## UNIT -4
## PERMANENT MAGNETS BRUSHLESS DC MOTORS

**1. what are the advantages of brushless dc motors drives?**

✓ Regenerative braking is possible
✓ Speed can be easily controllable

**2. what are the disadvantages of brushless dc motors drives?**

✓ It requires a rotor position sensor
✓ It requires a power semiconductor switching circuits.

3. **Define mechanical commutators?**

Its arrangement is located in the rotor
No of commutators segments are very high .

4.**Define electronic commutators?**

✓ Its arrangement is located in the stator
✓ No of switching devices limited to six

**5.mention some applications of PMBL DC motor?**

✓ Power alternators
✓ Automotive applications
✓ Computer and Robotics applications
✓ Textile and Glass industries

**6.what are conventional Dc motor?**

✓ Field magents on the stator
✓ Maintenance is high

**7.what are PMBL DC motor?**

✓ Field magents on the rotor
✓ Low maintanace

**8.why is the PMBLDC motor called electronically commulated motor?**

The PMBL DC motor is also called electronically commutated motor because the phase windings of PLMBL DC motor is energized by using power semiconductor switching circuits.here the power semiconductor switching circuits act as a commutator.

**9.what are the classification of BLPM DC motor?**

- ✓ BLPM square wave motor
- ✓ BLPM sine wave motor

**10.what are the two types of BLPM SQW DC motor?**

- ✓ 180"polerarc BLPM SQW motor
- ✓ 120"polearc BLPM SQW motor

**11.what are the two types of rotor position sensors?**

- ✓ Optical position sensor
- ✓ Hall effect position sensor

**12.what are the materials used for making Hall IC pallet?**

- ✓ Indiem-antinomy
- ✓ Gallium-arsenide

**13.what are applications of stator?**

- ✓ Automotive applications
- ✓ Veticular electric drive motors



**14.what are the classification of BLPM dc motor?**

- ✓ One phase winding and one pulse BLPM dc motor
- ✓ One phase winding and two pulse BLPM dc motor
- ✓ Two phase winding and two pulse BLPM dc motor
- ✓ Three phase winding and three pulse BLPM dc motor
- ✓ Three phase windings and six pulse circuits

**15.what are the features of one phase winding and one pulse BLPM dc motor?**

- ✓ It is inertia should be high,such that rotor rotates continuously
- ✓ Utilization of transistor and windings are less

**16.what are the features of one phase winding and two pulse BLPM dc motor?**

- ✓ In this case winding utilization is better,however transistor utilization is less.
- ✓ Torque developed is more uniform

**17.what are the features of two phase winding and two pulse BLPM dc motor?**

- ✓ Winding utilization is only 50%which is less
- ✓ It provide better torque waveforms

✓

**18.what are the features of three phase windings and 6 pluse circuits?**

✓ Utilization factor of winding will be better
✓ Torque pulse and ripple frequency components are less
✓

**21.what is meant by self control?**

Self control ensures that for all opearating points the armature and rotor fields move exactly at the same speed.

**22.what is meant by vector control?**

PMSm are employed for variable speed applications. The process of controlling voltage and frequency to get the desired speed and torque is known as vector control of PMSM

# UNIT-4

## permanent magnet brushless DC motor

1) sketch the structure of controller for PMBLDC motor & explain the functions of various blocks.

A PMBLDC machine is a polyphase synchronous motor. the stator consists of 3φ winding. The rotor consist of permanent magnets. three phase square or trapezoidal voltages are fed to the windings through inverter. Here no brushes in the rotor side. that is why called PMBLDC machine.

3) Derive the expressions for the emf & torque of a PMBLDC motor.



EMF Equation

$$e_{ph} = 4 B_g r l T_{ph} \omega_m \text{ volts}$$

Torque equation

$$T = K_m I$$

under starting condition, the torque developed in the motor is starting torque.

$$T_{st} = K_m I_{st}$$

Speed ratio

$$SR = 1 - \frac{2 I R_{ph}}{V}$$

$$TR = I / I_{st}$$

6) Sketch the torque-speed characteristics of a PMBLDC motor.

