NAME: FAWAD REHMAN
ID: 5053
PAPER: E.M
INST: ENGR. SANAULLAH AHMED
DATE: 25/09/2020

Question No 1.

A.

Answer:

Speed Control Methods:

→ Speed control is intentional change in speed of motor.

→ It is different from concept of speed regulation where there is natural change in speed due to loading and unloading of shaft.

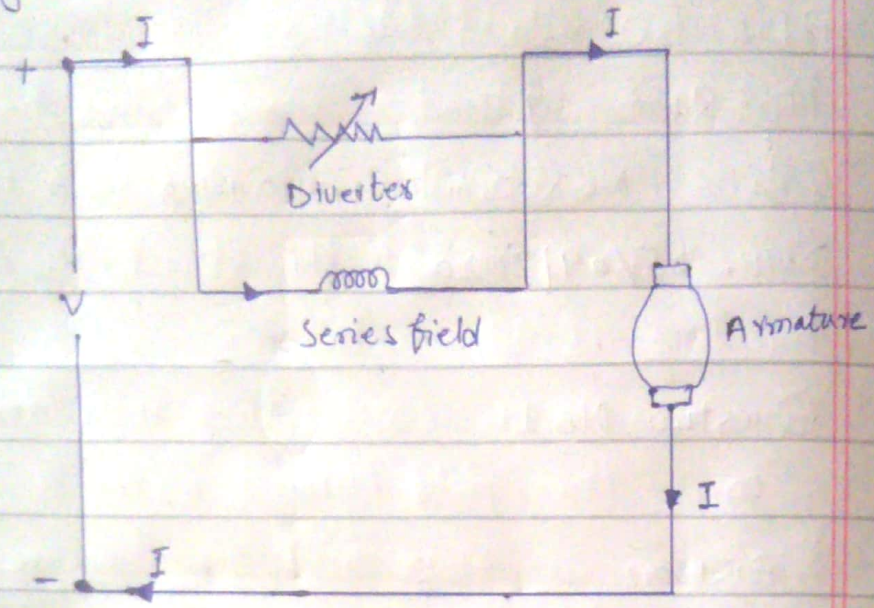
→ Speed change is done manually or by automatically control devices.

1. Speed Control of DC Series Motor:

a). Field Diverter Method:

This method uses a diverter. Here the field flux can be reduced by shunting a portion of motor current around the series field. Lesser the diverter resistance less is the field current, less flux therefore more speed.

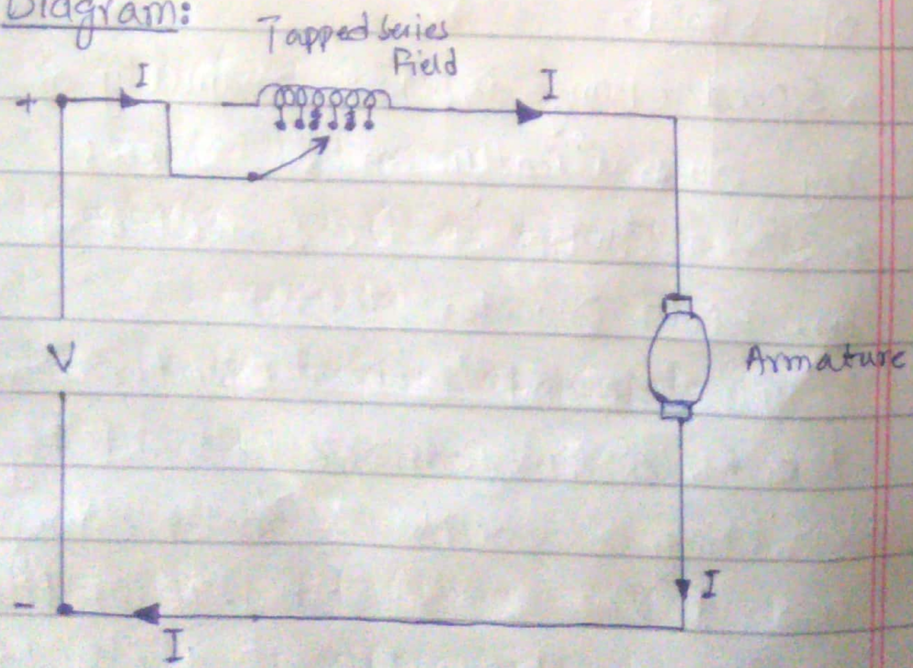
*Diagram:



b). Tapped Field Control:

This is another method of increasing the speed by reducing the flux and it is done by lowering number of turns of field winding through which current flows.

* Diagram:



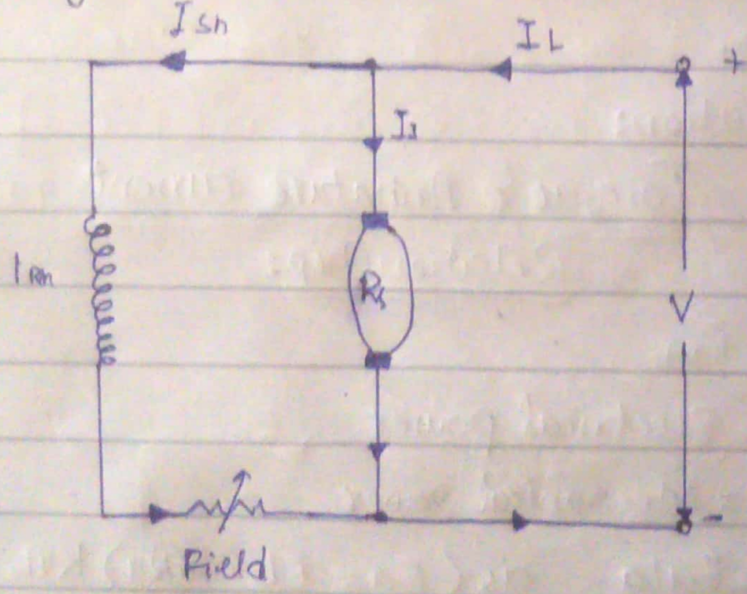
2. Speed Control method of DC Shunt M:

a). Flux Control Method:

In this method, a variable resistance (Known as shunt field rheostat) is placed in series with shunt field winding as shown below.

