



# SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

**An Autonomous Institution**

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

**19EE504 - SPECIAL ELECTRICAL MACHINES**





# CONTENTS

- Machine?
- Electrical machine?
- Special Electrical Machines?
- Syllabus
- Applications
- Case studies





# MACHINE

- A machine is a **physical system that uses power to apply forces** and control movement to perform an action.

OR

- An apparatus consisting of interrelated parts with separate functions, **used in the performance of some kind of work.**

OR

- Machine is any device that makes **work easier.**

OR

- A device that helps **lift a heavy load, speed up motion, or change the direction of the force in the desired direction** is called a machine.

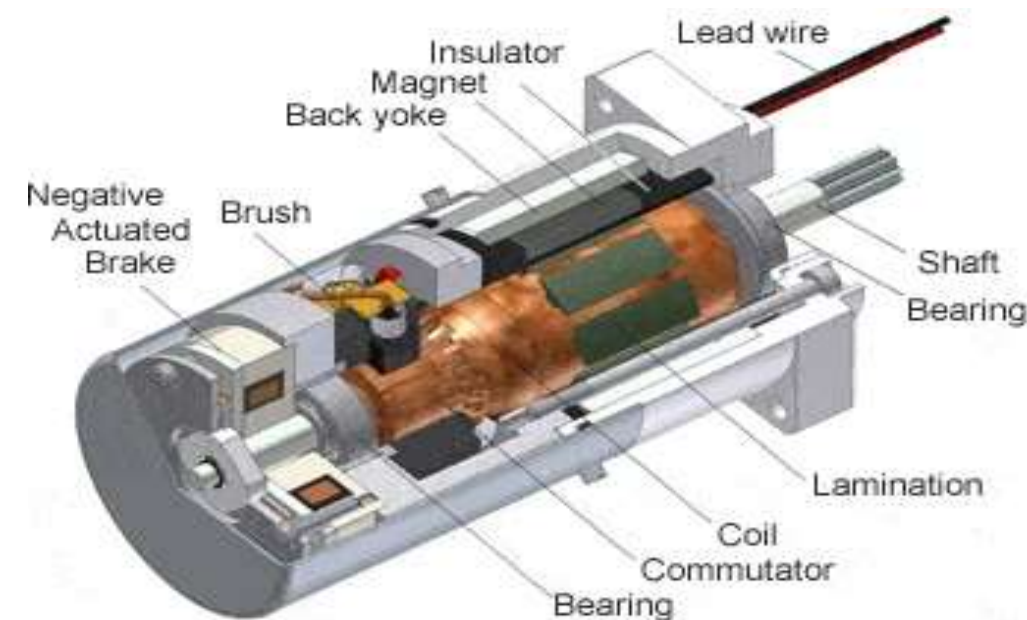


# MACHINE



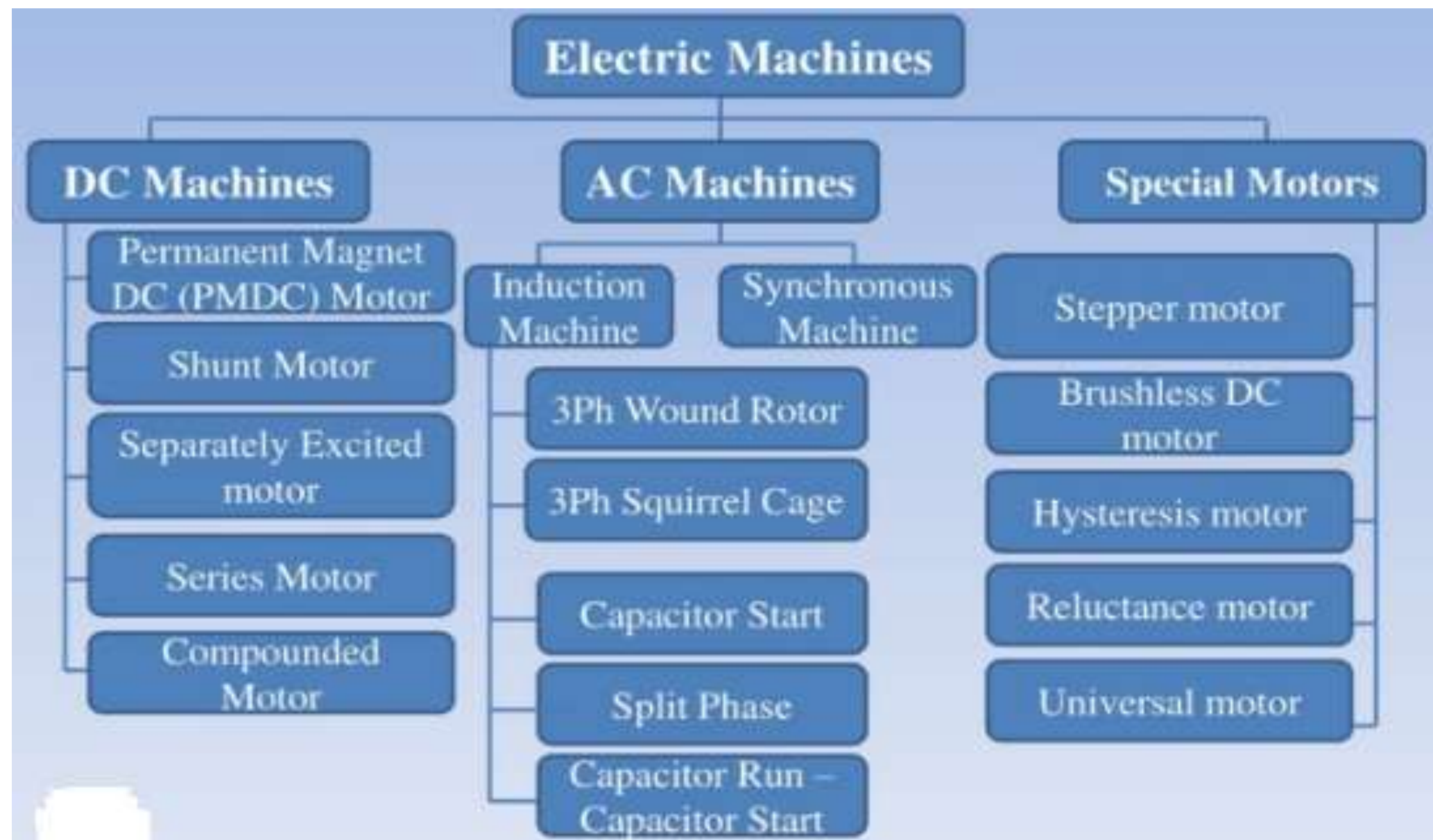
# ELECTRICAL MACHINES

- A machine that converts mechanical energy into electrical energy and vice versa is called as an Electrical Machine.





# TYPES OF ELECTRICAL MACHINES





# SPECIAL ELECTRICAL MACHINES

- Machines whose stator coils are energized by electronically switched currents.

