SCHEME OF COURSE WORK

Course Details:

Course Title	**: SPECIAL ELECTRICAL MACHINES**		
Course Code	**:15EE2207**	**L T C**	**: 3 0 3**
Program:	**: M. Tech.**		
Specialization:	**: POWER ELECTRONICS AND DRIVES**		
Semester	**: I SEM**		
Prerequisites	**: MATHEMATICS, ELECTRIC NETWORKS AND ELECTRICAL MACHINES**		
Courses to which it is a prerequisite	**: ----------**		

Course Outcomes (COs): At the end of the course students will be able to evaluate the performance of

1	Switched Reluctance Motor and Servo Motor.
2	Permanents Magnet Synchronous Motors.
3	Permanents Magnet Brushless DC Motor.
4	Linear Motors
5	Stepper Motor.

Program Outcomes (POs):

1	Develop in depth knowledge in the areas of "Static Power Electronics Converters", "Power Electronic Converter fed Electrical Drives" and "Power Quality".
2	Apply soft computing techniques for Power Electronic Systems and Electric Drives
3	Understand large scale Power Electronic Converter Systems, Electric Drives and issues involved through Modeling, Analysis and Simulation.
4	Apply present day techniques and tools to solve Power electronic and electric drives problems relevant to India and other countries.
5	Use state-of-the-art simulation tools such as PLEXIM, SABER, OPAL-RT Lab, DSPACE, MULTISIM, LABVIEW and other Tools.
6	Contribute positively to collaborative and multidisciplinary research to achieve common goals.
7	Demonstrate knowledge and understanding of power engineering and management principles and apply the same for efficiently carrying out projects with due consideration to economical and financial factors.
8	Communicate confidently, make effective presentations and write good reports to engineering community and society.
9	Recognize the need for life-long learning and have the ability to do it independently.
10	Acquire knowledge on social issues and shall contribute to the community for sustainable development.
11	Predict and examine critically the outcomes of actions, apply corrective measures subsequently and move forward positively through a self corrective approach.

Course Outcome versus **Program Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	S	S	S	S	-	M	M	M	M
CO-2	S	S	S	S	-	S	M	M	M
CO-3	S	S	S	S	-	M	M	M	M
CO-4	S	S	S	S	-	M	M	M	M
CO-5	S	S	S	S	-	S	M	M	M

S - Strongly correlated, *M - Moderately* correlated, *w- weakly correlated, Blank - No correlation*

Assessment Methods:	Assignment / Quiz / **Seminar** / Case Study / Mid-Test / End Exam

