



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 19EC309 ELECTRICAL MACHINES AND POWER SYSTEMS

II YEAR / 03 SEMESTER MECH & MCT

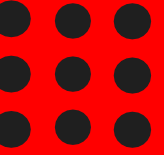
Unit 1 – DC Machines

Characteristics of DC Generator



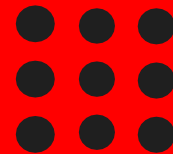
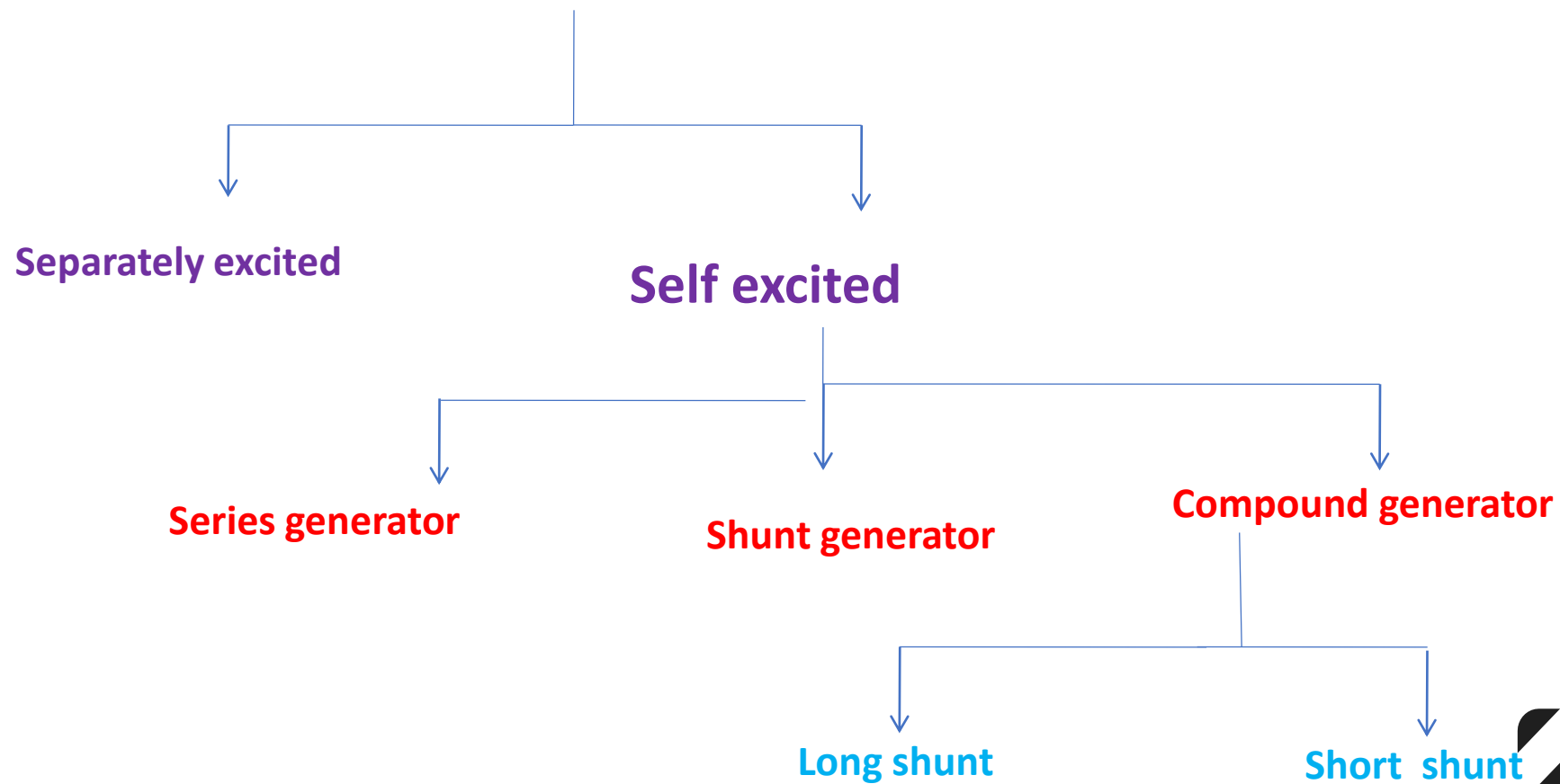
Can You Answer?