OR

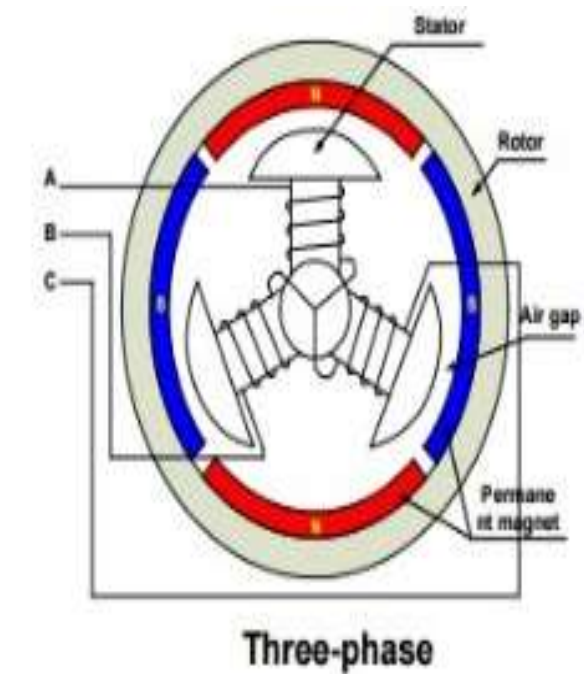
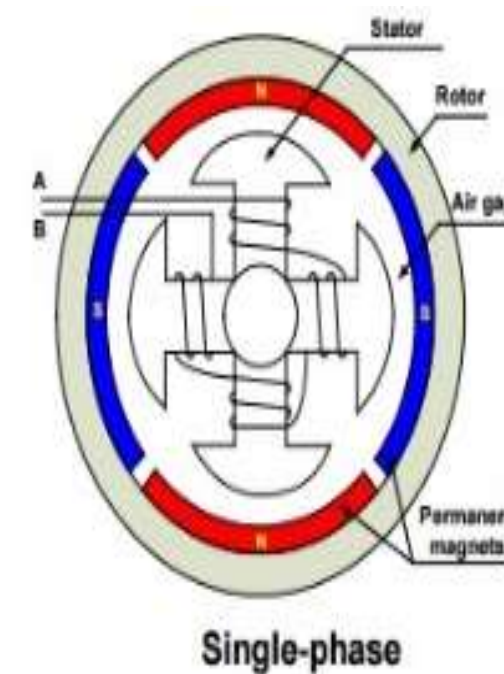
- A special machine is a semi or 100% automatic machine which allows specific operations dedicated to a product or a family of products to be carried out.

OR

- Term where any motor other than the general purpose motor has its special operating capacity by customization or manual design.

## PERMANENT MAGNET BRUSHLESS DC MOTOR

- Fundamentals of Permanent Magnets
- Types
- Principle of Operation
- Magnetic Circuit Analysis
- EMF and Torque Equations
- Characteristics and Control





