Name: _____ ECE 3600 homework DC1 Due: Sat, 3/22/25 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. **ECE 3600 homework DC1 p2**

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.

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