I Year I Semester **L P C**

Code: 17PE236 **4 0 3**

SPECIAL MACHINES
(Common to PE, P&ID, PE&ED, PE&D, PE&S, EM&D, PE&PS)

(Elective-IV)

Prerequisites: Concepts of Electrical machines.

Course Educational Objectives:

1. To know the concepts of special types of electrical machines.
2. To understand the different control schemes for PMSM.
3. To learn about the different sensor used in brushless DC motors.
4. To draw the characteristics of servo motors, tachometers and SRM.
5. To understand the concepts of linear induction motor.

UNIT I: Stepper Motors

Constructional features, Principle of operation, Modes of excitation torque production in Variable Reluctance (VR) stepping motor, dynamic characteristics, Drive systems and circuit for open loop control, closed loop control of stepping motor.

UNIT II: Permanent Magnet Synchronous Motors (PMSM) and Switched Reluctance Motors (SRM)

PMSM: Power electronic controllers, Torque speed characteristics, Self-control, Vector control, Current control SRM: Constructional features, Principle of operation. Torque equation, Characteristics, Control Techniques, Drive concept.

UNIT III: Permanent Magnet Brushless DC Motors

Concept of electronic commutation, Hall sensors, Optical sensors, back emf detection, Multiphase Brushless motor, square wave permanent magnet brushless motor drives, Torque and emf equation, Torque-speed characteristics, Speed control by microcontroller.

UNIT IV: Servomotors and AC Tachometers

Servomotor – Types – Constructional features – Principle of Operation – Characteristics -Control – Microprocessor based applications.AC Tachometers: Permanent magnet ac tachometer, AC induction tachometer, Schematicdiagrams, and operating principle.

UNIT V: Linear Motors

Linear Motors: Linear Induction Motor (LIM) Classification – Construction – Principle of Operation – Concept of Current sheet –Goodness factor – DC Linear Motor (DCLM) types – Circuit equation – DCLM control-applications.

Course Outcomes:
After completion of this course the students will be able to:

- Analyze the characteristics of different types of PM type brushless DC motors and design suitable controllers.
- Apply the knowledge of sensors used in PMSM which can be used for controllers and Synchronous machines.
- Analyze the different controllers used in electrical machines to propose the suitability of drives for different industrial applications.
- Classify the types of DC linear motors and apply the knowledge of controllers to propose their application in real world.
- Evaluate the steady state and transient behavior linear induction motors.

References Books:

1. Miller, T.J.E. "Brushless Permanent Magnet and Reluctance Motor Drives", ClarendonPress, Oxford, 1989.
2. Kenjo, T, "Stepping Motors and their Microprocessor control", Clarendon Press, Oxford, 1989.
3. Naser A and Boldea I, "Linear Electric Motors: Theory, Design and Practical
4. Application", Prentice Hall Inc., New Jersey,1987
5. Special Electrical Machines-K.Venkataratnam- University press
6. Floyd E Saner,"Servo Motor Applications", Pittman USA, 1993.
7. Kenjo, T and Naganori, S "Permanent Magnet and brushless DC motors", Clarendon
8. Press, Oxford, 1989.
9. Generalized Theory of Electrical Machines – P.S.Bimbra-Khanna publications-5th edition-1995.