DC Motor Problem Sheet

1. A permanent magnet dc motor has a back emf of 50V per 1000 rpm and an armature resistance of 3Ω. If the motor is driven by an amplifier with a maximum output of 200V and 10A calculate:

(a) The maximum no-load speed of the motor
(b) The maximum torque of the motor at low speeds
(c) The maximum speed that can be achieved when providing the torque in (b)

If the amplifier current and voltage are controllable calculate the regulated volts and amps required to produce a torque of 2 Nm at 1500 rpm. Sketch the torque/speed envelope for this motor amplifier combination.

(*4000 rpm; 4.8 Nm,. 3400 rpm; 4.17 A at 87.5 V*)

2. A 500V wound field shunt dc motor has its field winding connected directly across the armature supply. At a particular load the motor runs at 750 rpm and takes an armature current of 4 A. The field current is 330 mA and the armature has a resistance of 2.5Ω. Calculate the load torque and the motor efficiency.

If the field current is reduced to 120 mA but the load torque remains the same, what is the new armature current and speed.

(*25Nm; 90.5%; 11 A; 1989 rpm*)

3. A 100V, 4-pole d.c. shunt motor runs at 750 rpm and takes an armature current of 20 A when driving a certain load. The four field windings are connected all in series across the supply and draw a field current of 5 A. If the armature resistance is equal to 0.25 Ω, find the load torque.

The four field coils are now connected all.in-parallel and the machine is run as a series motor across a 125 V supply. Calculate the new speed if the load torque remains the same.

(*24.2 Nm; 750 rpm*)