IQRA National University, Peshawar

Name: ________________

Department of Electrical Engineering

Summers 20

Reg.No:_______________

Instructo

Engr. Sanaullah Ahmad

Electrical Machines

Total Marks : 50

Attempt All Questions.

Sketch neat and labeled diagrams.

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Question No 1.

A. Discuss any two methods of speed control each for series and shunt wound DC motors? 15 **(CLO – 3)**

B. Consider a 8 poles DC Generator, Number of conductors Z are 480, emf induced per 10 conductor is 2.2V , current per conductor is 100A find the terminal voltage E , output ~~current I and power generated for both lap and Wave windings ?~~ **(CLO – 1)**

Question No 2.

A. Determine Relationship between torque and armature current? **(CLO – 2)** 15

B. Differentiate between lap winding and wave winding? **(CLO – 3)** 10

"GOOD LUCK"

Name : Fayaz ullah

ID : 13854

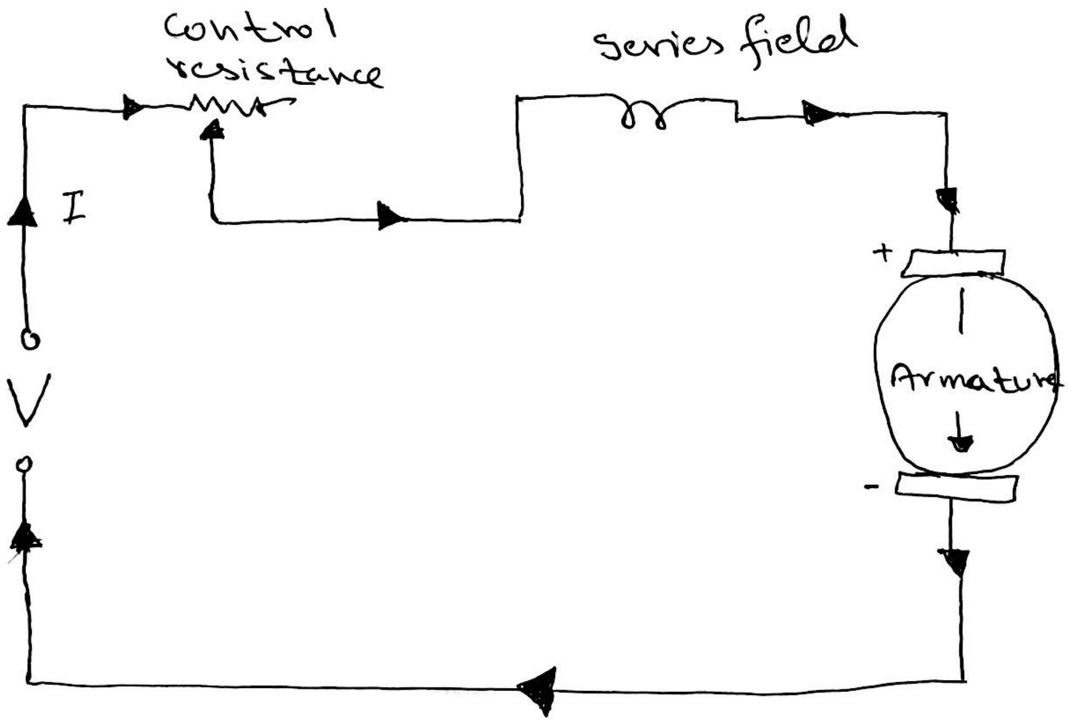
Subject : Electrical Machine

Final Term

Speed Control of DC Series Motor:

• **Armature Resistance control Method:**

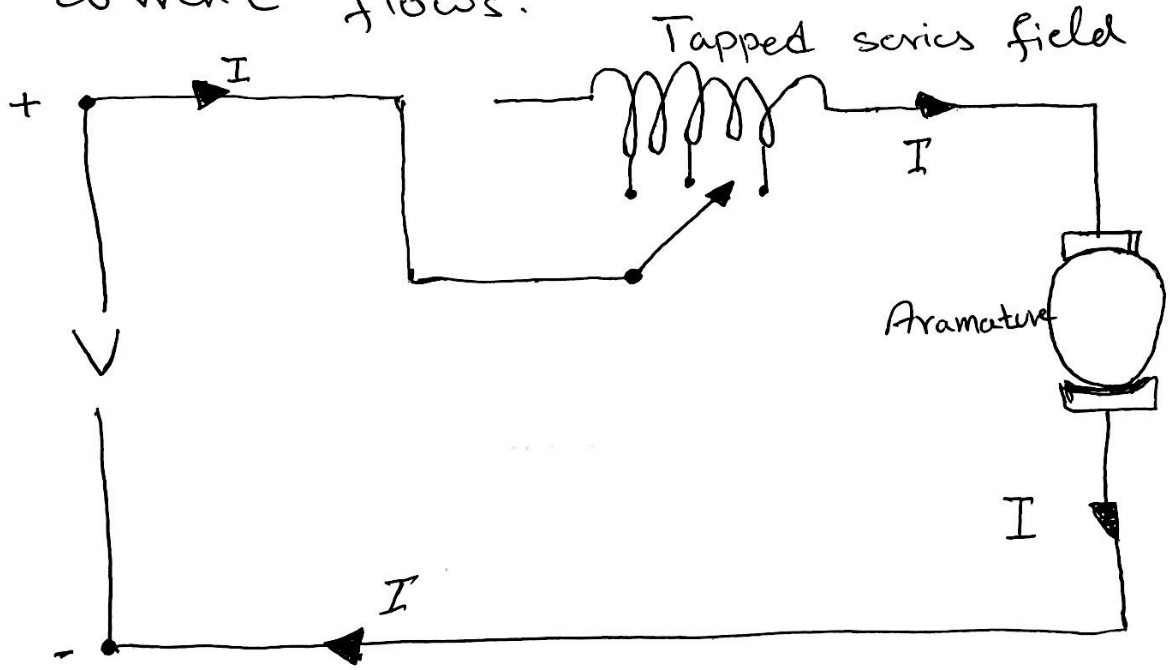
Here the controlling resistance is connected directly in series with the supply of the motor.



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.

- 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.

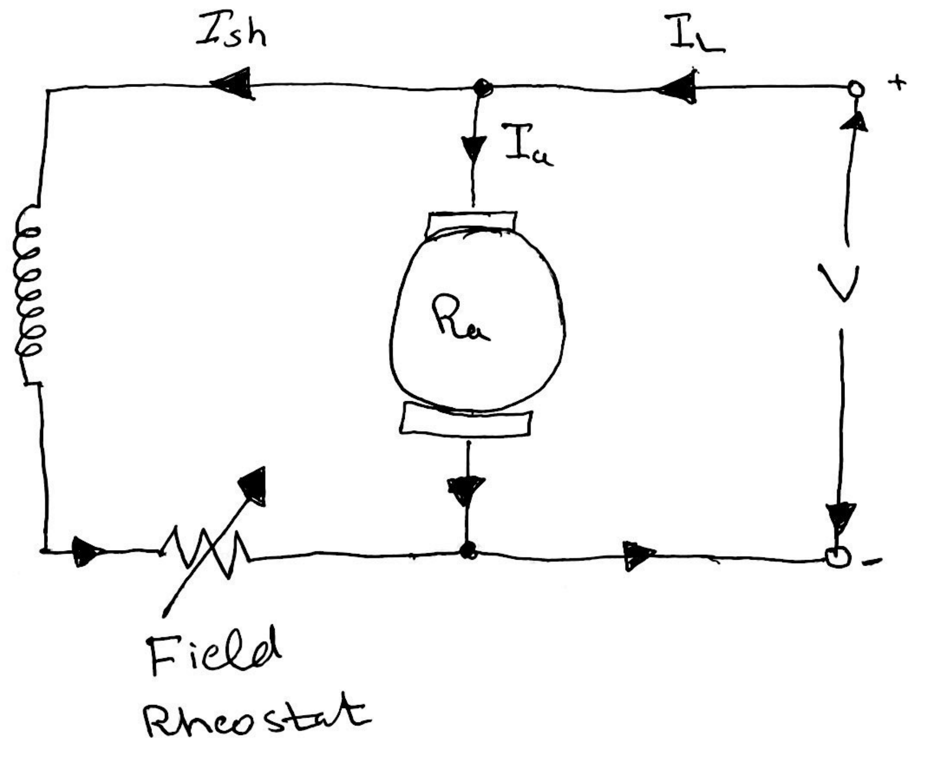


speed control of DC shunt Motor

• Flux control Method:

