**Assignment -2**

Q1) A 200 V, 20 A, 105 rad/sec separately excited dc motor is having armature resistance of 0.2 Ω. The voltage rating of its field winding is also 200 V. The machine is driving a load whose torque is independent of speed, and its magnitude is 15 Nm. Find the armature and field voltages that are required to applied so that the machine can drive the above load at 40 rad/s while drawing minimum possible armature current. Neglect rotational losses of the machine.

Q2) A 200 V, 20 A, 105 rad/sec separately excited dc motor is having armature resistance of 0.2 Ω. The voltage rating of its field winding is also 200 V. The machine is driving a load whose torque is independent of speed, and its magnitude is 15 Nm. Find the armature and field voltages that are required to applied so that the machine can drive the above load at 120 rad/s. Determine the armature current drawn by the machine. Neglect rotational losses of the machine.

Q3) A 200 V, 20 A, 105 rad/sec separately excited dc motor is having armature resistance of 0.2 Ω. The voltage rating of its field winding is also 200 V. Rated voltages are applied to the armature and field terminals. The machine is made to drive a load whose torque speed characteristic is given by $T_L = 500 - \omega$ where ω is the rotational speed expressed in rad/sec and $T_L$ is the load torque expressed in Nm. Determine the speed at which the motor will run, and also determine the toque developed by the motor. Neglect rotational losses of the machine.

Q4) A 200 V, 20 A, 105 rad/sec shunt dc motor is having armature resistance of 0.2 Ω and field resistance of 200 Ω. The motor is driving a load which is equal to half of its rated load, and is independent of speed while the motor is fed with 200 V dc supply. Determine the speed of the motor. The voltage applied to the shunt motor is now made to be 100 V while it is made to drive the same load. Find the new speed of the motor. Neglect rotational losses of the machine.

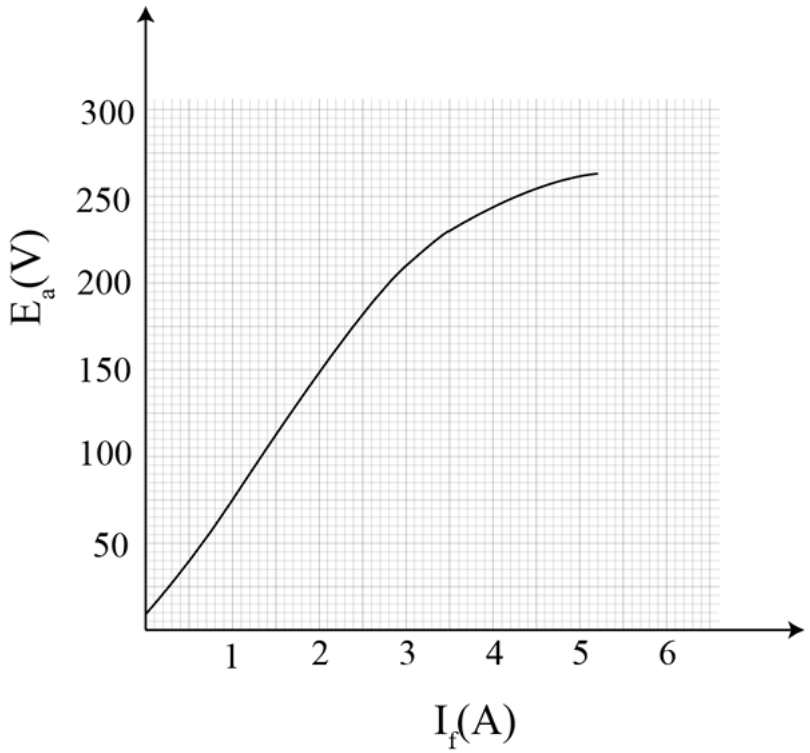
Q5)

A 230 V DC shunt machine has an armature resistance of 0.5 Ω and field resistance of 115 Ω. When the machine is connected to 230 V supply it operates as a motor. When operated as a generator the machine supplies a terminal voltage of 230 V. If the line current in each case is 40 A, find the ratio of the generator speed to the motor speed.

Q6 A permanent magnet dc motor has an armature resistance of 0.1 Ω, and runs at 1600 rpm while drawing an armature current of 100 A from a 230 V battery. The friction and air-drag loss is 300 W, no load hysteresis and eddy current losses are 1200 W. Find the efficiency of the motor.

Q7 The combined armature and field resistance of dc series motor is 0.3 Ω. When tested at standstill, 25 A of motor current produces a shaft torque of 10 Nm. The motor is now connected to a 200 V dc source, and is driving a constant load torque of 30 Nm. Calculate the speed at which the load is driven.

