## SHORT QUESTIONS AND ANSWERS

## UNIT-I - SYNCHRONOUS RELUCTANCE MOTOR

**1. What is synchronous reluctance motor?**

- A **reluctance motor** is a type of synchronous electric motor which induces non-permanent magnetic poles on the ferromagnetic rotor. Torque is generated through the phenomenon of magnetic reluctance.
- The stator consists of multiple salient (ie. projecting) electromagnet poles, similar to a wound field brushed DC motor. The rotor consists of soft magnetic material, such as laminated silicon steel, which has multiple projections acting as salient magnetic poles through magnetic reluctance.
- The number of rotor poles is typically less than the number of stator poles, which minimizes torque ripple and prevents the poles from all aligning simultaneously -- a position which can not generate torque.

2. **Define the characteristics of synchronous reluctance motor**.

The synchronous reluctance motor is not self starting without the squirrel cage. During run up it behaves as an induction motor but as it approaches synchronous speed, the reluctance torque takes over and the motor locks into synchronous speed.

**3. Write the applications of syrm.**

Used where regulated speed control is required in applications suc as metering pumps and industrial process equipment.

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**4. What are the classification of syrm**

- Axially laminated
- Radially laminated

5. **What are the primary design consideration of syrm**?

- High o/p power capability
- Ability of the rotor to withstand high speed.
- High reliability
- Low cost
- High efficiency

**6. Define power factor of syrm**

PF max=(Ld/Lq-1)/(Ld/Lq+1)
Higher Ld/Lq ratos yield higher power factors,which corresponds to reduced I^2R losses and reduce volt ampere ratings of the inverter driving the machine.

**7. What are the applications of the torque – speed characteristics of syrm?**

- Comparable power density but better efficiency than induction motor
- Slightly lower power factor
- Sensorless control is much easier due to motor saliency.

**8. What are advantages of syrm over pm machine?**

- More reliable than PM machine
- There need not be any excitation field as torque is zero,thus eleiminating electro magnetic spinning losses.

**9. What are applications of syrm?**

- Synthetic fiber manufacturing equipment
- Wrapping and folding machine
- Auxiliary time mechanism
- Synchronized conveyors
- Metering pumps

**10. What is vernier motor?**

It is an unexcited reluctance type sync.motor.the peculiar feature of this motor is that a small displacement of the rotor produces a large displacement of the axis of maximum and minimum permeance.

**11. What are the advantages of syrm ?**

a. Freedom from pm
b. Ability to maintain full load torque at zero speed c.
A wide speed range at constant power.

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**12. What are the classifications of SYRM?**

- ✓ Rotor configuration i)cage
  rotor for line start
  ii)cageless-rotors for variable speed
- ✓ Stator windings
- ✓ Stator current controlled mode

**13. What are the rotor configurations of SYRM?**

Rotor configuration i)cage
rotor for line start
ii)cageless-rotors for variable speed
load

UNIT - I

## Synchronous reluctance Motor

1. Explain the constructions & working principle of synchronous reluctance motor.

A reluctance motor that utilizes an ac rotating field, which allows for the possibility of extremely smooth torque & good operation to low speeds.

construction - Diagram

Stator - stationary part of the machine

Rotor - rotating part of the machine

→ different types
- salient rotor
- Radially laminated rotor
- Axially laminated rotor

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Principle

when a piece of magnetic material is located in a magnetic field, a force act on the material & bring it into a minimum reluctance position in which the flux linkages is maximum.

Advantages

There need be no excitation field at zero torque, thus eliminating electromagnetic spinning losses.

Drawbacks :-

compared to IM it is slightly heavier & has low power factor. But increasing the saliency ratio $\frac{L_d}{L_q}$ the powerfactor can be improved.

Applications :-

Fiber - spinning mills
Industrial process equipment
Metering pumps

2. explain in detail about classification of synchronous reluctance motor.

Types → Radial airgap motor
→ Axial airgap motor

Radial airgap motor :-

In this type of motor, the stator construction remain same. but the rotor has projecting pole lamination of steel core.

Axial airgap motor :-

In this motor, the length of laminated core is same as the length of winding.

The magnetic working radius varies over the area of the airgap

→ Diagram

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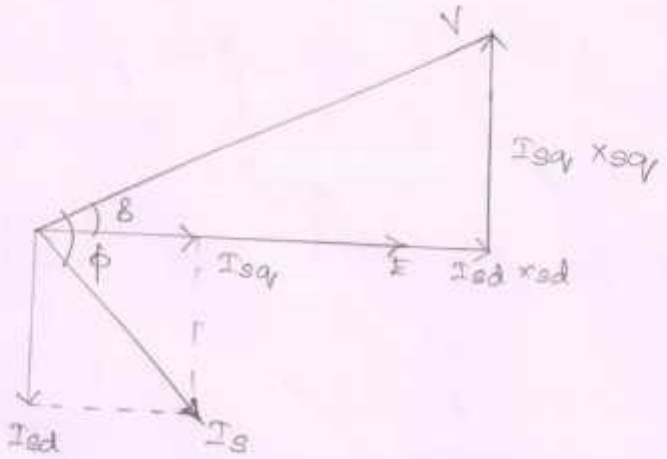
3. Draw the phasor diagram of synchronous reluctance motor.




4. Derive the torque equation of synchronous reluctance motor.

$$T = \frac{P_m}{\omega_s} = \frac{3V^2 \sin 2\delta}{2\omega_s}\left[\frac{x_{sd} - x_{sq}}{x_{sd} \cdot x_{sq}}\right]$$

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5. Draw & explain the characteristics of syn. reluc. motor.

i) T - δ :-

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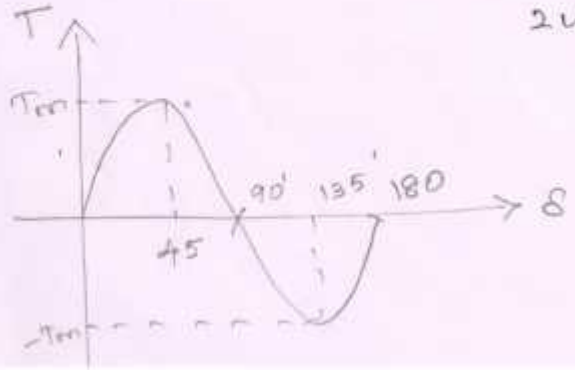
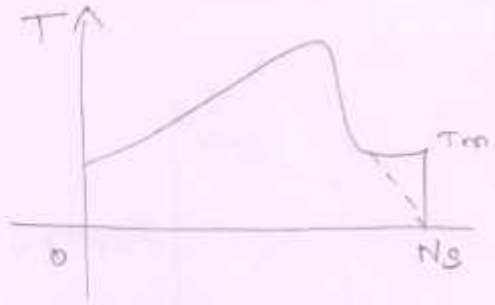
$$T = \frac{3V^2 \sin 2\delta}{2\omega_s}\left[\frac{x_{sd} - x_{sq}}{x_{sd} \cdot x_{sq}}\right]$$



Speed - Torque characteristics :-

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