Tutorial #4
DC MOTOR
(Electric Machine)

QN1 A dc shunt motor draws a current of 112 amp from 480V dc source. The armature winding and field winding resistances are 0.2 ohm and 240 ohms respectively. The motor has 6 poles with lap winding and the armature winding has 864 conductors. The flux per pole is 0.05 weber. Calculate:

a) Armature current
b) Speed
c) Torque developed by the armature [110A, 636 rpm, 756 N-m]

QN2 A 240V dc series motor has a total resistance of 0.2 ohm. When the speed is 1800 rpm, the motor draws a current of 40A. Calculate the value of resistance to be connected in series with the armature so as to limit the speed to 3600 rpm when the line current is 10A. [12.2 ohm]

QN3 A 250V dc shunt motor has armature winding resistance of 0.5 ohm and field winding resistance of 125 ohms. It draws a current of 25 amp at a speed of 900 rpm. It is required to increase the speed to 1100 rpm keeping the load torque constant. Calculate the value of additional resistance to be connected in series with the field winding to achieve this speed. [29.32 ohms]

QN4 A 250V dc shunt motor has armature winding resistance of 0.5 ohm and field winding resistance of 125 ohms. It draws a current of 32 amp and runs at a speed of 1100 rpm. Calculate the value of resistance to be connected in series with the armature winding in order to reduce the speed to 750 rpm keeping the load torque constant. [2.49 ohms]

QN5 A 240V dc shunt motor has armature-winding resistance of 0.4 ohm and field winding resistance of 120 ohms. It draws a current of 27 amp at half load and the corresponding speed is 600 rpm. If a resistance of 1 ohm connected in series with the armature winding keeping the load torque constant to half load torque, calculate the new speed. If a resistance of 1 ohm connected in series with the armature winding and the load torque is increased to full load torque, calculate the new speed.

[534.78 rpm, 443.48 rpm]

QN6 200 V series motor rakes a current of 100A and runs at 1000 rpm. The total resistance of the motor is 0.1 ohm and the field is unsaturated. Calculate:

a) Percentage change in torque and speed if the load is so changed that motor current is 50 A.
b) Motor current and speed if the torque is halved. (75 %, 105.2 %, 70.7 A, 1436 rpm)

QN7 A 220 V dc shunt motor drives a centrifugal pump where torque is proportional to the square of the speed. The motor draws a current of 50 A when running at 1000 rpm. What value of resistance must be inserted in the armature circuit in order to reduce the speed to 800 rpm? Given that armature resistance is 0.1 ohm and field resistance is100 ohm. (1.46 ohm)

QN8 A dc shunt machine when runs as a motor on no load take 440 Watt at 220 V and runs at 1000 rpm. The field current and armature circuit resistance are 1 A and 0.5 ohm respectively. Calculate the efficiency of the machine when running as a) a generator delivering 40 A at 220 V b) a motor taking 40 A from 220 V supply. (87.3 %, 86.4 %)

QN9 A 250 V dc shunt motor has speed of 1000 rpm at full load. Calculate the resistance to be connected in series with the armature to reduce the speed with the full load torque to 800 rpm, the full load armature current being 50 A. if the load torque is then halved, at what speed will the motor run? Take armature-winding resistance to be 0.3 ohm. (0.94 ohm, 932 rpm)

QN10 A 440 V dc shunt motor taking 5 A at no load has armature and field winding resistances are 0.5 ohm and 200 ohm respectively. Calculate the efficiency when the motor takes 50A on full load. Also calculate the percentage change in speed from no load to full load. (84.2 %, 5.64 %)

QN11. A 100 KW, 500 V shunt generator was run as a motor on no load at its rated voltage and speed. The total current taken was 9.5 A including a shunt field current of 2.5 A. the resistance of armature circuit at normal working temperature is 0.1 ohm. Calculate the efficiency of the generator at full load and at half load.
(91.9 %, 89.6 %)