SCHEME OF COURSE WORK

Course Details:

Course Title	**:POWER ELECTRONICS APPLICATIONS TO POWER SYSTEMS**		
Course Code	**:13EE1132**	**L T P C**	**:4 0 0 3**
Program:	**: Bachelor of Technology.**		
Specialization:	**: Electrical & Electronics Engineering**		
Semester	**: VII**		
Prerequisites	**:Power System &Power Electronics**		
Courses to which it is a prerequisite	**Post Graduate and Research**		

Course Outcomes (COs):

After completion of this course the student will be able to

1	Compare AC and DC systems**,** Explain the types of HVDC Links and various parameters in HVDC.
2	Analyze the Graetz circuit with various conditions
3	Describe various control schemes, Analyze the harmonics and Design the Filters in HVDC
4	Describe the types of FACTS devices, Operations, various Shunt Devices and their control.
5.	Describe the various Series devices, operation and their control

Program Outcomes (POs):

The student of Electrical and Electronics Engineering at the end of the program will be able to:

1	Apply the knowledge of basic sciences and electrical and electronics engineering fundamentals to solve the problems of power systems and drives.
2	Analyze power systems that efficiently generate, transmit and distribute electrical power in the context of present Information and Communications Technology
3	Design and develop electrical machines and associated controls with due considerations to societal and environmental issues
4	Design and conduct experiments, analyze and interpret experimental data for performance analysis
5	Apply appropriate simulation tools for modeling and evaluation of electrical systems
6	Apply the electrical engineering knowledge to assess the health and safety issues and their consequences
7	Demonstrate electrical engineering principles for creating solutions for sustainable development
8	Develop a techno ethical personality that help to serve the people in general and Electrical and Electronics Engineering in particular
9	Develop leadership skills and work effectively in a team to achieve project objectives
10	Communicate effectively in both verbal and written form
11	Understand the principles of management and finance to manage project in multi disciplinary environments
12	Pursue life-long learning as a means of enhancing the knowledge and skills

Course Outcome Versus **Program Outcomes:**

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO-1	S	S	S	M	S	S			S			M
CO-2	S	M	S	S	M	S			S			M
CO-3	S	S	S	S	S	S			S			M
CO-4	S	M	S	S	S	S			S			M
CO-5	S	M	S	S	S	S			S			M

S - Strongly correlated, *M - Moderately* correlated, *W-Weakly correlated*

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	Evolution of HVDC Transmission. Comparison of HVAC and HVDC systems.	CO-1	Compare HVAC and HVDC in all aspects	▫ Lecture through Black Board & LCD Video lectures ▫ Discussion	Seminar/Mid Test (Week 9-10)
2	Type of HVDC Transmission systems. Components of HVDC transmission systems	CO-1	Types of HVDC Systems What are the different components of HVDC Systems Modern Trends HVDC Systems	▫ Lecture through Black Board & LCD Video lectures ▫ Discussion	Seminar/Mid Test (Week 9-10)
3	Analysis of simple rectifier circuits. Required features of rectification circuits for HVDC transmission	CO-2	Required Features of HVDC Converter	▫ Lecture through Black Board & LCD ▫ Discussion	Seminar/Simulation based Assignments/Mid Test (Week 9-10)
4	Analysis of HVDC converter. a. Different modes of converter operation. b. Output voltage waveforms and DC voltage in rectification.	CO-2	Analyze the Greatz Circuit Analyze the Rectifier Voltage and Valve Voltages	▫ Lecture through Black Board & LCD ▫ Problem solving	Seminar/Simulation based Assignments /Mid Test (Week 9-10)
5	Analysis of HVDC converter a. Output voltage waveforms and DC in inverter operation. b. Thyristor voltages.	CO-2	Analyze the 12 Pulse Converter With necessary Diagrams and equations	▫ Lecture through Black Board & LCD Problem solving	Seminar/Simulation based Assignments /Mid Test (Week 9-10)
6	Equivalent Electrical Circuit of HVDC 12 Pulse Converter Operation	CO-2	derive the Equivalent Circuit of HVDC System	▫ Lecture through Black Board & LCD Problem solving	Seminar/Mid Test (Week 9-10)
7	Smoothing reactor and DC Lines. Reactive power requirements.	CO-2	What is the need for Requirement of Reactive Power Write about different types of Reactive Power sources	▫ Lecture through Black Board & LCD Discussion	Seminar/Mid Test (Week 9-10)
8	Harmonic analysis. Filter design	CO-3	How harmonics are generated and what are the different Harmonics present in HVDC system and how are they eliminated	▫ Lecture through Black Board & LCD Discussion	Seminar/Mid Test (Week 9-10)

9	**Seminar by the Students**				Seminar (Week 9)
10	**Mid-Test 1**				
11	HVDC system control features. Control Modes. Control Schemes. Control comparisons	CO-3	Explain the different control Strategies applied for HVDC system Explain and differentiate about the IPC and EPC modes of Firing	▫ Lecture through Black Board & LCD Discussion	Seminar/Mid Test (Week 17-18)
12	Transmission interconnections power flow in an AC system, loading capability limits. Dynamic Stability Considerations. Importance of Controllable parameters. Basic types of FACTS controllers,	CO-4	Explain the dynamic Stability Considerations of FACTS Devices Explain the Power Flow in an AC Network What are the different Types of FACTS Devices	▫ Lecture through Black Board & LCD Discussion	Seminar/Mid Test (Week 17-18)
13	Benefits from FACTS controllers. Objectives of Shunt Compensation. Midpoint Voltage Regulation. Voltage Instability Prevention, Improvement of transient stability. Power oscillation damping.	CO-4	Benefits of FACTS devices Define the Term Compensation and what are the Objectives of Shunt Compensations How a shunt Controller can Compensate	▫ Lecture through Black Board & LCD Discussion	Seminar/Mid Test (Week 17-18)
14	Methods of controllable VAR generation. 1. Variable Impedance Type Static VAR Generators 2. Switching Converter Type VAR Generators 3. Hybrid VAR Generators.	CO-4	Explain about Variable Type of VAR Generators 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)
15	Concept of series capacitive compensation. Improvement of Transient Stability. Power oscillation and damping, sub-synchronous oscillation damping.	CO-5	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)
16	Functional requirements of GTO Thyristor Controlled Series Capacitor (GCSC), Thyristor Switched Series Capacitor(TSSC) 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**				
19/20	**END EXAM**				