

GUJARAT TECHNOLOGICAL UNIVERSITY

POWER ELECTRONICS & ELECTRICAL DRIVES APPLICATION OF POWER ELECTRONICS TO POWER SYSTEM SUBJECT CODE: 2734501 M.E. 3RD SEMESTER

Type of course: Engineering Science (Electrical)

Prerequisite: NA

Rationale: NA

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)		
						ESE	OEP	PA	RP	
3	2#	2	5	70	30	20	10	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Reactive Power Control and Compensation By Conventional Controllers Control of power flow in AC transmission line, Analysis of uncompensated AC line, Passive reactive power compensation, effects on power transfer capability, Compensation by a series capacitor connected at the mid point of the line, shunt compensation at the mid point of the line, comparison of shunt and series connected capacitor, configuration and operating characteristics of Synchronous condensers, Saturated Reactor, Thyristor Controlled Reactor (TCR), Thyristor Controlled Transformer, Fixed Capacitor-TCR, Thyristor switched capacitor (TSC), TSC-TCR	09	20
2	Static Var Compensator (SVC) Analysis of SVC, Comparison of all SVCs, SVC Controller, Modelling of SVC, Voltage regulator Design, harmonics and their filtering, protection of SVC, characteristics of SVC, Voltage control by the SVC, Advantages of the slope in the SVC Dynamic Characteristic, Influence of the SVC on System Voltage, Applications – Increase in steady state power transfer capacity, Improvement of transient stability, Augmentation of power system damping	09	20
4	Thyristor Controlled Series Capacitor (TCSC) and Static Synchronous Series Compensator (SSSC) Principle of operation, modeling, control and applications.	7	15
3	Static Synchronous Compensator (STATCOM) Principle of operation, characteristics, control and applications of STATCOM.	6	15
5	Unified Power Flow Controller (UPFC) and Interline Power Flow Controller (IPFC)	7	15

	Operation, control and applications of UPFC and IPFC		
6	Active Power Filter Need, Advantages, Types – Shunt, Series and Hybrid, Operation, Instantaneous reactive power theory, synchronous reference frame theory	7	15

Reference Books:

1. Mathur R. M. and Varma R. K “Thyristor-based FACTS controllers for Electrical Transmission System”, Wiley-IEEE press, 2002.
2. Padiyar K. R. “FACTS controller in power transmission and distribution”, New Age international publishers, 1st edition, 2007.
3. Hingorani N. G. and Laszlo Gyugyi, “Understanding Facts: Concepts and Technology of Flexible AC Transmission Systems”, Wiley-IEEE Press, 1999.
4. Acha E., Agelidis V. G., Anaya O., Miller T. J. E., “Power Electronics Control in Electrical Systems”, Newnes Power Engineering Series, 2002.
5. Sood V. K., “HVDC and FACTS Controllers: Applications of Static Converters in Power Systems”, Springer, 1st edition, 2004.

Course Outcome:

After learning the course the students should be able to:

1. Understand working of different power electronic converter based devices used in power system
2. Model and control these devices
3. Mitigate power system issues using these devices

List of Experiments:

1. To analyse operation of Thyristor controlled Reactor (TCR)
2. To analyse operation of Fixed Capacitor - Thyristor controlled Reactor (FC-TCR)
3. To evaluate performance of Thyristor switched capacitor (TSC)
4. To analyse behavior of TSC-TCR
5. To evaluate performance of Thyristor Controlled Series Capacitor (TCSC)
6. To analyse operation of Static Synchronous Series Compensator (SSSC)
7. To evaluate performance of Thyristor switched capacitor (TSC)
8. To analyse operation of Fixed Capacitor - Thyristor controlled Reactor (TSC-TCR)
9. To evaluate performance of Static Synchronous Compensator (STATCOM)
10. To analyse operation of Unified Power Flow Controller (UPFC)
11. To analyse operation of Interline Power Flow Controller (IPFC)
12. To analyse behavior of Active power filter using instantaneous reactive power theory
13. To analyse behavior of Active power filter using synchronous reference frame theory

Design based Problems (DP)/Open Ended Problem:

Course coordinator has to define at least 3 open ended problems related to the course.

Major Equipment:

Necessary instruments, kits and apparatus are to be provided for conducting above said practical in a group of maximum four students.

List of Open Source Software/learning website:

- E-materials available at the website of NPTEL- <http://nptel.ac.in/>
- MATLAB (Trial version): Software is useful for simulation and analysis of electrical systems

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.