- What is Characteristics?
- What is testing?
- Why we have to go for testing?
- What we understand from testing characteristics?



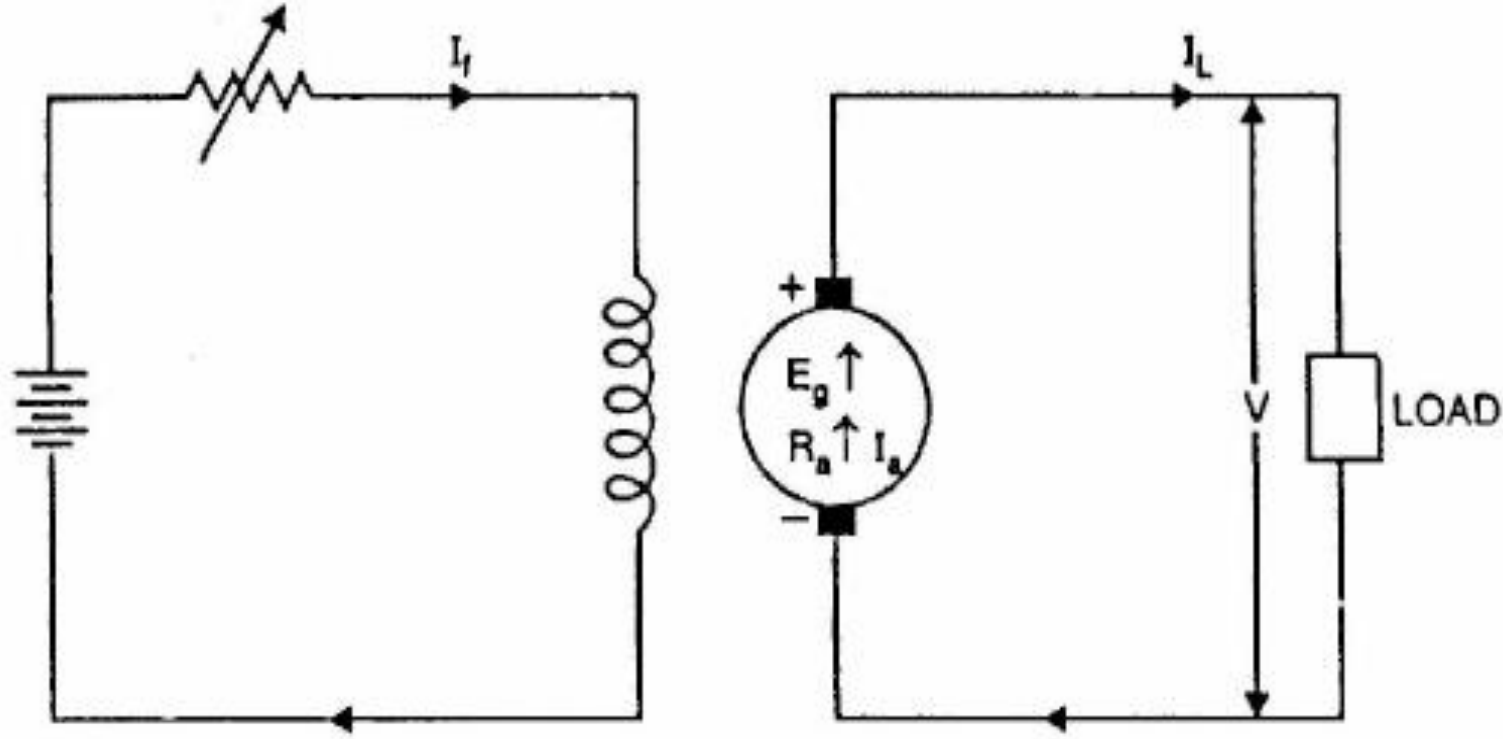


Types of generators





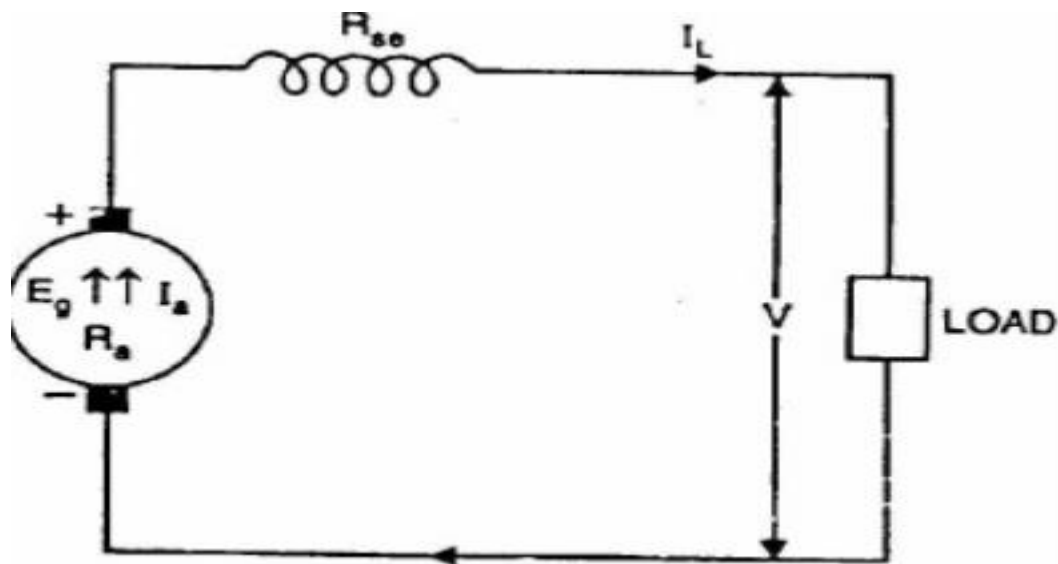
Separately excited generator



$$E_g = V + I_a R_a$$
$$I_a = I_L$$