Teaching-Learning and Evaluation

Week	TOPIC / CONTENTS	Course Outcomes	Sample questions	TEACHING-LEARNING STRATEGY	Assessment Method & Schedule
1	Switched Reluctance Motor (SRM) Constructional features, Principle of operation. Torque equation.	CO1	Explain the Construction details and principle of operation of SRM Derive the Torque Expression for SRM	▫ Lecture ▫ Discussion ▫ Problem solving	Mid-Test 1 (Week 9) Seminar (Week 1)
2	Characteristics OF Switched Reluctance Motor (SRM), Control Techniques for Switched Reluctance Motor (SRM), and Drive Concept for Switched Reluctance Motor(SRM)	CO1	Draw and explain Characteristics of SRM Explain different types of Control Strategies of SRM	▫ Lecture ▫ Discussion	Mid-Test 1 (Week 9) Seminar (Week 2)
3	Servomotor Types, Constructional features of servo Motor – Principle of Operation of Servo motor.	CO1	Explain Construction features and principle of operation of servo Motor Explain different Types of Servo Motor	▫ Lecture ▫ Discussion	Mid-Test 1 (Week 9) Seminar (Week 3)
4	Characteristics of servo motor, Control strategies of servo motor, Microprocessor based applications of servo motor-Transfer Function.	CO1	Draw and explain Characteristics of Servo Motor Explain the different Control Strategies of Servo Motor	▫ Lecture ▫ Discussion	Mid-Test 1 (Week 9) Seminar (Week 4)
5	Permanent magnet Synchronous Motors (PMSM) Principle of operation, power input	CO2	Explain the Principle of operation of PMSM	▫ Lecture ▫ Discussion	Mid-Test 1 (Week 9) Seminar (Week-5)
6	EMF and torque expressions, Phasor diagram	CO2	Derive the EMF and Torque Equations of PMSM Draw and explain the Phasor diagrams of PMSM	▫ Lecture ▫ Discussion ▫ Problem solving	Mid-Test 1 (Week 9) Seminar (Week-6)
7	Power Controllers, Torque speed characteristics, Self control, Vector control, Current control Schemes for Permanent magnet Synchronous Motors (PMSM)	CO2	Draw Torque and speed characteristics of PMSM Explain Different types of Control strategies of PMSM Explain Self ,vector, Current control schemes of PMSM	▫ Lecture ▫ Discussion	Mid-Test 1 (Week 8) Seminar (Week-7)
8	Commutation in DC motors, Difference between mechanical and electronic commutators, Hall sensors, Optical sensors, Multiphase Brushless motor.	CO3	Write the Difference between Mechanical and Electric commutators. Explain the Importance of Optical sensor, Hall sensor	▫ Lecture ▫ Derivation	Mid-Test 1 (Week 8) Seminar (Week-8)
9	**Mid-Test 1**		**Units 1, 2 and 3.**		
10	Types of Permanent Magnet motors, Square wave Permanent Magnet Brushless Motor (PM BLDC) drives, Torque and emf equation.	CO3	Explain how will be Torque produced in PM BLDC Motor Drive the Expression for EMF equation of PM BLDC Motor	▫ Lecture ▫ Discussion ▫ Problem solving	Mid-Test 2 (Week 18) Seminar (Week-10)
11	Torque-speed characteristics of PM BLDC Motor, Different types of Controllers, Microprocessors based controller.	CO3	Draw and Explain Torque-speed characteristics of PM BLDCM Explain Different Types of controllers for PM BLDC	▫ Lecture ▫ Derivation	Mid-Test 2 (Week 18) Seminar (Week-11)
12	Linear Induction Motor (LIM), Construction features, Principle of operation, Thrust equation, Concept of Current sheet, Goodness factor, Equivalent circuit, Performance characteristics, Control strategies.	CO4	Explain the principle of operation of LIM. Derive the equation for thrust equation for LIM. Explain the concept of Current sheet, Goodness factor, and also draw the performance characteristics of LIM.	▫ Lecture ▫ Discussion	Mid-Test 2 (Week 18) Seminar (Week-12)

Week	TOPIC / CONTENTS	**Course Outcomes**	**Sample questions**	**TEACHING-LEARNING STRATEGY**	**Assessment Method & Schedule**
13	Linear Synchronous Motors (LSM) Construction features, Principle of operation, Thrust equation, Control strategies, Applications.	CO4	Explain the principle of operation of LSM. Derive the equation for thrust equation for LSM. Explain the control strategies of LSM.	▫ Lecture ▫ Discussion	Mid-Test 2 (Week 13) Seminar (Week-13)
14	Linear Levitation Machines (LLM), Principle of operation, Attraction and repulsion types of LLM, Goodness factor and Levitation stiffness.	CO4	Explain the principle of operation of LLM. Derive the equation for thrust equation for LLM. Explain the concept Goodness factor and Levitation stiffness.	▫ Lecture ▫ Discussion	Mid-Test 2 (Week 18) Seminar (Week-14)
15	Constructional features, Principle of operation, Modes of excitation, Torque production in Variable Reluctance (VR) stepping motor.	CO5	Explain Construction features and principle of operation of stepper Motor Derive the Torque expression for Variable Reluctance Motor.	▫ Lecture ▫ Discussion	Mid-Test 2 (Week 18) Seminar (Week 15)
16	Dynamic characteristics, Drive system and circuit for open loop control, closed loop control, Stability and areas of applications.	CO5	Draw and explain the Characteristics of Stepper Motor Explain different types Control Strategies of Stepper Motor	▫ Lecture ▫ Discussion ▫ Problem solving	Mid-Test 2 (Week 18) Seminar (Week 16)
17	Revision				
18	**Mid-Test 2**		**Units 3, 4 and 5.**		
19	**END EXAM**				Assessment will be on all topics at END EXAM