

## SPECIAL ELECTRICAL MACHINES

### (Elective – II)

#### **Preamble:**

This is an advanced course on electrical machines. Students will be exposed to various special machines which are gaining importance in industry. This course covers topics related to principles, performance and applications of these special machines including switched reluctance motors, stepper motors, permanent magnet dc motors, linear motors and electric motors for traction drives.

#### **Learning Objective:**

- To explain theory of operation and control of switched reluctance motor.
- To explain the performance and control of stepper motors, and their applications.
- To describe the operation and characteristics of permanent magnet dc motor.
- To distinguish between brush dc motor and brush less dc motor.
- To explain the theory of travelling magnetic field and applications of linear motors.
- To understand the significance of electrical motors for traction drives.

#### **UNIT I:**

##### **Switched Reluctance Motor**

Principle of operation – Design of stator and rotor pole arc – Power converter for switched reluctance motor – Control of switched reluctance motor.

#### **UNIT II:**

##### **Stepper Motors**

Construction – Principle of operation – Theory of torque production – Hybrid stepping motor – Variable reluctance stepping motor – Open loop and closed loop control.

#### **UNIT III:**

##### **Permanent Magnet DC Motors**

Construction – Principle of working – Torque equation and equivalent circuits – Performance characteristics – Moving coil motors.

**UNIT IV:****Permanent Magnet Brushless DC Motor**

Construction – Principle of operation – Theory of brushless DC motor as variable speed synchronous motor – Sensor less and sensor based control of BLDC motors.

**UNIT V:****Linear motors**

Linear induction motor: Construction– principle of operation– applications.  
Linear synchronous motor: Construction – principle of operation– applications.

**UNIT VI:****Electric Motors for traction drives**

AC motors– DC motors –Single sided linear induction motor for traction drives – Comparison of AC and DC traction.

**Learning Outcomes:**

The student should be able to

- Explain theory of operation and control of switched reluctance motor.
- Explain the performance and control of stepper motors, and their applications.
- Describe the operation and characteristics of permanent magnet dc motor.
- Distinguish between brush dc motor and brush less dc motor.
- Explain the theory of travelling magnetic field and applications of linear motors.
- Understand the significance of electrical motors for traction drives.

**Text Books:**

1. Special electrical Machines, K.Venkata Ratnam, University press, 2009, New Delhi.
2. Brushless Permanent magnet and reluctance motor drives, Clarendon press, T.J.E. Miller, 1989, Oxford.
3. Special electrical machines, E.G. Janardhanan, PHI learning private limited, 2014.