SPECIAL ELECTRICAL MACHINES

Subject Code: 15EE2207

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Pre requisites: Knowledge of Mathematics, Electric Networks and Electrical Machines.

Course Outcomes:

At the end of the course, a student will be able to:

CO 1: Evaluate the performance of Switched Reluctance Motor (SRM) and Servo Motor.

CO 2: Evaluate the performance of Permanents Magnet Synchronous Motors (PMSM).

CO 3: Evaluate the performance of Permanents Magnet Brushless DC (BLDC) Motor.

CO 4: Evaluate the performance of Linear Motor.

CO 5: Evaluate the performance of Stepper Motors.

UNIT-I

SWITCHED RELUCTANCE MOTORS (SRM) & SERVOMOTORS

Switched Reluctance Motor (SRM) Constructional features, Principle of operation. Torque equation, Characteristics, - Microprocessor-Based, Sensorless control of SRM drive.

Servomotors, AC and DC servo motors, Constructional features, Principle of operation, Performance Characteristics, Control and Microprocessor based applications, Transfer function. (10 Lectures)

UNIT-II

PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM)

Constructional details, Principle of operation, EMF and torque equation, Phasor diagram, Torque speed characteristics, Power Controllers, Comparisons of conventional and PM synchronous motor, Transfer function of PMSM, Self control, Vector control, Sensor less control, Microprocessor- Based, DSP based control of PMSM. (10 Lectures)

UNIT-III

PERMANENT MAGNET BRUSHLESS DC (BLDC) MOTORS

Constructional features, Principle of operation, Commutation in DC motors, Difference between mechanical and electronic commutators, sensors- Hall sensors, Optical sensors, Types of BLDC motors, EMF and torque equation, Torque-speed characteristics, Microprocessor- Based, DSP based and sensorless control of PMSM. (10 Lectures)

UNIT-IV

LINEAR MOTORS

Linear Induction Motor (LIM), Construction features, Principle of operation, Thrust equation, Concept of Current sheet, Goodness factor, Equivalent circuit, Performance characteristics, Control strategies. Linear Synchronous Motors (LSM) Construction features, Principle of operation, Thrust equation, Control strategies, Applications. Linear Levitation Machines (LLM), Principle of operation, Attraction and repulsion types of LLM, Goodness factor and Levitation stiffness. (10 Lectures)

UNIT-V

STEPPER MOTORS

Constructional features, Principle of operation, Modes of excitation, Torque production in Variable Reluctance (VR) stepping motor, dynamic characteristics, Drive system and circuit for open loop control, closed loop control, Stability and areas of applications. (10 Lectures)

Text Books:

1. K. Venkataratnam "Special Electrical Machines" Universities Press (India) Private Limited, Hyderabad, First Edition reprinted in 2013.
2. E.G. Janardanan "Special Electrical Machines" PHI Learning Private Limited, Delhi First Edition reprinted in 2014.

Reference Books:

1. R.S. Krishnan "Switched Reluctance Motor Drives: Modeling Simulation Analysis, Design and Application" CRC press2001.
2. 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.
4. 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.

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