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

i. armature resistance, and

ii. the torque produced.

Ans: i. 6 Ω, ii. 12.7 mNm

2. When the torque load of the motor in Question #1 is changed, its speed drops to 2000 RPM. How much current is drawn at this new operating point?

Ans: $\frac{4}{3}$ A

3. Torque constant and armature resistance of a PMDC motor are 50 mNm/A and 10 Ω, respectively. If the motor is driven by a 10V DC source,

i. what is the maximum mechanical power this motor can produce?

ii. what is the torque at the maximum power?

Ans: i. 6.25 mW, 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 Ω. When the load on the motor is changed, it draws 90 A current. Determine the speed at the new operating point.

Ans: $\approx$ 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 Ω. Rotational loss due to friction etc. is 500 W. What is the load torque?

Ans: 298.4 Nm