SCHEME OF COURSE WORK

Course Details:

Course Title	**:** SOLID STATE CONTROL OF AC DRIVES
Course Code	**:** 15EE2211
Program:	**: M.Tech.**
Specialization:	**: Power Electronics and Drives**
Semester	**:II Semester**
Prerequisites	**:** Power Electronics & Power Electronic Drives

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

1	Explain the Operation of induction motor and analyze speed control of AC Drives by VSI fed drives
2	Analyze speed control of AC Drives by CSI fed drives and by slip power recovery drives
3	Analyze vector control of Induction motors
4	Analyze various control schemes to control speed of synchronous motor drives
5	Analyze vector control of PMSM drives

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	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.
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**	**PO10**	**PO11**
CO-1	S	M	S	M	S	M	M	M	M	M	M
CO-2	S	M	S	M	S	M	M	M	M	M	M
CO-3	S	M	S	M	S	M	M	M	M	M	M
CO-4	S	M	S	M	S	M	M	M	M	M	M
CO-5	S	M	S	M	S	M	M	M	M	M	M

S - Strongly correlated, *M - Moderately* correlated

Assessment Methods:	Assignment / Seminar / Mid-Test / End Exam

Teaching-Learning and Evaluation

Week	TOPIC / CONTENTS	Course Outcomes	Sample questions	TEACHING-LEARNING STRATEGY	Assessment Method & Schedule
1	Review of steady-state operation of Induction motor, Equivalent circuit analysis, torque-speed Characteristics.	CO-1	(1) Draw the equivalent circuit of 3-Ø Induction Motor (2) Define different torques in 3phase induction motors from its slip torque characteristics for different rotor resistances	▫ Lecture ▫ Discussion	Assignment Mid Seminar
2	Scalar control- Voltage fed Inverter control-Open loop volts/Hz control, Speed control with slip regulation	CO-1	(1) Explain open loop volts/Hz speed control with voltage fed inverter (2) Explain closed loop speed control with volts/Hz control and slip regulation	▫ Lecture ▫ Discussion	Assignment Mid Seminar
3	Speed control with torque and Flux control-Current controlled voltage fed Inverter Drive.	CO-1	(1) Explain the Speed control with torque and Flux control-Current controlled voltage fed Inverter Drive. (2) Explain Current controlled Voltage Source Inverter drive for torque control of 3-Ø Induction Motor	▫ Lecture ▫ Discussion	Assignment Mid Seminar
4	Current-Fed Inverter control-Independent current and frequency control	CO-2	(1) Explain the Current-Fed Inverter control of Induction Motor. (2)Explain the Independent current and frequency control of Induction Motor. (3)Explain independent current and frequency control for a Current Source Inverter fed 3-Ø induction motor.	▫ Lecture ▫ Discussion	Assignment Mid Seminar
5	Flux control in Current-Fed Inverter drive-Volts/Hz control of Current Fed Inverter drive- Efficiency optimization control by flux program	CO-2	Explain the flux control in Current- Fed Inverter drive of Induction Motor	▫ Lecture ▫ Discussion	Assignment Mid Seminar
6	Slip Power Recovery Drives-Static Kramer Drive-Phasor Diagram-Torque Expression-Speed Control of Kramer Drive	CO-2	(1)Explain the Static Kramer Drive (2)Explain the Static Rotor Power control by which the induction motor rotor power is fed back to the source for its speed control	▫ Lecture ▫ Discussion	Assignment Mid Seminar

7	Static Scherbius Drive Modes of Operation, Principles of Vector control	CO-2,3	Explain the Static Scherbius Drive What are various Modes of Operation	▫ Lecture ▫ Discussion	Assignment Mid Seminar
8	Direct vector control Implementation block diagram; estimation of flux.	CO-3	Explain the Principle of vector control. What are the various flux vector estimation method	▫ Lecture ▫ Discussion	Assignment Mid Seminar
9	Indirect Vector control, Implementation block diagram Flux weakening operation.	CO-3	(1)Explain the indirect vector control of Induction Motor. (2)Distinguish between Direct Vector Control and Indirect Vector Control	▫ Lecture ▫ Discussion	Assignment Mid Seminar
Mid-Test 1					
10	Principles of Vector control, Derivation of Indirect Vector control, implementation block diagram; estimation of flux, flux weakening operation..	CO-3	Explain the voltage model feedback signal estimation with neat block diagram	▫ Lecture ▫ Discussion	Assignment Mid Seminar
11	Direct vector control, implementation block diagram; estimation of flux, flux weakening operation..	CO-3	Explain the current model feedback signal estimation with neat block diagram	▫ Lecture ▫ Discussion	Assignment Mid Seminar
12	Synchronous motor and its characteristics- Control strategies: Constant torque angle control-power factor control	CO-4	Explain the Various control strategies of Synchronous motor	▫ Lecture ▫ Discussion ▫	Assignment Mid Seminar
13	Constant flux control, torque per ampere control,	CO-4	Explain Load commutated inverter fed synchronous motor drive	▫ Lecture ▫ Discussion	Assignment Mid Seminar
14	Load commutated inverter fed synchronous motor drive, motoring and regeneration, phasor diagrams.	CO-4	Explain the speed control of Synchronous Motor when fed with L C I with phasor diagram	▫ Lecture ▫ Discussion	Assignment Mid Seminar
15	Characteristics of permanent magnet, synchronous machines with permanent magnet,	CO-5	Explain the Characteristics of permanent magnet, synchronous machines with permanent magnet	▫ Lecture ▫ Discussion	Assignment Mid Seminar
16	Vector control of PMSM- Motor model and Drive system schematics	CO-5	Explain vector controlled PM Synchronous motor drive	▫ Lecture ▫ Discussion	Assignment Mid Seminar
17	Control strategies of PMSM- Motor model and Drive system schematics	CO-5	Discuss various control strategies for control of PMSM drides	▫ Lecture ▫ Discussion	Assignment Mid Seminar
18	**Mid-Test 2**				
	END EXAM				