Name: _____ ECE 3600 homework DC1 Due: Mon , 3/26 dxt

1. A shunt-connected dc motor operates from 24 V and has an armature resistance of 0.30. The armature current is 10 A, the field current is 1 A, and the speed is 1200 rpm. The rotational losses are 5% of the output power.
   a) Find the input power.

   b) Find the output power in watts and horsepower.

   c) Find the efficiency of this motor.

   d) Find the machine constant $K\phi$.

   e) Find the no-load speed in rpm, assuming rotational losses remain approximately the same as at full load..

   f) Find the approximate no-load speed in rpm, assuming rotational losses are zero ($I_A = 0$). Is this a good estimate of the actual no-load speed?

2. A shunt-excited dc motor has the following nameplate information: 1.5 hp, 1750 rpm, 180 V, 7.3 A armature current, l.05-Ω armature resistance, 0.55 A field current. Assume constant rotational losses in this problem.
   a) Find the rotational losses. (Since they are assumed to be constant, calculate at nameplate operation.)

   b) Find the developed torque at full load.

   c) Determine the no-load speed.

   d) If the field winding connection malfunctioned so that the field flux dropped to a residual value of 15% of the original value, what would be the new no-load shaft speed. $V_T = 180\ V$. Is this speed likely to damage the motor?

Answers

1. a) 264·W b) 200·W = 0.268•hp c) 75.8·% d) 0.167·V·sec e) 1364·rpm f) 1371·rpm yes
2. a) 139·W b) 6.86·N·m c) 1820·rpm
   d) 12133·rpm The rotor may fly apart.