

DC Motor Practice Problems

1. A PMDC motor is powered by a 12 V DC source. The current drawn by the motor is 2 A when the motor shaft is clamped such that it cannot spin. The same motor draws $\frac{2}{3}$ A current from the source when a different load is attached, and spins at 4000 RPM. Find
- armature resistance, and
 - the torque produced.

Ans: i. $6\ \Omega$, ii. 12.7 mNm

2. When the torque load of the motor in Question #4 is changed, its speed drops to 2000 RPM. How much current is drawn at this new operating point?

Ans: 1.33 A

3. Torque constant and armature resistance of a PMDC motor are 50 mNm/A and $10\ \Omega$, respectively. If the motor is driven by a 10V DC source,
- what is the maximum mechanical power this motor can produce?
 - what is the torque at the maximum power?

Ans: i. 2.5 Watt, ii. 25 mNm

4. A separately excited dc motor with constant field current runs at 1045 RPM and draws an armature (rotor) current of 50 A from a 120 V dc source. The resistance of the armature is $0.1\ \Omega$. When the load on the motor is changed, it draws 90 A current. Determine the speed at the new operating point.

Ans: ≈ 1009 RPM

5. A 230 V shunt-connected dc motor delivers power to a load at 1200 RPM. The rotor current is 200 A. Rotor coil resistance is $0.2\ \Omega$. Rotational loss due to friction etc. is 500 W. What is the load torque?

Ans: 298.4 Nm

6. A 220 V series-connected DC motor has armature (rotor) resistance of $0.5\ \Omega$ and stator field winding resistance of $1.5\ \Omega$. The motor draws 20 A current in driving a load at 1200 RPM. The rotational loss (friction, windage etc.) is 150 W. Find the output power and efficiency.

Ans: 3450 Watt, 78.4 %