GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720736
Semester – II
Subject Name: STATIC VAR CONTROLLER AND HARMONIC FILTERS

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	• Fundamentals of Load Compensation. • Steady-State Reactive Power Control in Electric Transmission Systems. • Reactive Power Compensation and • Dynamic Performance of Transmission Systems.	6
2	• Power Quality Issues: Sags, Swells, Unbalance, Flicker, Distortion. • Current Harmonics. Sources of Harmonics in Distribution Systems and its Effects.	6
3	• Static Reactive Power Compensators and their control. Shunt Compensators. • SVCs of Thyristor Switched and Thyristor Controlled types and their control, • STATCOMs and their control. • Series Compensators of thyristor Switched and Controlled Type and their Control. • SSSC and its Control, Sub-Synchronous Resonance and damping. • Use of STATCOMs and SSSCs for Transient and Dynamic Stability improvement in Power System.	10
4	• Converters for Static Compensation. • Single Phase and Three Phase Converters and Standard Modulation Strategies (Programmed Harmonic Elimination and SPWM). • GTO Inverters. Multi-Pulse Converters and Interface Magnetics. • Multi-Level Inverters of Diode Clamped Type and Flying Capacitor Type and suitable modulation strategies (includes SVM). • Multi-level inverters of Cascade Type and their modulation. Current Control of Inverters.	8

5	• Passive Harmonic Filtering. • Single Phase Shunt Current Injection Type Filter and its Control. • Three Phase Three-wire Shunt Active Filtering and their control using p-q theory and d-q modeling. • Three phase four wire shunt active filters. • Hybrid Filtering using Shunt Active Filters. • Dynamic Voltage Restorer and its control. • Power Quality Conditioner	8
6	• Series Active Filtering in Harmonic Cancellation Mode. • Series Active Filtering in Harmonic Isolation Mode.	4

Reference Books:

1. Ned Mohan et.al, "Power Electronics",John Wiley and Sons,2006.
2. Hirofumi Akagi et al., "Instantaneous Power Theory and Application to Power Conditioning" IEEE Press, Willey-Interscience A Jhon Willey & Son Publication
3. R. Sastry Vedam & Mulukutla S. Sarma, "Power Quality : VAR Compensation in power systems" , CRC press 2009
4. Reactive Power Compensation in Electric System By THE Miller, Wiley Publication
5. Deare A Paice, "Power Electronics Converter Harmonics" IEEE Press
6. C. Sankaran, "Power quality" , CRC Press, 2002

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Acquire knowledge about the fundamental principles of Passive and Active Reactive Power Compensation Schemes at Transmission and Distribution level in Power Systems	25
CO-2	Understand various single phase and three-phase Static VAR Compensation schemes and their controls.	25
CO-3	To develop analytical modeling skills needed for modeling and analysis of Static VAR compensator.	25
CO-4	To develop analytical modeling skills needed for modeling and analysis of active and passive filters.	25

List of Experiments:

1. To study basic ffundamentals of Load Compensation and Steady-State Reactive Power Control in Electric Transmission Systems.

2. To study various Power Quality issues.

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3. To study various single phase and three-phase Static VAR Compensation schemes and their controls.

4. To study various converter control strategies for static compensation.

5. To design passive harmonic filter for given harmonics filtering.

6. To study shunt active harmonic filter using p-q theory.

7. To study hybrid filter and compare it with passive and active filters.

8. To study dynamic voltage restorer.

9. Prepare simulation for passive filter.

10. Prepare simulation for shunt active filter.

Major Equipment:

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

List of Open Source Software/learning website:

1. Courses available through NPTEL.
   - website : nptel.ac.in