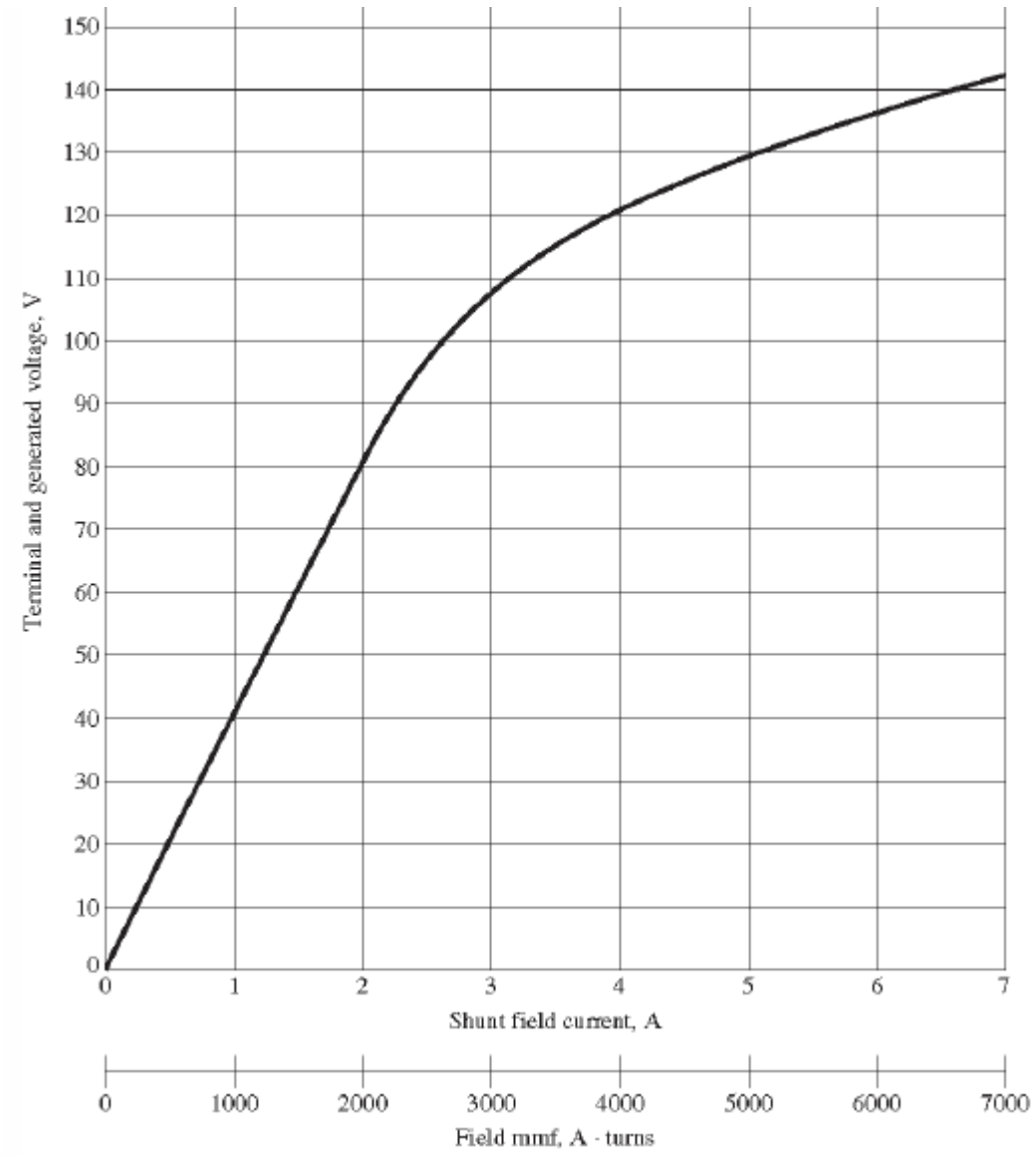


FIGURE P8–8



Q6)

Assuming that the generator in Problem **(Q5)** has an armature reaction at full load equivalent to 400 A·turns of magnetomotive force, what will the terminal voltage of the generator be when $I_F = 5$ A, $n_m = 1700$ r/min, and $I_A = 50$ A?