Tutorial #3

DC Generator

(Electric Machine –I)

The data obtained from no-load magnetization test of a dc shunt generator running at 800 rpm is as follow:

Field current(I_f in Amp) :	0	1.6	3.2	4.8	6.4	8	9.6	11.2
Emf (E in volts) :	10	148	285	390	460	520	560	590

The field winding resistance is 60 ohms.

a) Draw the OCC and calculate the emf generated by the machine at no-load.
b) Find the critical resistance of the machine at 800 rpm. [550V, 91 ohms]

A 4-pole dc shunt generator has wave wound armature. The armature and field winding resistances are 0.2 ohm and 60 ohms respectively. The brush contact drop is 1V per brush. The generator is delivering a power of 3kW at 120V. Calculate :

a) Total armature current coming out from the brush.
b) Current in each armature conductor
c) Generated EMF (E) [27A, 13.5A, 127.4V]

A dc series generator is running at 800 rpm and delivering a power of 6kW to the load at 120V. The armature and field winding resistance are 0.1 ohm and 0.3 ohm respectively. When the load is increased to 9kW, the speed is increased to 1200 rpm. Calculate the new values of armature current and load terminal voltage. [46.85A, 145.27 V]

A dc compound generator has to supply a current of 120A at 120V. The shunt field, series field and armature winding resistances are 30 ohm, 0.05 ohm and 0.1 ohm respectively. Calculate the emf generated by the armature in the following two cases :

i) Long shunt connection
ii) Short shunt connection [138.6V, 138.42V]

Calculate the resistance of the load which consumes a power of 5 kW from a dc shunt generator whose load characteristic is described by the equation : $V_L = 250 - 0.5*I_L$. [11.48 ohms]

A short shunt cumulative compound dc generator supplies 7.5kw at 230V. The shunt field, series field and armature resistance are 100, 0.3and 0.4 ohms respectively. Calculate the induced emf and the load resistance. [253.8V, 7.05Ω]

The resistance of the field circuit of a shunt excited dc generator is 200Ω. When the output of the generator is 100 KW, the terminal voltage is 500V and the generated emf 525V.Calculate (a) the armature resistance and (b) the value of the generated emf when the output is 60kw, if the terminal voltage then is 520V. [0.123Ω, 534.56V]

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QN8. A 6 pole wave-wound dc shunt generator has 1200 armature conductors. The useful flux per pole is 0.02wb. the armature resistance is 0.4Ω and the speed is 400 rpm. If the shunt resistance is 220Ω. calculate the maximum current which the generator can deliver to an external load if the terminal voltage is not to fall below 440V. [98 A]

QN9 A separately excited dc generator running at 1200rpm supplies 200A at 125V to a load of constant resistance. What will be the current when the speed is dropped to 1000 rpm if the field current is unaltered? Given that armature resistance =0.04Ω, total drop at brushes = 2 V. [1.66.17A]

QN10. A dc generator is connected to 220V dc mains. The current delivered by the generator to the main is 100A. The armature resistance is 0.1Ω.The generator is driven at a speed of 400rpm.Calculate:(a) the induced emf (b) the electromagnetic torque (c) the power input and output of the armature when the speed drops to 350 rpm. State weather the machine is generating or motoring. Assume constant flux.

[230V, 549.08N-m, 23kW, 37.73kW]

QN.11 A dc shunt machine, connected to 250V mains has an armature resistance of 0.12Ω and the resistance of the field circuit is 100Ω. Calculate the ratio of the speed as a generator to the speed as a motor, the line current in each case being 80A. [1.081]

QN12. A 1500 kW, 500V, 16 pole, dc shunt generator runs at 150 rpm.What must be the useful flux per pole if there are 2500 conductors in the armature and the winding is lap connected and full-load armature copper loss is 25kW? Calculate the area of the pole shoe if the air gap flux density has a uniform value of 0.9wb/m^2. Neglect charge in speed. Take R_f =55Ω.

QN13. A shunt generator delivers 50 KW at 250 V and 400 rpm. The armature resistance is 0.02Ω and field resistance is 50Ω . Calculate the speed of the machine when running as a shunt motor and taking 50 KW input at 250 V. [387 rpm]

QN14. A dc shunt generator has an output of 10 KW at 500 V; the speed being 1000 rpm. The armature circuit resistance is 0.5 and the field resistance is 250. Calculate speed when running as a shunt motor taking 50 KW at 500 V.

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