GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering Power Electronics
Subject Code: 3722919
Semester – II
Subject Name: Power Electronics application for power system

Type of course:

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	• Introduction Transmission line theory, Transmission interconnections, Load balancing, flow of power in an AC system, Power flow and dynamic stability considerations of a transmission interconnection, voltage profile at the point of common coupling (PCC), need for load compensation, load balancing using passive elements, Review of PWM techniques, Instantaneous reactive power theory, expression for active and reactive powers in terms of d-q components, Basic definition and description of FACT controllers, Basic types of FACT controller, Advantage and Application of FACT controller.	8
2	• Shunt Compensators • Introduction, Method of Controllable VAR generation: Thyristor Controlled Reactor (TCR), Thyristor Switched Capacitor (TSC), The Fixed Capacitor Thyristor Controlled Reactor (FC-TCR), Static Var compensators: SVC and STATCOM, the regulation slope, Transfer function and dynamic performance, Enhancement and power oscillation damping, applications.	8
3	• Series Compensators • Introduction and objective of series compensator, Comparison between Series and shunt compensator. Basic concept of series capacitive, compensator, Various Equipment: GTO Controlled Series Capacitor (GCSC), Thyristor Switched Series Capacitor(TSSC), Thyristor Controlled Series Capacitor(TCSC), Static Synchronous Series compensator(SSSC),Mode of operation, Thyristor Controlled Voltage Regulator(TCVR) and Thyristor Controlled Phase Angle Regulator(TCPAR), applications.	8
4	**Combined Compensator** • Introduction, Unified power flow controller, basic operating principles,	8

	independent real and reactive power flow control, Control Structure, Basic control system for P and Q control.	
5	**HVDC System** • Introduction, DC verses AC transition, various possible HVDC configurations, Uni-polar and bipolar Link, Components of HVDC system, Multi pulse bridge converter, rectifier and inverter operation, Effect of source inductance, Equivalent Circuit Control of HVDC system, constant current control, Constant extinction angle and constant Ignition angle control. Individual phase control and equidistant firing angle control, DC power flow control.	**8**

Reference Books:

1. T.J.E. Miller, "Reactive power control in Electrical system", John Wiley & Sons, New York, 1982.
2. Hingorani N. G,"Understanding FACTs concept and Technology of FACT system"IEEE press 2000.
3. K. R. Padhiyar, "FACTs controllers in Power Transmission and Distribution System "New age international (P) Ltd., 1990
4. K. R. Padiyar: High Voltage Direct current Transmission, Wiley Eastern Ltd., New Delhi – 1992.
5. R. Mohan Mathur, Rajiv K. Verma., "Thyristor based FACT Controllers for Electrical transmission system", IEEE press, John Wiley & Sons, 2002.
6. Vijay K. Sood,"HVDC AND FACT CONTROLLERS Application of Static Converter in Power System" Kluvkar Academic Publisher, New York.2004.
7. J.Arrillaga, N.R.Watson,"Power System Harmonics" John Wiley & Sons, 2003.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	To understand the fundamental concepts and the Operation of various FACT controllers.	20
CO-2	To understand the basic concepts of reactive power compensation using shunt controller.	20
CO-3	To understand the basic concepts of reactive power compensation using series controller.	20
CO-4	To understand the basic concepts of reactive power compensation using combined FACT controller.	20
CO-5	To understand the fundamental concept of HVDC system, its Control and Application.	20

List of Experiments:

To study Shunt compensator.
1. To study series compensator.
2. To study Thyristor Controlled Reactor (TCR).

3. To study Thyristor Switched Capacitor (TSC).
4. To study STATCOM.
5. To study Thyristor Switched Series Capacitor(TSSC).
6. To study Thyristor Controlled Series Capacitor(TCSC).
7. To study Thyristor Controlled Phase Angle Regulator(TCPAR).
8. To study Unified power flow controller.
9. To study about HVDC transmission system.

Major Equipment:

- ✓ Simulation software like MATLAB along with necessary toolbox, PSIM or Scilab

List of Open Source Software/learning website:

www.nptl.ac.in