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

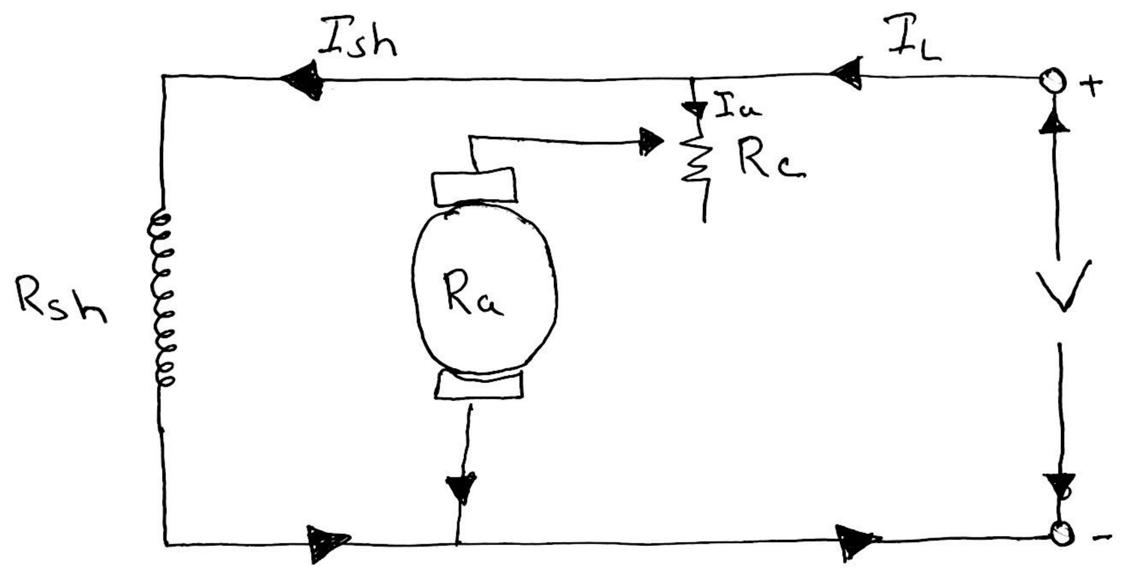
→ An increase in controlling resistances reduces the field current with a reduction in flux and an increase in speed.



- **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.



Question 1
Part (B)

Poles = 8

Z = 480

emf induced = 2.2V

I = 100A

No. of conductors per pole = $\frac{480}{8} = 60$

terminal voltage

E = emf induced × no. of conductors

= 2.2 × 60

E = 132V

output current = current per conductor × no. of parallel paths

= 100 × 8

output current = 800 A

Power generated = output current × generated emf

= 800 × 132

Power generated = 105.6 kW

For wave winding

No. of parallel paths = 2

No. of coductors per path = $\frac{480}{2}$ = 240

Terminal voltage = 2.2 × 240 = 528V

output current = 100 × 2 = 200A

Power generated = 200 × 528

= 105.6 kW

Question No 2

Part (a)

Relationship b/w Torque & Armature current

$Pe = Pm$

Pe = Electrical Power

Pm = Mechanical Power

$Pe = E_a I_a$ as ($E_a = E_b + I_a R_a$) KVL

$Pe = (E_b + I_a R_a) I_a$

$Pe = E_b I_a + ~~I_a~~ I_a^2 R_a$ (dissipate in form of heat)

~~$Pe = E_b I_a$~~

$Pe = E_b I_a$

Now,

$Pm = T_g W$ ∵ T_g = Torque in N.M
W = angular speed in rad/sec

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

~~Pm=~~

$$P_m = T_g N 2\pi / 60$$

$$P_m = P_e$$

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

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

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

Hence

T_g is directly proportional to I_a

Part (b)

	Lap Winding	Wave Winding
Definition	The coil is lap back to the succeeding coil.	The coil of the winding form the wave shape.
EMF	Less	More
Efficency	Less	High
Additional coil	Equalizer ring	Dummy coil
Types	Simplex and Duplex	Progressive & Retrogressive
Other name	Parallel or multiple winding	Two-circuit or series winding
Uses	In low voltage, high current machines	In high voltage, low current machines.