



IV Year-II Semester		L	T	P	C
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H.V.D.C. TRANSMISSION (R1642022)					

Prerequisite Course:

Power systems – II
Switch gear and Protection
Power System Operation and Control

Course Description and Objectives:

This subject deals with the importance of HVDC transmission, analysis of HVDC converters, Faults and protections, Harmonics and Filters. It also deals with Reactive power control and Power factor improvements of the system.

Course Outcomes:

Upon completion of the course, the student will be able to achieve the following outcomes.

Cos	Course Outcomes	POs
1	Learn different types of HVDC levels and basic concepts	3
2	Know the operation and configuration of converters	4
3	Know the control of converter and HVDC Transmission.	5
4	Understand the significance of reactive power control and AC/Dc load flow	3
5	Understand converter faults, protection and harmonic effects	3
6	Design low pass and high pass filters	3

Syllabus:

UNIT I:

Objective: Understand basic concepts of HVDC Transmission.

Basic Concepts

Economics & Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC &DC Transmission, Application of DC Transmission System – Planning & Modern trends in D.C. Transmission.

UNIT II:

Objective: Analyze the converter configuration

Analysis of HVDC Converters

Choice of converter configuration – analysis of Graetz – characteristics of 6 pulse & 12 pulse converters – Cases of two 3 phase converters in star –star mode – their performance.

UNIT III:

Objective: Know the control of converter and HVDC Transmission.

Converter & HVDC System Control

Principal of DC Link Control – Converters Control Characteristics – Firing angle control – Current and extinction angle control – Effect of source inductance on the system - Starting and stopping of DC link - Power Control



UNIT IV:

Objective: Understand the significance of reactive power control and AC/Dc load flow.

Reactive Power Control in HVDC

Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategiesources of reactive power-AC Filters – shunt capacitors-synchronous condensers.

Power Flow Analysis In AC/DC Systems

Modelling of DC Links-DC Network-DC Converter-Controller Equations-Solution of DC loadflow – solution of AC-DC Power flow-Simultaneous method-Sequential method.

UNIT V:

Objective: Know different converter faults, protection and effect of harmonics.

Converter Fault & Protection

Converter faults – protection against over current and over voltage in converter station – surge arresters – smoothing reactors – DC breakers –Audible noise-space charge field-corona effects on DC lines-Radio interference.

Harmonics

Generation of Harmonics –Characteristics harmonics, calculation of AC Harmonics, Non- Characteristics harmonics, adverse effects of harmonics – Calculation of voltage & Current harmonics – Effect of Pulse number on harmonics.

UNIT VI:

Objective: Learn low pass and high pass filters

Filters

Types of AC filters, Design of Single tuned filters –Design of High pass filters.

TEXT BOOKS:

1. HVDC Power Transmission Systems: Technology and system Interactions – by K.R.Padiyar,New Age International (P) Limited, and Publishers.
2. HVDC Transmission by S.Kamakshaiah andV.Kamaraju-Tata McGraw–Hill

REFERENCE BOOKS:

1. HVDC Transmission – J.Arrillaga.
2. Direct Current Transmission – by E.W.Kimbark, John Wiley & Sons.
3. Power Transmission by Direct Current – by E.Uhlmann, B.S.Publications.