Q8) The Open Circuit Characteristic (OCC) of dc shunt generator at 1200 rpm is given below:




Determine:

a) Field resistance and field current for a no-load voltage of 240 V.

b) The value of critical field resistance (the value of resistance above which the generator will fail to self excite

c) In case a no load voltage of 220 V is required, calculate the additional resistance that must be inserted in the field circuit.

Q9) A 8kW, 400 V, 1200 rpm separately excited generator is having an armature resistance of 0.01 Ω. The field winding of the generator is connected to the rated voltage, and the shaft of the generator is coupled to a steam turbine. The generator is feeding a 200 V, 2kW load. Determine the torque and speed of the turbine.

Q10) A 200 V, 20 A, 105 rad/sec separately excited dc motor is having armature resistance of 0.2 Ω. The voltage rating of its field winding is also 200 V. Neglect the rotational losses of the machine. The machine is driving a load whose torque is independent of speed, and its magnitude is 15 Nm.

a) Find the armature and field voltages that are required to be applied so that the machine can drive the above load at 120 rad/s while drawing minimum possible armature current. Determine the armature current drawn by the machine.

b) What is the maximum speed at which the motor can drive the same load (i.e. 15 Nm load torque which is independent of speed) without violating its armature current rating?

Q11) The shafts of two identical separately excited dc motors, A and B of 200 V, 20 A, 105 rad/s having armature resistance of 0.2 Ω are mechanically coupled to each other as shown in the figure. The field voltage rating of both the machines are also 200 V. Neglect iron, rotational, stray and air drag losses.

Machine-A : The armature terminals (A-AA) and the field terminals (F-FF) are connected to two separate 200 V dc supplies.

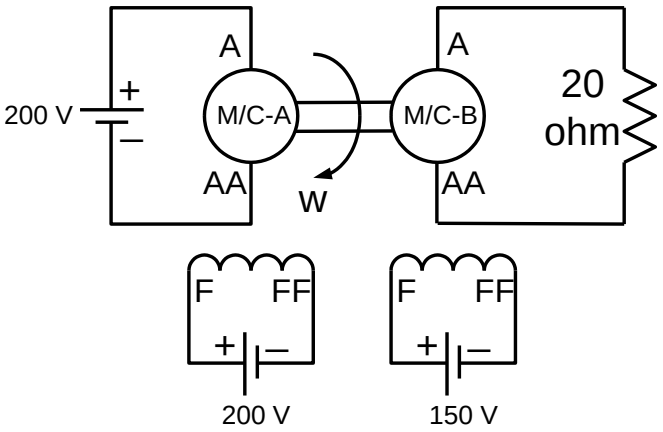
Machine-B : The field terminals (F-FF) are connected to a 150 V dc supply while a 20 Ω resistance is connected across its armature terminals (A-AA).

Once the system has attained steady state operation determine

a) The speed (ω) at which the combined system would run

b) Magnitude of current flowing through the 20 Ω resistance connected to the armature terminals of Machine-B

c) Magnitude of armature current of machine-A.




Q12) The shafts of two identical separately excited dc motors, A and B of 200 V, 20 A, 105 rad/s having armature resistance of 0.2 Ω are mechanically coupled to each other as shown in the figure. The field voltage rating of both the machines are also 200 V. Neglect iron, rotational, stray and air drag losses.

Machine-A : The armature terminals (A-AA) and the field terminals (F-FF) are connected to two separate 200 V dc supplies.

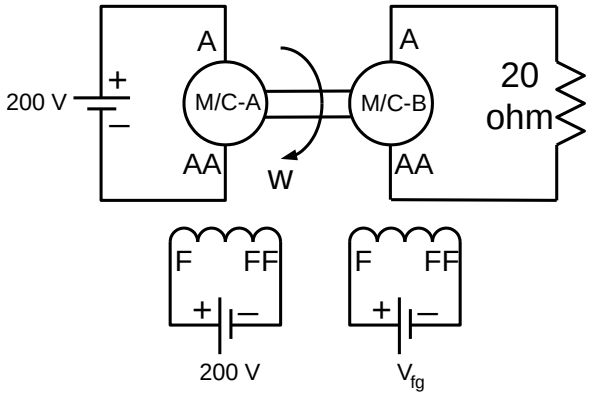
Machine-B : A 20 Ω resistance is connected across its armature terminals (A-AA).

At steady state 5 A current is required to flow through the 20 Ω resistor.

a) Determine the magnitude of the field voltage, $V_{fg}$ that is required to be applied to the field winding (F-FF) of Machine-B

b) Magnitude of armature current of machine-A.

c) The speed (ω in rad/s) at which the combined system would run


A
A
200 V
+
–
M/C-A
M/C-B
20
ohm
AA
AA
w
F
FF
F
FF
+
–
+
–
200 V
$V_{fg}$