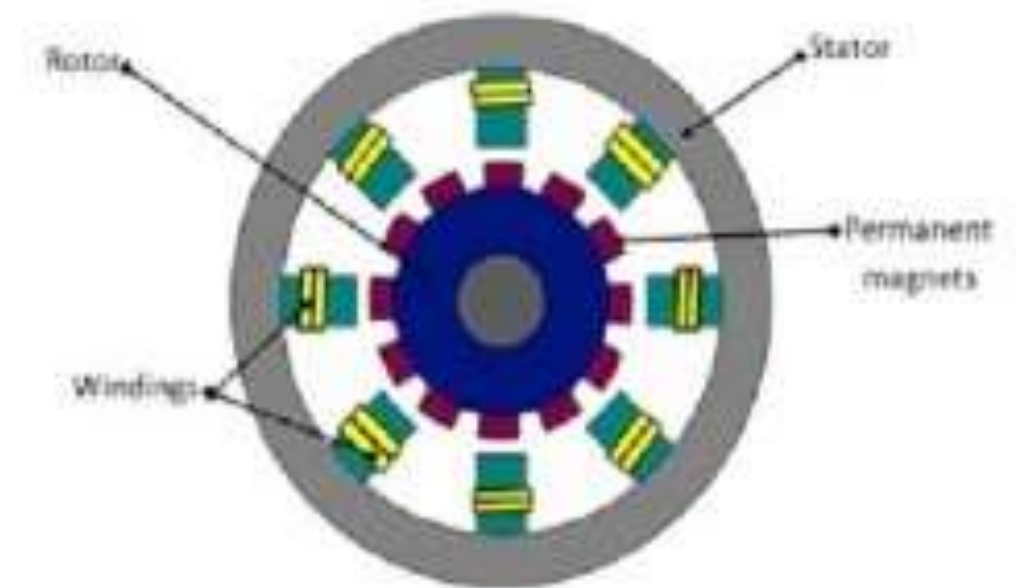


## UNIT – 2



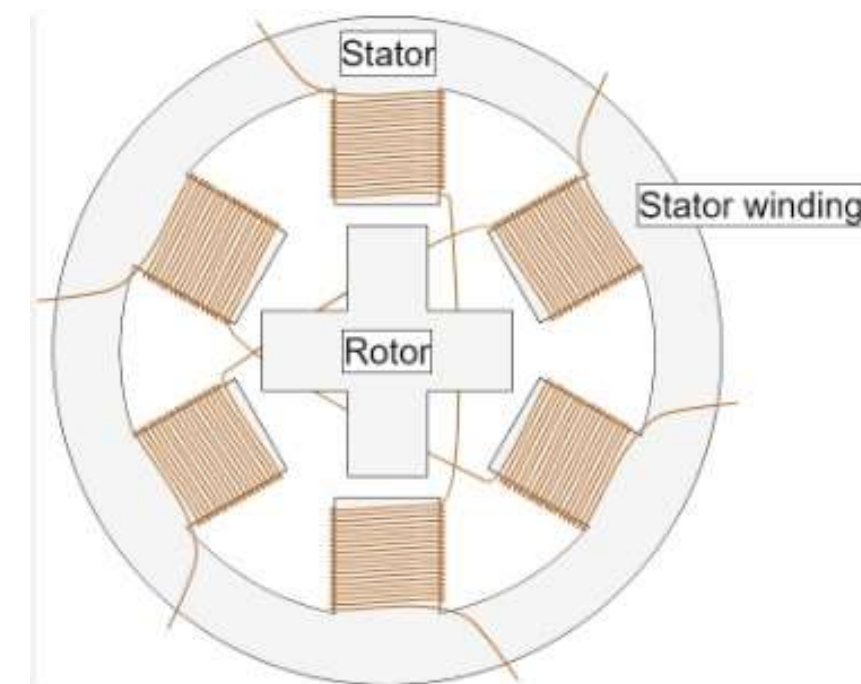
# PERMANENT MAGNET SYNCHRONOUS MOTOR

- Principle of Operation
- EMF and Torque Equations
- Phasor Diagram
- Power Controllers
- Performance Characteristics
- Digital Controllers
- Constructional Features, operating Principle
- Characteristics of Synchronous Reluctance Motors



