

COURSE TITLE	FACTS & HVDC
COURSE CODE	01EE0716
COURSE CREDITS	3

Objective:

- 1 The course is aimed to learn the importance of HVDC transmission, analysis of HVDC Converters. It also deals with basic FACTS concepts, static shunt and series compensation and combined compensation techniques.

Course Outcomes: After completion of this course, student will be able to:

- 1 Identify the suitable FACTS controller that aligns with the specific system requirements.
- 2 Choose the shunt and/or series controller's for power flow control in transmission.
- 3 Examine the construction and functionality of various types of HVDC links.
- 4 Describe the functioning of HVDC conversion systems and conduct power flow analysis in AC/DC systems.

Pre-requisite of course:Power system – I & II, Power electronics

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	0	50	30	20	0	0

Contents : Unit	Topics	Contact Hours
1	FACTS Concepts Review of basics of power transmission networks, Control of power flow in AC transmission line, Analysis of uncompensated AC Transmission line, Passive reactive power compensation, Effect of series and shunt compensation at the mid-point of the line on power transfer, Need for FACTS controllers, Types of FACTS controllers, Comparison of AC & DC Transmission	11
2	Static Shunt Compensators Objectives of Shunt Compensation, Methods of Controllable Var Generation –Thyristor controlled Reactor (TCR), Thyristor Switched Reactor (TSR), Thyristor Switched Capacitor (TSC), Operation of Single Phase TSC – TSR, Configuration of SVC, Voltage regulation by SVC, Applications Static synchronous compensator (STATCOM), Operation of STATCOM, Voltage regulation, Power flow control with STATCOM	12

Contents : Unit	Topics	Contact Hours
3	Static Series Compensators Objectives of Series Compensation, Concept of Series Capacitive Compensation, Operation of TCSC, Operation of TSSC, Basic concept and operation of Static synchronous series compensator (SSSC)	7
4	HVDC transmission Introduction to HVDC transmission, Power Handling Capabilities of HVDC Lines , Reliability, Limitations, Types of HVDC links - Monopolar, Bipolar and Homopolar links, Components of HVDC transmission system, Applications of HVDC lines, Basic Conversion principle, Analysis of HVDC Converters, Power flow in HVDC Links	12
Total Hours		42

Textbook :

- 1 Understanding FACTS – Concepts and Technology of Flexible AC Transmission Systems, Narain G. Hingorani, Laszlo Gyugyi, Wiley India publications, 2011
- 2 Thyristor – Based Facts Controllers for Electrical Transmission Systems, Mohan Mathur, R., Rajiv. K. Varma, IEEE press and John Wiley & Sons, Inc., 2012
- 3 HVDC Power Transmission Systems, K.R.Padiyar, New Age International (P) Ltd., 2017

References:

- 1 Introduction to FACTS Controllers: Theory, Modeling, and Applications, Introduction to FACTS Controllers: Theory, Modeling, and Applications, Kalyan K. Sen, Mey Ling Sen, Wiley-IEEE Press, 2016
- 2 HVDC and FACTS controllers- Applications of Static Converters in Power System, HVDC and FACTS controllers- Applications of Static Converters in Power System, V.K.Sood, Kluwer Academic Publishers, 2013
- 3 FACTS Controllers in Power Transmission and Distribution, FACTS Controllers in Power Transmission and Distribution, K.R.Padiyar, New Age International (P) Ltd., 2016

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
10.00	20.00	25.00	25.00	10.00	10.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs, etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the classroom.
- 3 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, and Virtual Laboratory

Supplementary Resources:

- 1 <https://nptel.ac.in/courses/108/106/108106025/>
- 2 <https://nptel.ac.in/courses/108/107/108107114/>
- 3 <https://nptel.ac.in/courses/108/104/108104013/>