DC series generator



Armature current, $I_a = I_{se} = I_L = I$ (say)

Terminal voltage, $V = E_G - I(R_a + R_{se})$

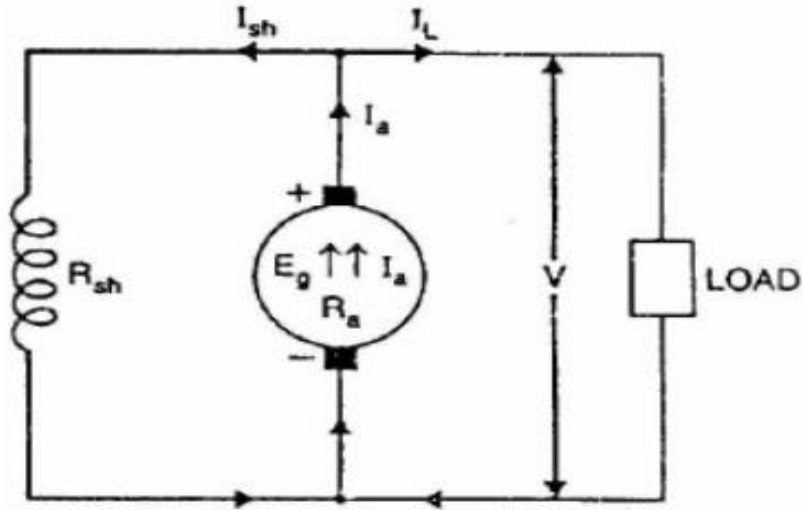
Power developed in armature = $E_g I_a$

Power delivered to load

$$= E_g I_a - I_a^2 (R_a + R_{se}) = I_a [E_g - I_a (R_a + R_{se})] = VI_a \text{ or } VI_L$$