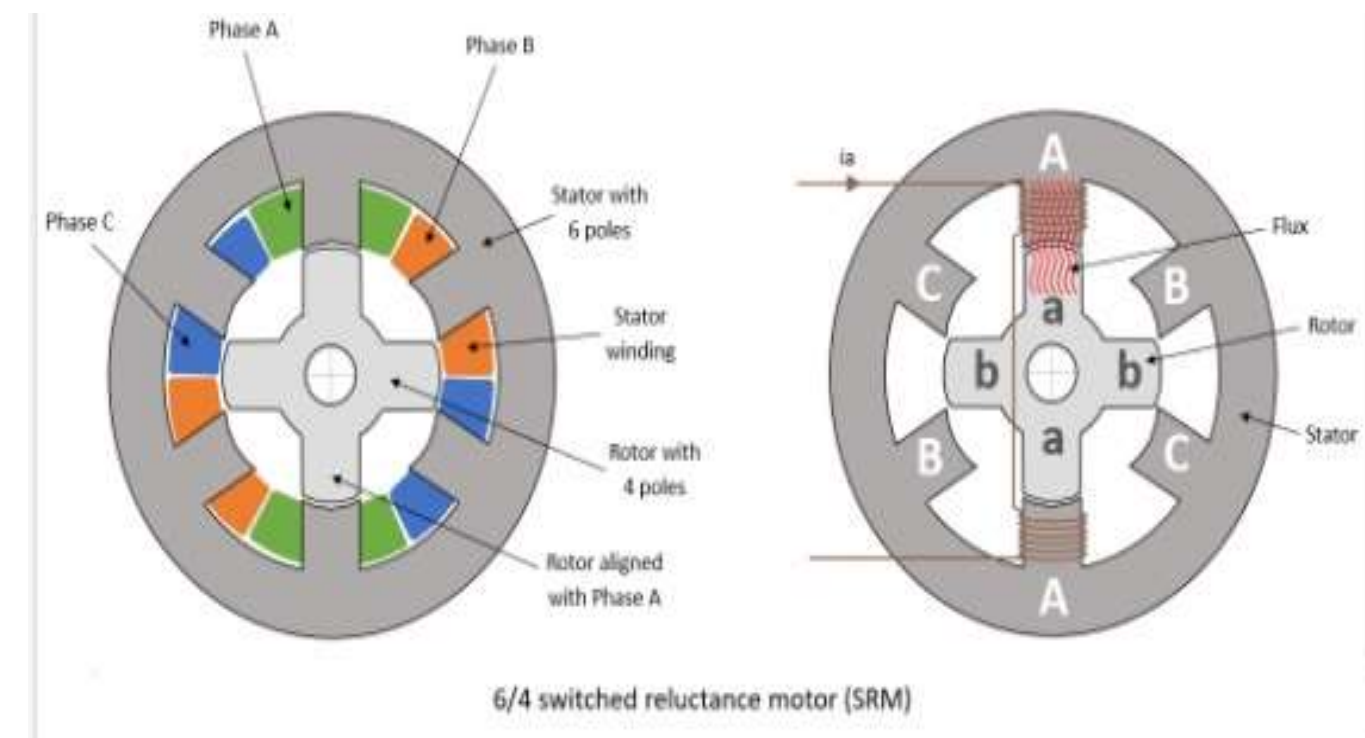
## STEPPER MOTOR

- Constructional Features
- Principle of Operation
- Types
- Torque Equation
- Linear and Non Linear Analysis
- Characteristics
- Drive Circuits
- Closed Loop Control
- Applications



## SWITCHED RELUCTANCE MOTOR

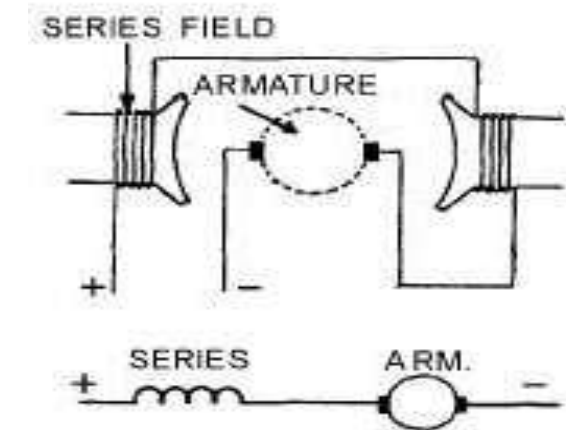
