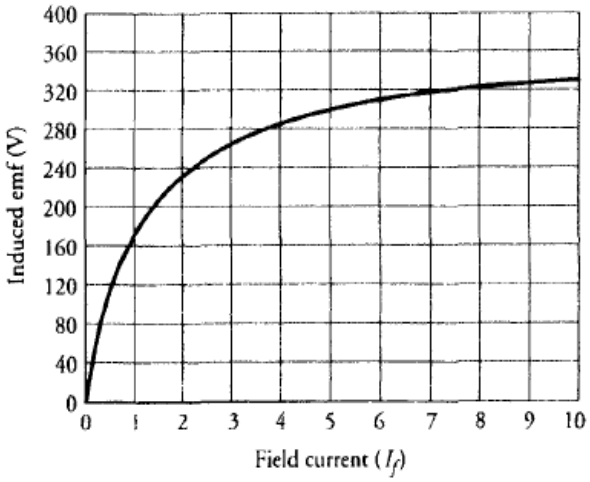
Course Title: Electrical Machines I **Course Code:** EE321

Sheet 6

DC Generators

1. A 240-kW, 240-V, 6-pole, 600-rpm, separately excited generator is delivering the rated load at the rated voltage. The generator has $R_a = 0.01\ \Omega$, $R_f = 30\ \Omega$, $V_f = 120$ V, $N = 500$ turns per pole, and $P_r = 10$ kW. Its magnetization curve is given below. Determine:

a) The induced emf at full load.
b) The power and the torque developed.
c) The applied torque and efficiency
d) The external resistance in the field winding.



2. A 50 KW, 250 V shunt generator has an armature and field winding resistances of 0.02 Ω and 150 Ω respectively. The friction, windage and core losses are 1500 W at full load.
Calculate:

a- Load current
b- Field current
c- Armature current
d- Voltage regulation
e- Shunt field copper loss
f- Armature copper loss
g- Efficiency

3. A 50 KW, 250 series generator has an armature resistance of 0.02 Ω and a series field resistance of 0.045 Ω. The friction, windage, and core losses are 2.5 KW. At rated load calculate:

a- Armature current
b- Induced emf
c- Armature copper losses
d- Total copper losses
e- Generator efficiency

4. A 10 KW, 230V self-excited shunt generator, delivering rated load, has an armature circuit voltage drop that is 6 percent of the terminal voltage and a shunt field current equal to 4 percent of the rated load current. Calculate the resistance of the armature circuit and that of the field circuit.

5. The OCC of a DC shunt generator when driven at 400 rpm is as follows:

Field current (A)	2	3	4	5	6	7	8	9
E.M.F (V)	110	155	186	212	230	246	260	271

Find:

a) The emf to which the machine will excite when the field resistance is 34 Ω.
b) The critical value of the shunt field resistance.
c) The critical speed when the field circuit resistance is 34 Ω.
d) The additional resistance required in the field circuit to reduce the emf to 220 V.

6. The following figures were obtained from an open circuit test on a shunt generator driven at 1000 rpm.

Field current (A)	1	1.5	2	2.5	3
E.M.F (V)	104	119	130	138	145

If the field resistance is 50 Ω, find graphically:

a- The terminal voltage on open circuit when the speed is 1000 rpm.
b- The terminal voltage on open circuit when the speed is 750 rpm.
c- The additional field resistance required so that the machine builds up 89 V when the speed is 750 rpm.