DC shunt Generator



Shunt field current, $I_{sh} = V/R_{sh}$

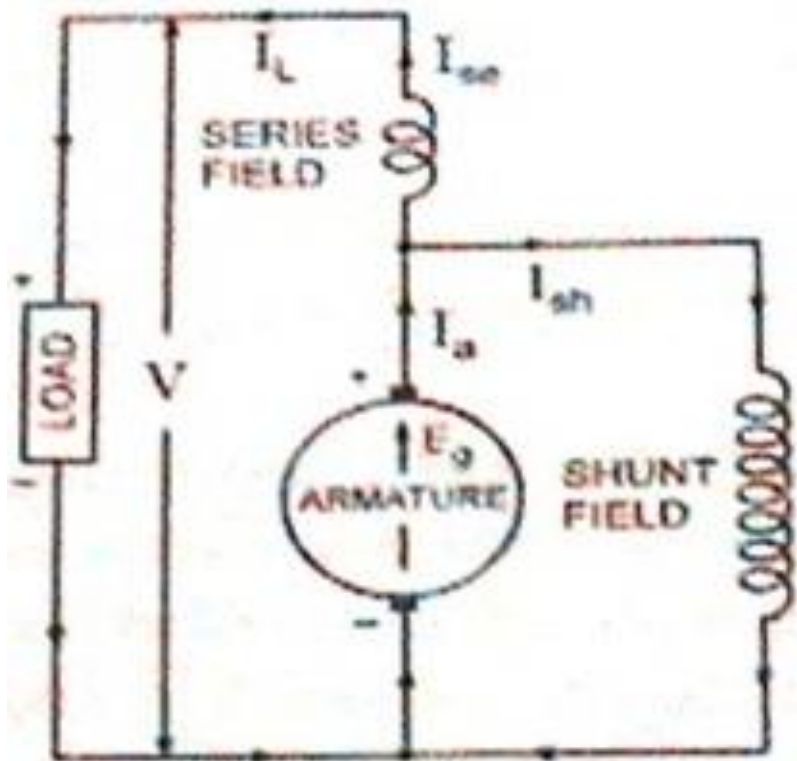
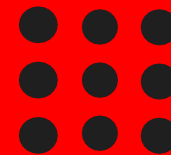
Armature current, $I_a = I_L + I_{sh}$

