

DEPARTMENT OF ELECTRICAL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY JAMSHEDPUR
JHARKHAND – 831014

SPRING SEMESTER 2018-19

Course Handout

Date: 01/01/2019

Course Code : EEG7122

Course Title : HVDC Transmission System

Instructor-in-charge : Dr. Om Hari Gupta

Course Description:

Introduction; DC Transmission System: mono-polar, bi-polar and homo-polar lines, back-to-back HVDC Systems, components of HVDC transmission system, main applications of DC transmission. Converter operation (normal and abnormal); 6-pulse and 12-pulse rectifiers and inverters. Harmonics and filters. HVDC control systems. Valve blocking and by-passing; Starting, stopping and power flow reversal. Dis-operation of converters, Faults in HVDC system and their protection. Measurement of voltage and current for fault detection, Parallel operation of AC-DC systems: effective short-circuit ratio (ESCR). Recent developments and problems in HVDC transmission. Operating principle of VSC-based HVDC transmission. Advantages of VSC-based HVDC transmission over classical CSC-based HVDC transmission.

Scope:

- To provide good fundamental concepts of requirements of HVDC transmission system.
- To study the comparative analysis of HVAC and HVDC transmission systems.
- To study different types of HVDC links and their advantages and limitations.
- To study principles of conversion from AC to DC and vice-versa.
- To study the protection aspects of HVDC transmission systems
- To study parallel operation and control of power.

Objectives:

- At the end of this course, the students will be able to understand the basics of HVDC transmission system.
- At the end of this course, the students will be able to understand different processes of HVDC transmission system and its advantages and limitations over HVAC transmission system.

Text Books:

- T1. Kimbark E.W., “Direct Current Transmission”, Wiley International New York.
- T2. Padiyar K. R., “HVDC Power Transmission System”, New Age International (P) Limited.
- T3. Ullmann V. “Power Transmission by Direct Current” Springer-Veriag.

Reference Books:

- R1. M. H. Rasid, “Power Electronics – Circuits, Devices and Applications”, Pearson, 2003.
- R2. N. Mohan, T.M. Undel and W.P. Robbins, “Power Electronics: Converter, Application and Design”, John Wiley and Sons, New York, 2003.

Course Plan:

Lecture No.	Learning Objectives	Major Topics	Book & course material
1-15	Introduction; DC Transmission System: mono-polar, bi-polar and homo-polar lines, back-to-back HVDC Systems, components of HVDC transmission system, main applications of DC transmission.	Introduction and types of links, applications	T1
16-25	Converter operation (normal and abnormal); 6-pulse and 12-pulse rectifiers and inverters. Harmonics and filters.	Converter working and AD/DC filters	R1, R2
26-32	HVDC control systems. Valve blocking and by-passing; Starting, stopping and power flow reversal.	Control of HVDC system	T2
33-37	Dis-operation of converters, Faults in HVDC system and their protection. Measurement of voltage and current for fault detection, Parallel operation of AC-DC systems: effective short-circuit ratio (ESCR).	Faults and parallel operation	T2, T3
37-45	Recent developments and problems in HVDC transmission. Operating principle of VSC-based HVDC transmission. Advantages of VSC-based HVDC transmission over classical CSC-based HVDC transmission.	Recent trends and VSC to CSC comparison	T1, T2

Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage	Nature of Component
1.	Mid-Term Exam	90 Min.	30%	Closed Book
2.	End-Term Exam	180 Min.	50%	Closed Book
3.	Assignment	--	5%	Take Home
4.	Class Assignment	30 Min.	10%	Closed Book
5.	Attendance	--	5%	--

Chamber Consultation Hour: Friday, After Lunch, Chamber (Room No-712)

Notices: All notices regarding the course will be displayed only on the **Department of Electrical Engineering notice board.**

Instructor In-Charge