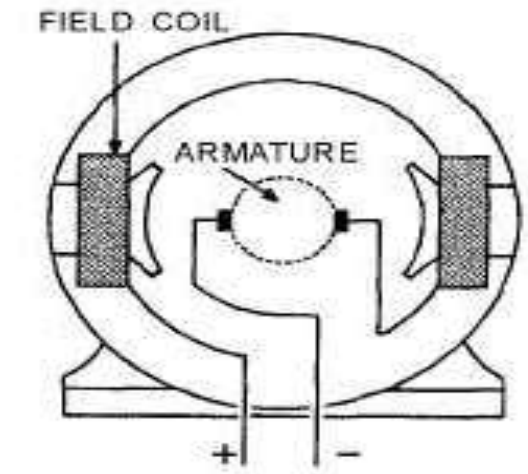
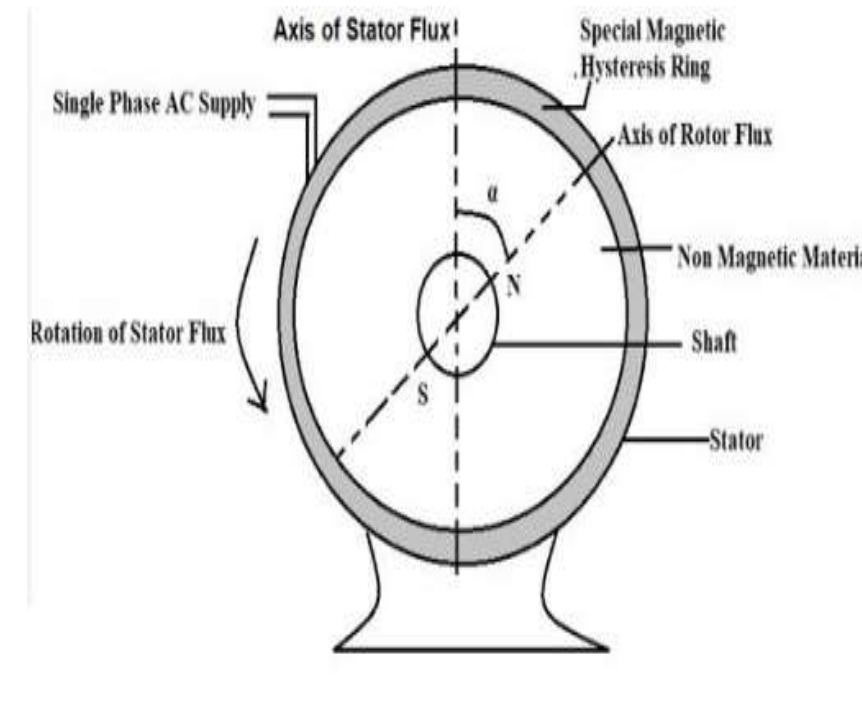
- Constructional Features
- Principle of Operation
- Torque Prediction
- Performance Characteristics
- Power Controllers
- Control of SRM drive
- Sensor less operation of SRM
- Applications