Terminal voltage, $V = E_g - I_a R_a$

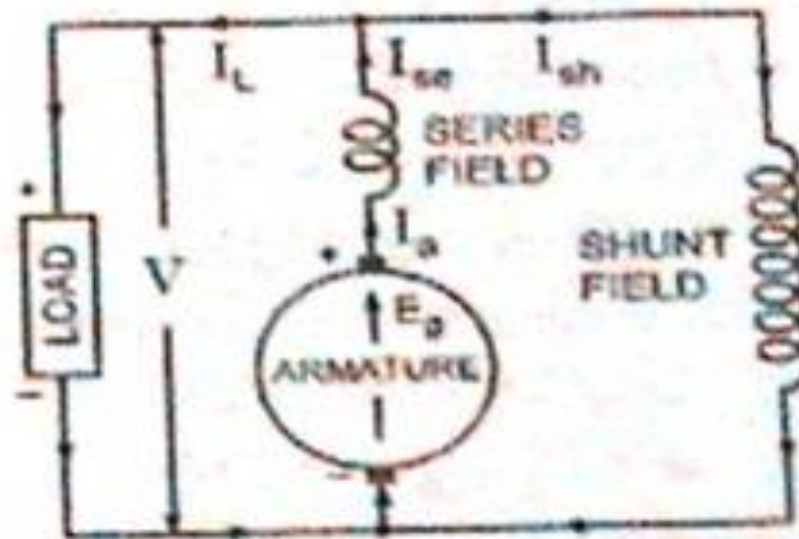
Power developed in armature = $E_g I_a$

Power delivered to load = $V I_L$

DC Compound Generator



(d) Short-Shunt Compound Wound Generator

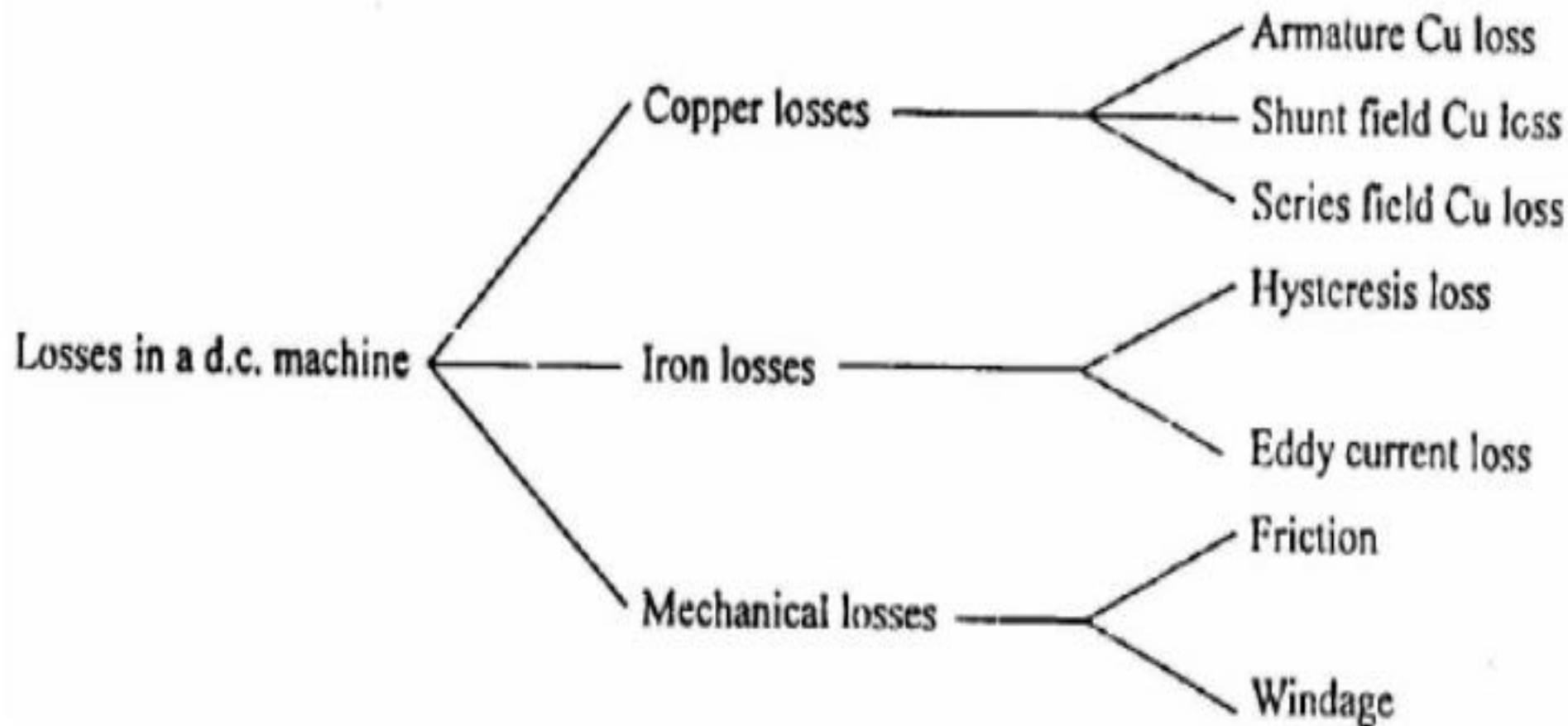


(e) Long-Shunt Compound Wound Generator





Losses in a dc machine





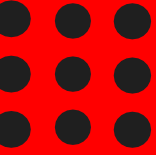
Applications of DC generator

- **DC shunt generator**
 - To supply loads needing constant voltage
 - Battery charging
 - Exciters for ac generators
 - To supply loads needing constant voltage
- **DC series generator**
 - Used as boosters
 - Series incandescent lighting
- **DC compound generators**
 - To supply power to railway circuits
 - Elevator motors etc.

