ID: 13748

Name: Hamza Ishaq (1)

Electrical Machine

Q 1 (a)

Ans.

Speed Control Method of DC Motors:

→ 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.

Speed Control of DC Series Motor.

1. Armature Resistance Control Method: Here the controlling resistance is connected directly in series with the supply of the motor.

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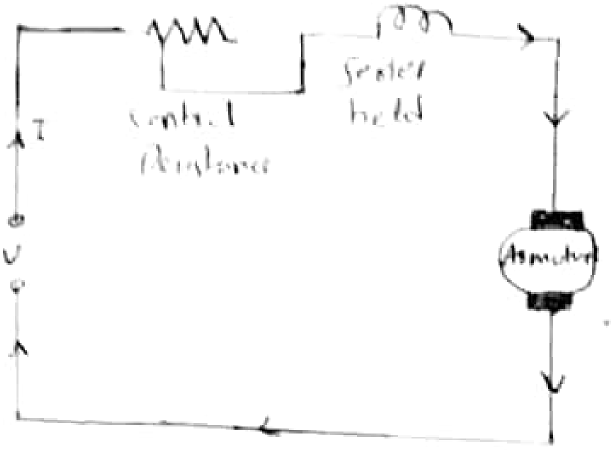

This reduces the voltage available across the armature and hence the speed falls by changing the value of variable resistance

This method of speed control is most economical for constant torque.

2. Tapped Field control:

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

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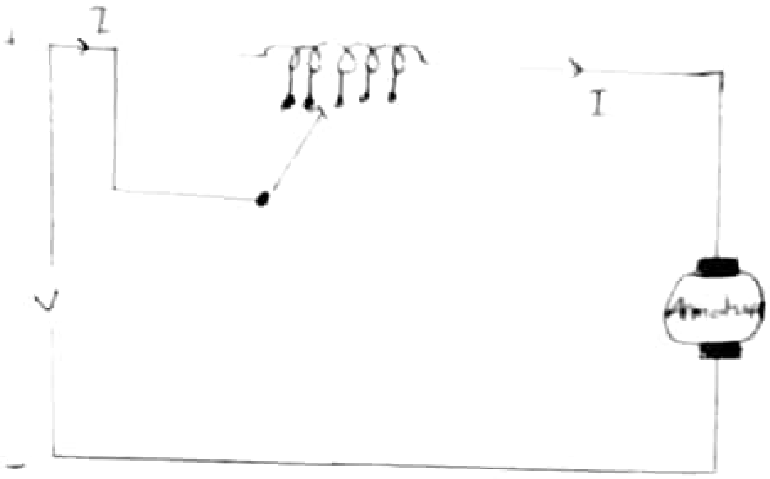

Speed Control of DC Shunt Motor:

1. Flux Control method:

In this method variable resistance (known as shunt field rheostat) is placed in series with shunt field winding as.

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

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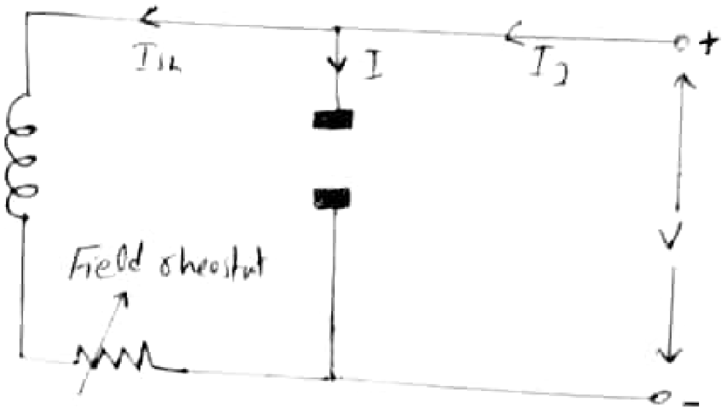

- This is an easy and convenient method.
- It is an inexpensive method since very little power is wasted in the shunt field rheostat due to relatively small value Ish.

2. Armature Control Method:

This is done by inserting a variable resistance Rc (unknown or controller resistance) in series with the armature.

