SCHEME OF COURSE WORK

Course Details:

Course Title	**: SOLID STATE CONTROL OF DC DRIVES**		
Course Code	**:** 15EE2202	**L T P C**	**:3 0 0 3**
Program:	**: M.Tech.**		
Specialization:	**: Power Electronics and Drives**		
Semester	**:I Sem**		
Prerequisites	**:** Power Electronics & Power Electronic Drives		

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

1	Describe the Electric Drive, Torque Equation, Load Torque components and their classification.
2	Analyze1Φ and 3Φ Converter Fed Drives.
3	Analyze the Two Quadrant and Four Quadrant Control of DC Motor Drive.
4	Analyze the Speed Control of Chopper Fed Drives.
5	Simulate the Speed Control of DC Motor 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, *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	Electrical drives, Advantages of Electrical Drives, Parts of Electrical, Drives, choice of electrical drives, Status of dc and ac drives	CO-1	Draw the basic block diagram of an electric drive and explain each block of the drive. List out some advantages of electric drives.	▫ Lecture ▫ Discussion	Assignment Mid-Test Seminar
2	Fundamental torque equation, speed torque conventions and multi quadrant operation, equivalent values of drive parameters	CO-1	Write the fundamental torque equation. Explain the multi-quadrant operation of electric drive.	▫ Lecture ▫ Discussion	Assignment Mid-Test Seminar
3	Components of load torques, nature and classifications of load torques, steady state stability.	CO-1	Explain the nature and classification of load torques. Explain what do you understand by the steady state stability? What is the main assumption	▫ Lecture ▫ Discussion ▫ Problem solving	Assignment Mid-Test Seminar
4	Introduction, Fully Controlled Rectifier Drives, Single phase fully controlled rectifier control of DC separately excited motor-Discontinuous current-continuous current	CO-2	Describe the operation of single phase fully controlled rectifier control of DC Separately excited motor with neat waveforms and obtain the expression of motor speed for continuous and discontinuous modes of operations A 200 V, 875 rpm, 150A separately excited DC motor has an armature resistance of 0.06 ohms and inductance of 0.85mH. It is fed from a single phase fully controlled rectifier with an AC source voltage of 220V, 50Hz. Assuming continuous conduction Calculate. (i) Firing angle for rated motor torque and 750 rpm. (ii) Firing angle for rated motor torque and (-600 rpm) (iii) Motor torque for firing angle 60 degrees and speed is 400 rpm.	▫ Lecture ▫ Discussion ▫ Problem solving	Assignment Mid-Test Seminar
5	Single phase half controlled rectifier control of DC separately excited motor Discontinuous current-continuous current.		With the help of neat sketch explain the operation of single phase half controlled rectifier control of Dc motor both in continuous and discontinuous	▫ Lecture ▫ Discussion Problem solving	Assignment Mid-Test Seminar

			mode of operation.		
6	Three phase semi converter and three phase full converter control of a separately excited DC motor for continuous and discontinuous modes of operation power and power factor	CO-2	With the help of neat sketch explain the operation of 3-ph semi converter and full converter control of DC motor.	▫ Lecture ▫ Discussion Problem solving	Assignment Mid-Test Seminar
7	Addition of Free-wheeling diode Three phase dual converter control of separately excited DC Motor	CO-2	Explain the effect of free wheeling diode in power electronic circuits. Explain the operation of 3-ph dual converter control of separately excited DC motor. A 200V, 1250 rpm, 40 A separately excited dc motor with Ra = 0.4ohms is fed from a circulating current dual converter with ac source voltage (line) = 160 V. Determine converter firing angles for following operating points. (i) Motoring operating at rated motor torque and 900 rpm. (ii) Braking operation at rated motor torque and 900 rpm. (iii) Motoring operation at rated motor torque and (-900) rpm. (iv) Braking operation at rated motor torque and (-900) rpm.	▫ Lecture ▫ Discussion Problem solving	Assignment Mid-Test Seminar
8	Two-Quadrant three phase converter controlled DC motor drive,	CO-3	Explain the operation of two quadrant 3-ph converter controlled DC motor drive..	▫ Lecture ▫ Discussion	Assignment Mid-Test Seminar
9				▫	
	Mid-Test 1				
10	Four quadrant DC motor drive, Transfer Functions of the subsystem DC motor and load- converter	CO-3	Explain the operation of four quadrant DC motor drive. Derive the transfer function of DC motor	▫ Lecture ▫ Discussion ▫ Problem solving	Assignment Mid-Test Seminar
11	current and speed controllers current feedback-speed feedback.	CO-3	Explain the closed loop control of DC motor drive with current controller and current taken as feedback.	▫ Lecture ▫ Discussion Problem solving	Assignment Mid-Test Seminar
12	Principle of operation of the chopper, Four quadrant chopper circuit, Chopper for inversion	CO-4	Explain the operation of Four quadrant chopper circuit	▫ Lecture ▫ Discussion Problem solving	Assignment Mid-Test Seminar
13	Chopper with other power devices, Model of the chopper , Input to the chopper, Steady state analysis of	CO-4	Analyze the chopper controlled DC motor drive under steady state.	▫ Lecture ▫ Discussion	Assignment Mid-Test Seminar

	chopper controlled DC motor drives, Ratings of the devices			Problem solving	
14	peed controlled drive system, Current control loop, Pulse width modulated current controller	CO-4	Explain the closed loop control of DC motor drive with speed as controllable parameter using chopper.	▫ Lecture ▫ Discussion Problem solving	Assignment Mid-Test Seminar
15	Hysteresis current controller, modeling of current controller, Design of current controller	CO-4	Explain Hysteresis current controller operation. Explain how to design a current controller	▫ Lecture ▫ Discussion	Assignment Mid-Test Seminar
16	Dynamic simulations of the speed controlled DC motor drives	CO-5	Develop a flow chart for the digital computer simulation of the one quadrant converter fed DC motor drive.	▫ Lecture ▫ Discussion	Assignment Mid-Test Seminar
17	Speed feedback speed controller and command current generator current controller	CO-5	Load changes haves a profound effect on the dynamic response of the DC motor drive. What are the techniques to counter the load sensitivity on the performance of the DC motor drive?	▫ Lecture ▫ Discussion	Assignment Mid-Test Seminar
18	**Mid-Test 2**				
	END EXAM				