Ministry of Higher Education and Scientific Research

Al-Mustaqbal University

College of Engineering & Technology

Medical Instrumentation Techniques Engineering Department

Electrical Technology

Third Class

Weeks 14

D.C machines: Generator E.M.F, losses and Efficiency

Tutorial

By Osamah Jaber Ghayyib

1. **The sole purpose of a commutator in a D.C. Generator is to**

    a. Increase output voltage.

    b. Reduce sparking at brushes.

    c. Provide smoother output.

    d. Convert the induced A.C. into D.C.

2. **In a D.C. generator, the generated e.m.f. is directly proportional to the**

    a. Field current.

    b. Pole flux.

    c. Number of armature parallel paths.

    d. Number of dummy coils.

3. **What is the average coil emf generated in a 4-pole DC machine having flux/pole equal to 0.1 wb rotating at 1500 rpm? (No. of coil sides = 100)**

    a. 19 kV.

    b. 1.9 kV.

    c. 190 V.

    d. 19 V.

4. **A 4-pole D.C wound machine is lap wound with 400 conductors. The pole shore is 20 cm long and average flux density over one-pole pitch is 0.4 T, the armature diameter being 30 cm. What is the value of induced emf**?

    a. 188 V.

    b. 276 V.

    c. 94 V.

d. 188 mV.

5. **If the average coil emf of a DC motor is doubled and flux is halved (keeping other parameters constant) then its shaft speed will become _____**

    a. Twice of the original speed.

    b. Square of the original speed.

    c. Four times of the original speed.

    d. Half of the original speed.

6. **For a constant emf, if field current is reduced then the speed of the DC motor will_____**

    a. Remains same.

    b. Increases.

    c. Decreases.

    d. Can't say.

7. **Copper losses in a rotating machine is_____.**

    a. Variable losses.

    b. Constant losses.

    c. Either (a) or (b).

    d. None of these.

8. **Hysteresis loss in a dc shunt generator**

    a. Depends only on the lamination thickness.

    b. Varies as 1.6 power flux density.

    c. Varies as the inverse of flux density

9. Iron losses in a dc machine take place in

a. armature rotor.

b. main body.

c. Commutator.

d. yoke.

10. If % η_m is the mechanical efficiency of a D.C. machine and % η_e is the electrical efficiency. Then the overall efficiency of D.C. machine is given by

a. % η_m + % η_e.

b. % η_m x % η_e.

c. (% η_m + % η_e) / % η_m.

d. (% η_m + % η_e) / % η_e.

11. The current flowing through the armature of a d.c. shunt machine at maximum efficiency is given by

a. $\sqrt{(W_{co} / Ra)}$.

b. $\sqrt{(Ra / W_{co})}$.

c. $\sqrt{(W_{co} / R^2a)}$.

d. $\sqrt{(Ra / (W_{co})^2)}$.

12. A D.C. shunt generator delivers 190 A at a terminal voltage of 220 V. The copper losses and stray losses are 2000 W and 1000 W respectively. The efficiency of the generator is_____

a. 91.35 %.

b. 92.60 %.

c. 93.30 %.

d. 94.23 %.

Ans 1-d , 2-b ,3-a ,4-a ,5-c ,6-b ,7-a ,8-b ,9-a ,10-b ,11-a ,12-c

Problems

1- A long-shunt dynamo running at 1000 r.p.m. supplies 22 kW at a terminal voltage of 220 V. The resistances of armature, shunt field and the series field are 0.05, 110 and 0.06 Ω respectively. The overall efficiency at the above load is 88%. Find

a. Cu losses.

b. Iron and friction losses.

c. The torque exerted by the prime mover.

Ans: - (Cu = 1584.5 W, Iron & friction = 1,415.5 W, T = 238.74 N − m)

2- A 4-pole D.C. generator is delivering 20 A to a load of 10 Ω. If the armature resistance is 0.5 Ω and the shunt field resistance is 50 Ω, calculate the induced e.m.f. and the efficiency of the machine. Allow a drop of 1 V per brush.

Ans: - (E_g = 214 V, ηe = 77.9 %)

3- A long-shunt compound-wound generator gives 240 volts at F.L. output of 100 A. The resistances of various windings of the machine are : armature (including brush contact) 0.1 Ω, series field 0.02 Ω, interpole field 0.025 Ω, shunt field (including regulating resistance) 100 Ω. The iron loss at F.L. is 1000 W ; windage and friction losses total 500 W. Calculate F.L. efficiency of the machine.

Ans: - (Total losses = 87%)