IV Year-I Semester		L	T	P	C
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SPECIAL ELECTRICAL MACHINES (R164102G)

Prerequisite Course:

Power Semiconductor Drives

Course Description and Objectives:

This is an advanced course on electrical machines. Students will be exposed to various special machines which are gaining importance in industry

Course Outcomes:

Upon completion of the course,the student will be able to achieve the following outcomes.

Cos	Course Outcomes	POs
1	Explain theory of operation and control of switched reluctance	3
2	Explain the performance and control of stepper motors, and their applications.	3
3	Describe the operation and characteristics of permanent magnet dc	2
4	Distinguish between brush dc motor and brush less dc motor.	1
5	Explain the theory of travelling magnetic field and applications of linear motors.	3
6	Understand the significance of electrical motors for traction drives.	

Syllabus:

UNIT I:

Objective: To explain theory of operation PMDC motor

Permanent magnet materials and PMDC motors

Introduction-classification of permanent magnet materials used in electrical machines-minor hysteresis loop and recoil line-Stator frames of conventional dc machines-Development of electronically commutated dc motor from conventional dc motor-Permanent-magnet materials and characteristics-B-H loop and demagnetization characteristics-Temperature effects: reversible and irreversible losses-high temperature effects-reversible losses Irreversible losses recoverable by magnetization-Mechanical properties, handling and magnetization-Application of permanent magnets in motors-power density-operating temperature range-severity of operation duty.

UNIT II:

Objective: To explain the performance and control of stepper motors, and their applications.

Stepper Motors

Classification of stepper motors – Hybrid and Variable Reluctance Motor (VRM) - Construction and principle of hybid type synchronous stepper motor – Different configuration for switching the phase windings control circuits for stepper motors – Open loop and closed loop control of 2-phase hybrid stepping motor. Construction and principle of operation of Variable Reluctance Motor (VRM) – Single stack and multiple stack – Open loop control of 3- phase VR Stepper Motor- Applications.

UNIT III:

Objective: To explain theory of operation and control of switched reluctance motor.

Switched Reluctance Motors

Construction – Comparison of conventional and switched reluctance motors – Design of stator and rotor

pole arcs – Torque producing principle and torque expression – Different converter configurations for SRM – Drive and power circuits for SRM – Position sensing of rotor – Applications of SRM.

UNIT IV:
Objective: To distinguish between brush dc motor and brush less dc motor.
Square Wave Permanent Magnet Brushless DC Motor
Types of constructions – Surface mounted and interior type permanent magnet – Principle of operation of BLDC motor. Torque and EMF equations – Torque speed characteristics – Performance and efficiency- Square wave brushless motors with 120 and 180 magnetic areas commutation.

UNIT V:
Objective: To distinguish between brush dc motor and brush less dc motor.

Sine wave Permanent Magnet Brushless Motor
Torque and EMF equations – Phasor Diagram – Circle diagram – Torque/speed characteristics Comparison between square wave and sine wave permanent magnet motors - Applications.

UNIT VI:
Objective: To explain applications of linear motors.
Linear Induction Motors (LIM)
Construction– principle of operation–Double sided LIM from rotating type Induction Motor – Schematic of LIM drive for traction – Development of one sided LIM with back iron- equivalent circuit of LIM.

TEXT BOOKS:

1. Brushless Permanent magnet and reluctance motor drives, Clarenden press, T.J.E. Miller, 1989, Oxford.
2. Special electrical Machines, K.VenkataRatnam, University press, 2009, New Delhi.

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