# UNIT – 5

## OTHER MOTORS

- Principle of Operation
- Characteristics of Hysteresis Motor
- AC Series Motors
- Linear Induction Motor
- Applications





# APPLICATIONS

## PMBLDC MOTORS :

- Computer hard drives and DVD/CD players.
- Electric vehicles, hybrid vehicles, and electric bicycles.
- Industrial robots
- CNC machine tools
- Simple belt driven systems.
- Washing machines, compressors and dryers.
- Fans, pumps and blowers.



# APPLICATIONS

## PMSM MOTORS :

- Refrigerators.
- Air Conditioners
- AC Compressors
- Robotic Arms
- Mobile Robots
- Aircraft Actuators



# APPLICATIONS

## STEPPER MOTORS :

- Floppy disk drives
- Computer printers
- Plotters
- Slot machines
- Image scanners
- Intelligent lighting
- CNC machines
- 3D printers.



# APPLICATIONS

## SRM MOTORS :

- Textile Machinery
- Oil Field Machinery
- Mining Machinerics
- Electric Vehicles





# CHART WORK

- **Comparison of different types of Special Electrical Machines.**

**Machine Type:** Identify the specific type of electrical machine (e.g., Stepper Motor, Brushless DC Motor, Linear Motor, Servo Motor)

**Power Rating:** Specify the power output or rating (in watts, kilowatts, horsepower, etc.).

**Voltage Rating:** Indicate the operating voltage range or nominal voltage.

**Current Rating:** Include the current requirements for operation (in amperes).

**Speed Range:** Detail the operating speed range (in RPM or other relevant units).

**Torque:** Provide the torque characteristics, including starting torque, running torque, and peak torque.

**Efficiency:** Mention the efficiency at various operating points.

**Control Method:** Describe the type of control used (e.g., PWM control, vector control, open-loop, closed-loop, etc.).



# CHART WORK



## ➤ **Comparison of different types of Special Electrical Machines.**

**Applications:** List typical applications or use cases for the machine.

**Construction:** Detail the physical construction (e.g., number of poles, rotor type, stator type, materials used, etc.).

**Starting Mechanism:** Describe how the machine starts (e.g., direct on-line, soft start, etc.).

**Cooling Method:** Specify the cooling method used (e.g., air-cooled, liquid-cooled, self-cooled, etc.).

**Maintenance Requirements:** Note the maintenance needs and intervals.

**Noise Level:** Include information on the noise level produced during operation (in dB).

**Size and Weight:** Provide the physical dimensions and weight of the machine.

**Cost:** Give an approximate cost or price range.

**Environmental Considerations:** Mention the operating environment conditions (e.g., temperature range, humidity tolerance, IP rating)

**Manufacturer:** Note the manufacturer or brand.

**Warranty:** Provide information on the warranty period and conditions.

