

III Year II Semester
17EE634

PROFESSIONAL ELECTIVE-I
SPECIAL ELECTRICAL MACHINES

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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 topic related to principles, performance and applications of these special machines including switched reluctance motors, stepper motors, permanent magnet motors, linear motors and electric motors for traction drives.

Learning Objective

- To explain the performance and control of stepper motors, and their applications.
- To describe the operation and characteristics of permanent magnet dc motor.
- To explain theory of operation and control of switched reluctance 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

Stepper Motors:

Introduction, Construction, Basic Principle of Operation, Types of stepper motors, Applications, Theory of torque production, Open loop and closed loop control.

UNIT II

Permanent Magnet DC Motors:

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

UNIT III

Switched Reluctance Motor :

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

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, applications.

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 the performance and control of stepper motors, and their applications.
- Describe the operation and characteristics of permanent magnet dc motor.
- Explain theory of operation and control of switched reluctance 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

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

Reference Books:

- R.S.Krishnan, “Switched Reluctance Motor Drives: Modeling Simulation Analysis, Design and Application” CRC press 2001.
- Miller, T.J.E. “Brushless Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, Oxford, 1989. 3
- R.S.Krishnan, “Permanent Magnet Synchronous Motor and Brushless DC Motor Drives”, RC press, 2002.
- Naser A and Boldea I, “Linear Electric Motors: Theory, Design and Practical Application”, Prentice Hall Inc., New Jersey, 1987. 5. Kenjo T, “Stepping Motor and their Microprocessor control”, Clarendon press Oxford, 1989