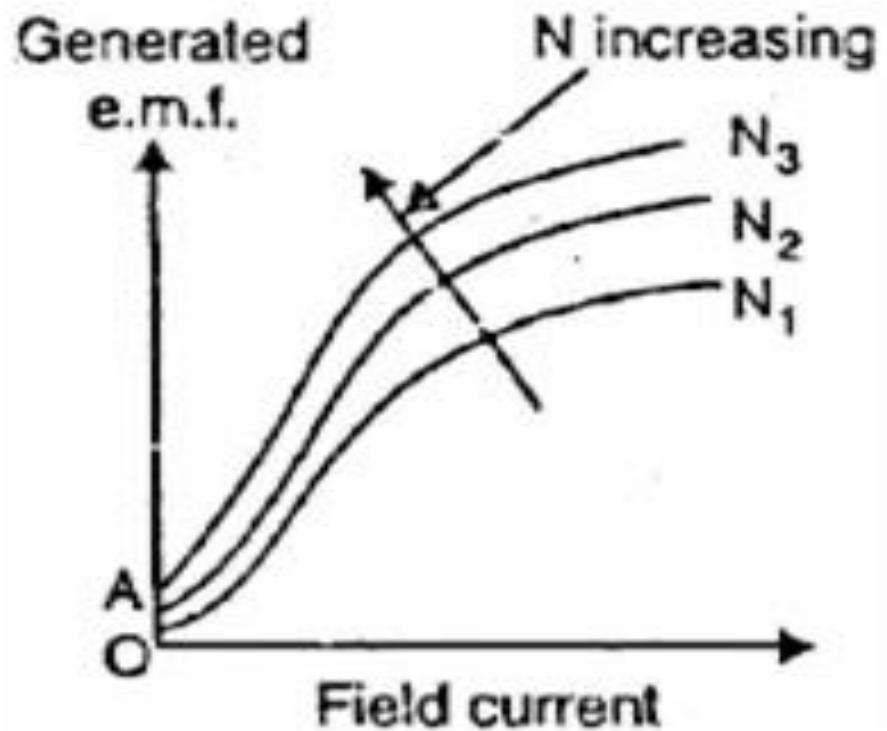
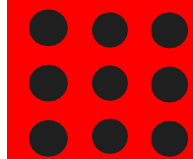


Characteristics of DC generators

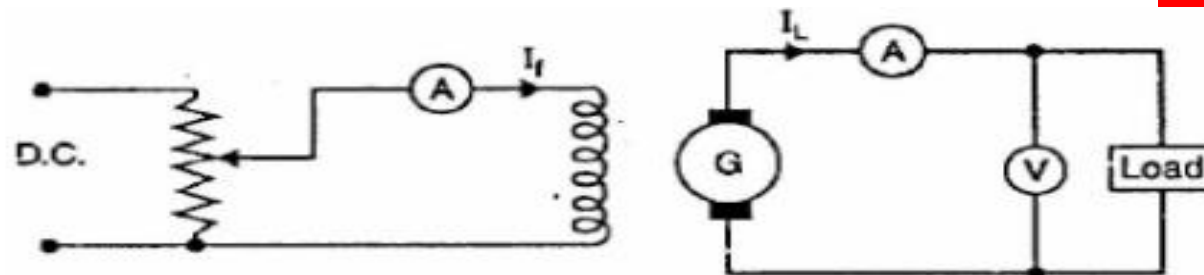
- Open circuit characteristics (OCC)(E_g/I_f)
- Internal characteristics(E/I_a)
- External characteristics(V/ I_L)



