



**C. U. SHAH UNIVERSITY**  
**Wadhwan City**

**FACULTY OF:** - Technology & Engineering  
**DEPARTMENT OF:** -Electrical Engineering  
**BRANCH:** Electrical & Electronics Engineering  
**SEMESTER:** - VII  
**CODE:** - 4TE07APS1  
**NAME –** Advanced Power System

**Teaching & Evaluation Scheme**

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE07APS1	Advanced Power System	4	0	2	6	5	30	1.5	70	3	--	20	30	<b>150</b>

**Objectives**

- To study the controlling techniques for flexible AC transmission
- To study the effect of power quality disturbances in AC and DC drives.
- To study the various concepts and aspects of smart grid technology
- To study the load compensation techniques and demand side management techniques for power system.

**Prerequisites**

- Basic Fundamentals of Electrical Machines, Control Systems Power Electronics and Power System Analysis

**Course Outlines**

Sr. No.	Course Contents	Hours
1	<b>Introduction:</b> Background, Electrical Transmission Networks, Conventional Control Mechanisms, Automatic Generation Control (AGC), Excitation Control Transformer Tap-Changer Control, Phase Shifting Transformers, Flexible ac Transmission Systems (FACTS), Advances in power Electronics Switching Devices, Principles and Applications of Semiconductor Switches, Emerging Transmission Networks	06
2	<b>Power Quality Considerations In Industrial Power Systems:</b> Voltage sag – equipment behaviour of Power electronic loads, induction motors, synchronous, motors, computers, consumer electronics, adjustable speed AC drives and its operation. Mitigation of AC Drives, adjustable speed DC drives and its operation, mitigation methods of DC drives.	10

3	<p><b>Introduction to Smart Grid Technology:</b> Introduction to smart grid- Electricity network-Local energy networks- Electric transportation- Low carbon central generation-Attributes of the smart grid-Alternate views of a smart grid.</p> <p><b>Smart Grid To Evolve A Perfect Power System</b> Introduction- Overview of the perfect power system configurations- Device level power system- Building integrated power, systems- Distributed power systems Fully integrated power system-Nodes of innovation.</p>	10
4	<p><b>Dynamic Energy Systems Concept:</b> Smart energy efficient end use devices-Smart distributed energy resources-Advanced whole, building control systems- Integrated communications architecture-Energy management-Role of technology in demand response- Current limitations to dynamic energy management-Distributed energy resources-Overview of a dynamic energy management-Key characteristics of smart devices-Key characteristics of advanced whole building control systems-Key characteristics of dynamic energy management system.</p>	10
5	<p><b>Load Compensation:</b> Objectives and specifications – reactive power characteristics – inductive and capacitive approximate biasing – Load compensator as a voltage regulator – phase balancing and power factor correction of unsymmetrical loads- examples.</p>	10
6	<p><b>Demand Side Management:</b> Load patterns – basic methods load shaping – power tariffs- KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels.</p> <p><b>Distribution Side Reactive Power Management</b> System losses –loss reduction methods – examples – Reactive power planning – objectives –Economics Planning capacitor placement – retrofitting of capacitor banks</p>	10

## Learning Outcomes

The students will become aware with smart grid technology concepts. The controlling technology for flexible ac transmission line will be helpful to cope up with the advanced technology implemented for the transmission lines. The power quality parameter for industrial system will become an on hand solution techniques for ac and dc drive installation side effects on the quality of electrical power delivered. Load compensation techniques and demand side management will become a handy tool for reactive power issues.

## Books Recommended

1. “Thyristor-Based FACTS Controllers for Electrical Transmission Systems” by R.M.Mathur, John Wiley & Sons, Inc., 2002
2. “Reactive power control in Electric Power Systems” by T.J.E.Miller, John Wiley and sons, 1982 (Units I to IV)
3. “Reactive power Management” by D.M.Tagare, Tata McGraw Hill,2004.(Units V to VIII)
- 4 “The Smart Grid, Enabling Energy Efficiency and Demand Side Response” by Clark W Gellings CRC Press, 2009.
5. “Smart Grid: Technology and Applications” by Janaka Ekanayake, Kithsiri Liyanage,Jianzhong.Wu, Akihiko Yokoyama, Nick Jenkins, Wiley, 2012.

6. "Smart Grid :Fundamentals of Design and Analysis" by James Momoh, Wiley, IEEE Press, 2012
7. "Understanding Power Quality Problems" by Math H J Bollen. IEEE Press.
8. "Power Quality VAR Compensation in Power Systems", by R. SastryVedam Mulukutla S. Sarma, CRC Press.