The flux remain constant while armature current is changed produces change in speed

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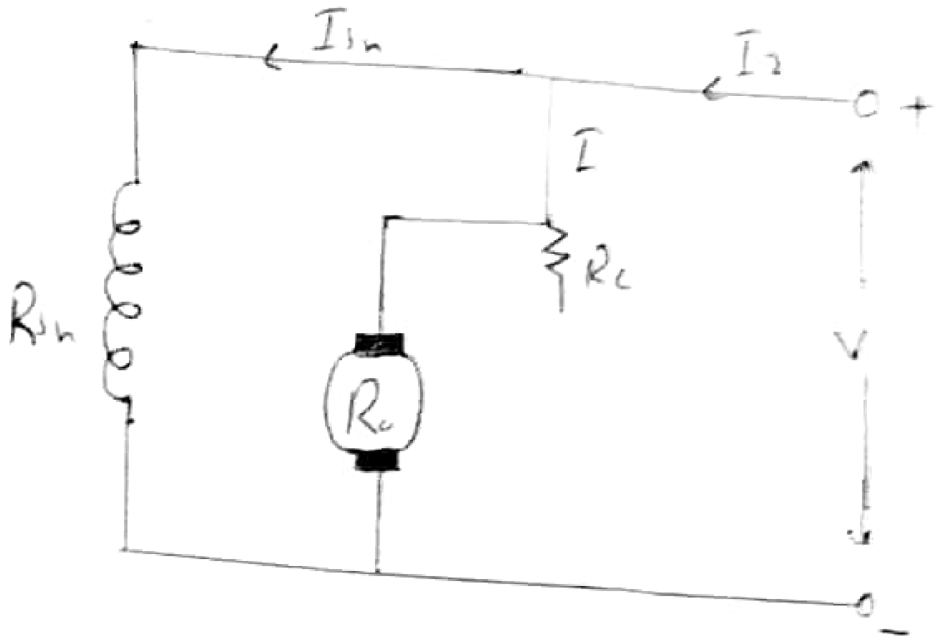

Large amount of power is wasted in this controller resistance since it carries full armature current I_a.

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Q 1 (b)

Ans

Z = 480

P = 8

emf = 22 v

Current = 100 A

total Voltage = ?

o/p current = ?

P = ?

Solution:

For lap A = 8

$$Emf = 22 \times \frac{480}{8} = 132$$

Current = 100 × 8 = 800

P = VI = 800 × 132

= 105 kw

For wave

A = 2

$$emf = 22 \times \frac{480}{2} = 528$$

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Current = 100×2

= 200

P = 105kW

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Q 2 (a)

Relationship b/w Torque and Armature current:

$Pe = Pm$

Pe = Electrical Power

Pm = Mechanical Power

$Pe = Ea\ Ia$ as ($Ea = Eb + IaRa$) KVL

$Pe = (Eb + IaRa)\ Ia$

$Pe = Eb +$ ~~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 = $N \times 2\pi/60$ = rad/sec

$Pm = Tg\ N 2\pi/60$

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$P_m = P_e$

$T_g \, N \, 2\pi / 60 = E_b \, I_a$

$$E_b = \frac{P \cdot \phi \cdot Z \cdot N}{60 \cdot A}$$

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

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Q 2 b.

Ans. Difference b/w Lap winding and wave winding.

Basis for Comparison	Lap winding	Wave winding
Definition	The coil is lap back to the succeeding coil.	The coil of the winding form the wave shape
Connection	The end of the armature coil is connected to an adjacent segment on the commutators	The end of the armature coil is connected to commutator segment some distance apart
Parallel Path	The number of parallel path are equal to the total of number poles	The number of parallel paths is equal to two.
Other name	Parallel winding or Multiple winding	Two-circuit or series winding
EMF	Less	More
Number of Brushes	Equal to the number of parallel paths	Two
Types	Symplex and Duplex lap winding	Progressive and Retrogressive wave winding
Efficiency	Less	High

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Additional coil	Equalizer Ring	Dummy coil
Winding cost	High (because more conductor is required)	Low
Uses	In low voltage, high current machines	In high voltage & low current machines