SCHEME OF COURSE WORK

Course Details:

Course Title	**: SOLID STATE CONTROL OF DC DRIVES**		
Course Code	**: 13EE2202**	**L T P C**	**: 4 0 0 3**
Program:	**: M.Tech.**		
Specialization:	**: Power Electronics & Drives**		
Semester	**: I**		
Prerequisites	**: Electrical Machines – I, Power Electronics**		
Courses to which it is a prerequisite	**: Research**		

Course Outcomes (COs):

After Completion of the Course, the Student will be able to

At the end of the course, the student will be able to

CO1	Describe the electric drive, torque equation, load torque components and their classification
CO2	Analyze 1Φ and 3Φ Converter fed drives.
CO3	Analyze the Two Quadrant and Four Quadrant Control of DC Motor Drive.
CO4	Analyze the speed control of chopper Fed drives.
CO5	Simulate the speed control of DC Motor drives

Program Outcomes (POs):

PO1	The graduate will be a professional workforce in the areas of "Static Power Electronics Converters", "Power Electronic Converter fed Electrical Drives" and "Power Quality".
PO2	The graduate will be able to apply soft computing techniques for Power Electronic Systems and Electric Drives
PO3	The graduate will be trained to understand large scale Power Electronic Converter Systems, Electric Drives and issues involved through modeling, analysis and simulation
PO4	The graduate will be able to apply present day techniques and tools to solve Power electronic and electric drives problems relevant to India and other countries
PO5	The graduate will be able to use state-of-the-art simulation tools such as PLEXIM, SABER, OPAL-RT Lab, DSPACE, MULTISIM, LABVIEW and other Tools
PO6	The graduate will be capable of contributing positively to collaborative and multidisciplinary research to achieve common goals.
PO7	The graduate will demonstrate knowledge and understanding of power system engineering and management principles and apply the same for efficiently carrying out projects with due consideration to economical and financial factors.
PO8	The graduate will be able to communicate confidently, make effective presentations and write good reports to engineering community and society.
PO9	The graduate will recognize the need for life-long learning and have the ability to do it independently.
PO10	The graduate will become aware of social issues and shall contribute to the community for sustainable development of society.
PO11	The graduate will be able to independently observe and examine critically the outcomes of his/her actions and 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	M	M	M	M	W	W	W	W
CO-2	S	M	M	M	M	W	W	W	W
CO-3	S	M	M	M	M	W	W	W	W
CO-4	S	M	M	M	M	W	W	W	W
CO-5	S	M	M	M	S	W	W	W	W

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	What are the advantages of electric drives? What is the status of DC and AC drives in the present trend of technology?	▫ Lecture ▫ Discussion	Mid-Test 1 (Week 9) Seminar (Week 2)
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	Mid-Test 1 (Week 9) Seminar (Week 2)
3	components of load torques, nature and classifications of load torques, steady state stability.	CO-1	Explain the nature and classification of load torques.	▫ Lecture ▫ Problem solving	Mid-Test 1 (Week 9) Seminar (Week 3)
4	Introduction, Fully Controlled Rectifier Drives, Single phase fully controlled rectifier control of DC separately excited motor- Discontinuous current-continuous current	CO-2	With the help of neat sketch explain the operation of fully controlled rectifier control of DC drive for both continuous and discontinuous mode of operation.	▫ Lecture ▫ Discussion	Mid-Test 1 (Week 9) Seminar (Week 4)
5	Single phase half controlled rectifier control of DC separately excited motor Discontinuous current- continuous current.	CO-2	With the help of neat sketch explain the operation of single phase half controlled rectifier control of ED motor for both continuous and discontinuous mode of operation.	▫ Lecture ▫ Discussion ▫ Problem sloving	Mid-Test 1 (Week 9) Seminar (Week 5)
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	Mid-Test 1 (Week 9) Seminar (Week 6)
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.	▫ Lecture ▫ Discussion	Mid-Test 1 (Week 9) Seminar (Week 7) Assignment (Week 6-7)
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	Mid-Test 1 (Week 9) Seminar (Week 8) Quiz (Week 1-8)
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	Mid-Test 2 (Week 18) Seminar (Week 10)
11	current and speed controllers-	CO-3	Explain the closed loop control of	▫ Lecture	Mid-Test 2

	current feedback-speed feedback.		DC motor drive with current controller and current taken as feedback.	▫ Discussion	(Week 18) Seminar (Week 11)
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	Mid-Test 2 (Week 18) Seminar (Week 12)
13	Chopper with other power devices, Model of the chopper, Input to the chopper, Steady state analysis of chopper controlled DC motor drives, Ratings of the devices.	CO-4	Analyze the chopper controlled DC motor drive under steady state.	▫ Lecture ▫ Discussion ▫ Problem Solving	Mid-Test 2 (Week 18) Seminar (Week 13)
14	Speed 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	Mid-Test 2 (Week 18) Seminar (Week 14)
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	Mid-Test 2 (Week 18) Seminar (Week 15) Assignment (Week 14-15)
16	Dynamic simulations of the speed controlled DC motor drives	CO-5	Simulate the speed controlled DC motor drive for a give set of parameters of DC motor drive in MATLAB SIMULINK	▫ Lecture ▫ Demonstration	Mid-Test 2 (Week 18) Seminar (Week 16) Quiz (week 10 -16)
17	Speed feedback speed controller, and command current generator current controller	CO-5	Using current controller simulate the closed loop of DC motor drive in MATLAB SIMULINK	▫ Lecture ▫ Demonstration	Mid-Test 2 (Week 18) Seminar (Week 17)
18	**Mid-Test 2**				
19/20	**END EXAM**				