SCHEME OF COURSE WORK

Course Details:

Course Title	**: FLEXIBLE AC TRANSMISSION SYSTEMS**		
Course Code	**: 13EE2215**	**L P C**	**: 4 0 3**
Program:	**: Master of Technology.**		
Specialization:	**: Power Electronics & Drives**		
Semester	**: II**		
Prerequisites	**: Power Electronics and Power Systems**		
Courses to which it is a prerequisite	**: Research**		

Course Outcomes (COs):

After completion of this course the student will be able to:

1	Describe the Types of FACTS devices and their Operations
2	Analyze the 2 level and 3 level VSC and Compare VSC and CSC.
3	Describe the various Shunt devices, their operation and control.
4	Analyze the various technical parameters of SVC and STATCOM.
5	Describe the various Series devices, their operation and control

Program Outcomes (POs):

The Graduates of will be able to:

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	PO10	PO11
CO-1	S	S	S	S	S	M	S	W	W	M	S
CO-2	S	S	S	S	S	S	S	W	W	M	S
CO-3	S	S	M	S	S	S	S	W	W	M	S
CO-4	S	S	M	S	S	S	S	W	W	M	S
CO-5	S	S	M	S	S	S	S	W	W	M	S

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	Transmission interconnections power flow in an AC system, loading capability limits. Dynamic Stability Considerations. Importance of Controllable parameters.	CO-1	Explain the dynamic Stability Considerations of FACTS Devices Explain the Power Flow in an AC Network	▫ Lecture through Black Board & LCD Discussion	Seminar/Mid Test (Week 9-10)
2	Basic types of FACTS controllers, Benefits from FACTS controllers.	CO-1	What are the different Types of FACTS Devices Benefits of FACTS devices	▫ Lecture through Black Board & LCD ▫ Discussion	Seminar/Mid Test (Week 9-10)
3	Basic Concept of VSC Single Phase Full Bridge Operation Square Wave Voltage Harmonic for Single Phase Full Bridge	CO-2	Explain Single Phase Bridge converter operation in detail with Diagrams	▫ Lecture through Black Board & LCD ▫ Discussion	Seminar/Mid Test (Week 9-10)
4	Three level voltage source converter pulse width modulation converter	CO-2	What is the difference between the two level and three level VSC and explain in detail Explain Three Level Voltage Sourced Converters Explain different Pulse width Modulation Techniques Uesd	▫ Lecture through Black Board & LCD ▫ Discussion	Seminar/Mid Test (Week 9-10)
5	Single phase three phase full wave bridge converter transformer connections for 12 pulse 24 and 48 pulse operation	CO-2	Explain in detail the Transformer Connections in 12,24 and 48 Pulse operation with Diagrams	▫ Lecture through Black Board & LCD ▫ Discussion	Seminar/Mid Test (Week 9-10)
6	Basic concept of current source Converters in detail	CO-2	Explain the Basic concept of current source Converters in detail wrt Turn off devices	▫ Lecture through Black Board & LCD ▫ Discussion	Seminar/Mid Test (Week 9-10)
7	comparison of current source converters with voltage source converters	CO-2	comparison of current source converters with voltage source converters with necessary equations and diagrams	▫ Lecture through Black Board & LCD ▫ Discussion	Seminar/Mid Test (Week 9-10)
8	Objectives of Shunt Compensation. Midpoint Voltage Regulation. Voltage Instability Prevention, Improvement of transient stability. Power oscillation damping.	CO-3	Define the Term Compensation and what are the Objectives of Shunt Compensations How a shunt Controller can Compensate for Voltage Instability Prevention, Improvement of transient stability and Power oscillation damping.	▫ Lecture through Black Board & LCD Discussion	Seminar/Mid Test (Week 9-10)
9	**Seminar by the Students**				Seminar (Week 9)
10	**Mid-Test 1**				Week -10
11	Methods of controllable VAR generation. 1. Variable Impedance Type Static VAR Generators	CO-3	Explain about Variable Type of VAR Generators	▫ Lecture through Black Board & LCD Discussion	Seminar/Mid Test (Week 17-18)
12	1. Switching Converter Type VAR Generators 2. Hybrid VAR Generators.	CO-3	Explain about Switching Type of VAR Generators Explain about Hybrid Type of VAR Generators	▫ Lecture through Black Board & LCD ▫ Discussion	Seminar/Mid Test (Week 17-18)
13	SVC and STATCOM The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping Operating point control and summary of compensator control.	CO-4	Explain SVC and STATCOM wrt its Regulation Slope, Transfer Function and Dynamic performance Explain SVC and STATCOM wrt its VAR reserve	▫ Lecture through Black Board & LCD ▫ Discussion	Seminar/Mid Test (Week 17-18)
14	Comparison of SVC and STATCOM Concept of series capacitive compensation. Improvement of Transient Stability. Power oscillation and damping, sub-synchronous oscillation damping.	CO-4 &CO-5	Compare of SVC and STATCOM wrt its Perforance Define the Term Compensation and what are the Objectives of Series Compensations How a Series Controllers improve Transient Stability, Power Oscillations damping and sub-synchronous Resonance	▫ Lecture through Black Board & LCD Discussion	Seminar/Mid Test (Week 17-18)
15	Functional requirements of GTO Thyristor Controlled Series Capacitor(GCSC), Thyristor Switched Series Capacitor(TSSC)	CO-5	Explain the Functional requirements of GTO Thyristor Controlled Series Capacitor(GCSC), Thyristor Switched Series Capacitor(TSSC)	▫ Lecture through Black Board & LCD Discussion	Seminar/Mid Test (Week 17-18)
16	Thyristor Controlled Series Capacitor(TCSC) control schemes for GCSC TSSC and TCSC	CO-5	Explain about the control Schemes of GCSC,TSSC and TCSC	▫ Lecture through Black Board & LCD Discussion	Seminar/Mid Test (Week 17-18)
17	**STUDENTS SEMINAR**				Seminar (Week 17)
18	**Mid-Test 2**				Week-18
19/20	**END EXAM**				Week-19