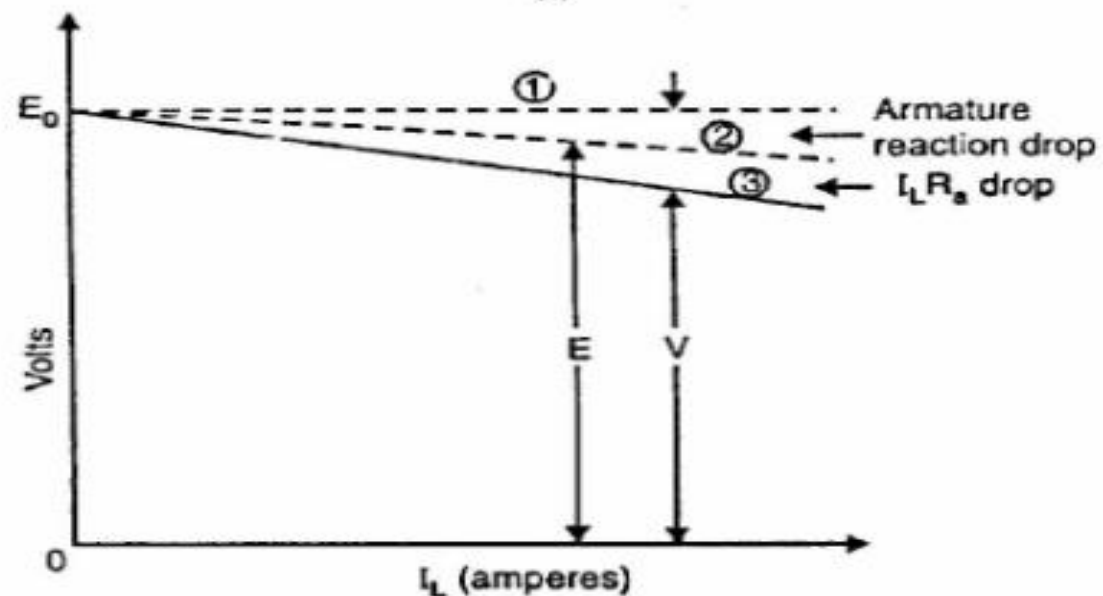
Separately excited dc generator



OCC



(i)



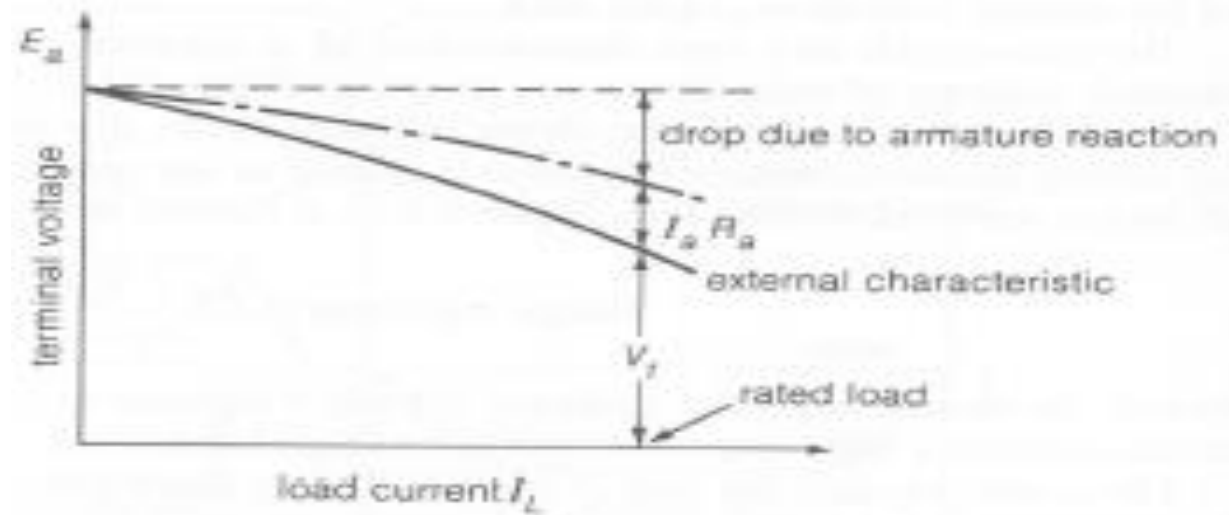
Load characteristics



DC Generator Characteristics

It can be seen from the external characteristics that the terminal voltage falls slightly as the load current increases. *Voltage regulation* is defined as the percentage change in terminal voltage when full load is removed, so that from the external characteristics,

$$\text{Voltage regulation} = \frac{E_a - V_t}{V_t} \times 100$$



External characteristics



ASSESSMENT

1. The terminal voltage of a D.C. shunt generator drops on load because of all of the following reasons except

- (A) Armature reaction
- (B) Armature resistance drop
- (C) Field weakening due to armature reaction and armature
- (D) Commutation

2. Which of the following generating machine will offer constant voltage on all loads?

- (A) Self-excited generator
- (B) Separately excited generator
- (C) Level compounded generator
- (D) All of the above



REFERENCES

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2. Gupta J.B, " Theory and Performance of Electrical Machines", S.K.Kataria and Sons, (2002)
3. Kothari D.P and Nagrath I.J " Electric Machines", Tata McGraw Hill Publishers, (2002)
4. Bhimbhra P.S., "Electrical Machinery", Khanna Publishers, (2003)

THANK YOU