An increase in controlling resistance reduces the field current with a reduction in flux and an increase in speed.

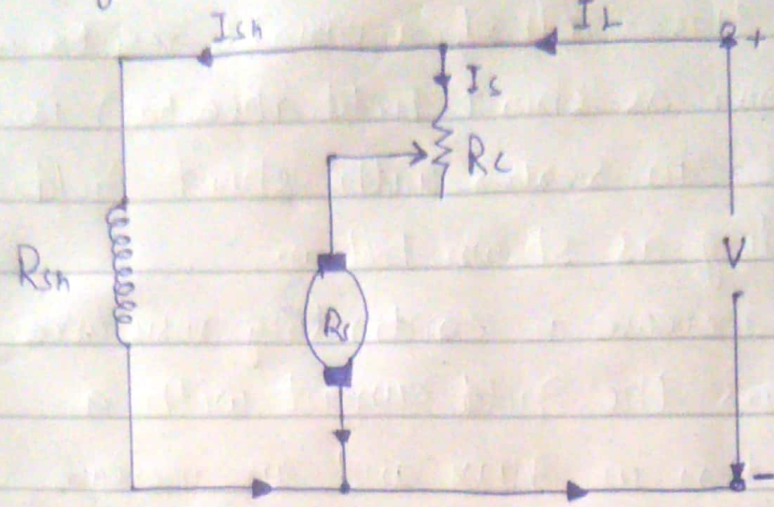
* Diagram:



b). Armature control method:

This is done by inserting a variable resistance Rc (Known as controller resistance) in series with the armature. The flux remains constant while armature current is changed produces change in speed.

* Diagram:



Question No 2.

A).

Solution:

Torque & Armature current Relationship:

$Pe = Pm$

Pe = Electrical power

Pm = Mechanical power

$Pe = EaIa$ as $(Ea = Eb + IaRa)$ KVL

$Pe = (Eb + IaRa)Ia$

$Pe = Eb\,Ia +$ ~~Ia^2Ra~~ (as dissipate in form of heat)

$Pe = Eb\,Ia$

Now

$Pm = Tg\,W$ ∵ Tg (torque in N·M) and W (angular speed in rad/sec)

1 radian = $1/2\pi$ ∵ In RPM = $N * 2\pi/60$ = rad/sec

$P_m = T_g N 2\pi/60$

$P_m = P_e$

$T_g N 2\pi/60 = E_b I_a$ $\quad \because E_b = \frac{P \cdot \phi \cdot Z \cdot N}{60 \cdot A}$

$$T = \frac{P \cdot Z \cdot \phi \cdot I_a}{2 \cdot \pi \cdot A}$$

Hence T_g is diectly propositional to I_a

Question No 2.

(b).

Answer:

* Differentiate b/w lap & wave winding:

1). Lap winding:

→ The coil is lap back to the succeeding coil.

→ The end of the armature coil is connected to an adjacent segment on the commutators.

→ The numbers of parallel path are equal to the total of number poles.

→ Other names parallel or Multiple winding.

→ It have less EMF.

→ Number of brushes are equal to the number of parallel paths.
→ Having types; simplex and Duplex lap winding
→ It have less efficiency.
→ Having additional coil; equalizer Ring.
→ Having high winding cost because more conductor is required.
→ It is used in low voltage and high current machine.

2. Wave Winding:
→ The coil of the winding from the wave shape.
→ The end of the armature coil is connected to commutator segments some distance apart.
→ The number of parallel paths is equal to two.
→ Other names; two circuit or series winding.
→ It have more EMF.
→ Number of brushes equal to two.
→ Having types; Progressive and Retrogressive wave winding.

→ It have high efficiency.
→ It have additional coil; Dummy coil.
→ It has low winding cost.
→ It is used in high voltage and low current machine.

Question No 1.

b).

Solution:

Given Data:

no of poles = 8

Z = 480

EMF per 10 conductor = 2.2V

current per conductor = 100 A

Required Data:

Terminal valtage E = ?

output current I = ?

power generated for both lap & wave winding = ?

Sol:

No of conductor per Path

= 480/8

= 60

e.m.f per conductor = 0.22 V

P-T-O

* Terminal voltage:

= emf per conductor x no of conductor

= 0·22 x 60

= 13·2 V

* Output current:

= current per conductor x no of parallel path

= 100 x 8 = 800A

* Power generated for lap winding:

= output current x generated emf

= 800 x 13·2

= 10,560 W

* Power generated for wave winding:

no of parallel paths = 2

no of conductor per path

So 480/2 = 240

terminal voltage

= 0·22 x 240

= 52·8 V

output current

100 x 2 = 200 A

So

200 x 52·8

= 10,560 W

"The END"