Course Number and Name

BEE011 & High Voltage Dc Transmission

Credits and Contact Hours

3 & 45

Course Coordinator's Name

Mr.Uma Mageshwaran

Text Books and References

Text Books:

1. K.R. Padiyar ,"HVDC Power Transmission System Technology and System Interaction"-Willey Eastern Ltd. 1991.
2. E.W Kimbark, "DirectCurrent Transmission", Vol. Willey Inter Science. New York 1971.

References:

1. Colin Adamson and N.G. Hingorani. "High Voltage Direct Current Power Transmission", Garraway limited. England 1960.
2. B.J Kor(ed), "High Voltage Direct Current Converters and Systems", Macdonald and Co, London 1965.
3. B.M WedyBectric "Power Systems", John Wiley and Sons, London 1979.
4. Arrillaga, J., "High Voltage Direct Current Transmission", Peter Pregrinus, London, 1983.
5. Online courses on HVDC Transmission systems-http://nptel.ac.in/courses/108104013/

Course Description

To master the various fundamentals, converter design, protection schemes of HVDC transmission systems. This will help you to gain knowledge and to do research in the area of HVDC transmission systems.

Prerequisites	Co-requisites
Basic Electrical and Electronics Engineering	Nil

required, elective, or selected elective (as per Table 5-1)

Required

Course Outcomes (COs)

CO1:To learn about the historical development and emergence of HVDC transmission.
CO2:To study about the various thyristor converters used in HVDC transmission.
CO3:To analyze various control methodologies and characteristics of converters.
CO4:To understand the principle of protection schemes used in HVDC transmission.
CO5:To learn the fundamentals of ground return, filters and harmonics.

Student Outcomes (SOs) from Criterion 3 covered by this Course

COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	M	M	M	H	M	M	M	H		H	L	M
CO2	H	M	M	H	H		M	H	H	H	L	M
CO3	L	H		H	H	M	L	H	H	H	L	H
CO4	L	H	M	H	H	M	L	M	H	L	H	H
CO5	H	M	M	H	H		M			L	L	L

List of Topics Covered

UNIT I GENERAL ASPECTS 9

Historical development HVDC and HVDC link – Comparison of AC and DC Transmission – Application of DC Transmission – Types of DC link – Converter Station - HVDC projects in India and abroad – Advantages and disadvantages of HVDC transmission Principal application of dc transmission – Economical factor – Development of power devices for HVDC transmission – Thyristors - switching and steady state characteristics.

UNIT II INTRODUCTION TO CONVERTERS 9

Line Commutated Converter – Analysis of Graetz Bridge Neglecting Overlap – Choice of Converter Configurations for any Pulse Number – Analysis of a 12 Pulse Converter – Voltage Source Converter – Basic Two level Converter (Graetz Bridge) – A Three Level Voltage Source Converter – Converter Using Pulse Width Modulation – capacitor Commutated Converter.

UNIT III CONTROL OF CONVERTERS 9

Principles of DC Link Control – Converter Control Characteristics – Firing Angle Control – Current and Extinction Angle Control – Starting and Stopping of DC Link - Power Control - Higher Level Controllers – SVC and STATCOM.

UNIT IV FAULTS AND PROTECTION 9

Converter Faults – commutation failure – Arc through – Misfire – Current extinction – Short Circuit in a Bridge – Protection against Over currents – Over voltages in a converter station – Disturbance on the DC side – Surge Arrestors – Protection Against Overvoltage – Protection against faults in a voltage Source Converter – DC Breakers.

UNIT V HARMONICS AND FILTERS 9

Generation of Harmonics - Characteristics and Non-Characteristic Harmonics - Troubles caused by harmonics – Means of Reducing Harmonics - .Design of AC Filters – Passive AC Filters – DC Filters – Active Filters – Carrier Frequency and RI Noise.