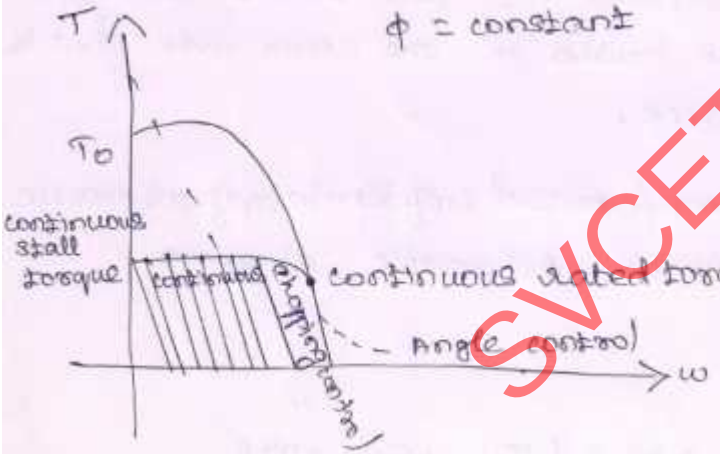
$$\frac{\omega}{\omega_{no}} = 1 - \frac{T}{T_{st}}$$

$$\omega = \omega_{no}\left(1 - \frac{T}{T_{st}}\right)$$

where the no load speed is

$$\omega_{no} = \frac{V}{K\phi} = \frac{V}{K_m} \text{ rad/sec}$$

$\phi$ = constant



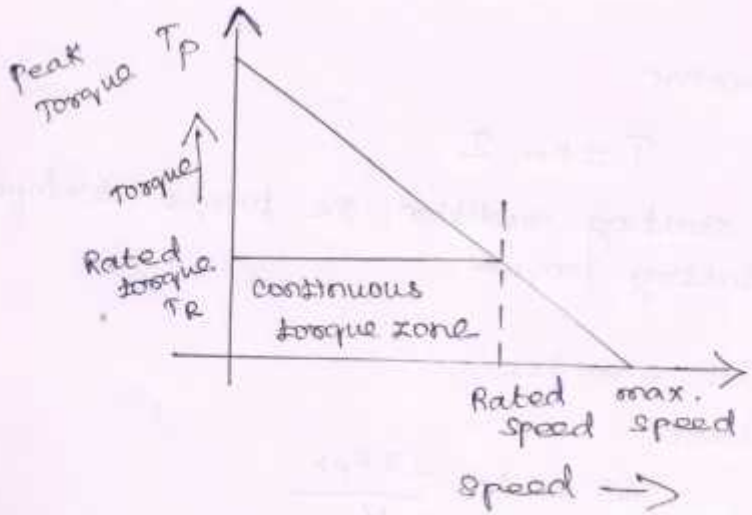

The stall torque,

$T_{st} = K\phi I_{st}$

stall current,

$I_{st} = V/R$





4. Draw the diagram of electronic commutator. Explain the operation of electronic commutator.

The PMBLDC motor is also called electronically commutated motor because the phase windings of PMBLDC motor is energized by used in power semiconductor switching circuits. Here, the power semiconductor switching circuits act as a commutator. It is done by using inverter circuits. It converts dc voltage into ac voltage. commutator arrangement is located in the stator.

It requires a separate rotor position sensor.

No sliding contacts

There is no sparking

Number of switching devices is limited to 6.

It is possible to get the feedback from the stored energy in the magnetic field to the mains. It requires less maintenance.

Diagram, Explanation

5) Discuss the use of Hall sensors for position sensing in PMBLDC motor.

Hall sensor :-

A sensor that is operated with hall effect principle is called hall sensor. It is used to sense the rotor position of the PMBLDC motor.

Diagram & Explanation