

**B.P. PODDAR INSTITUTE OF MANAGEMENT AND TECHNOLOGY**

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**Department of Electrical Engineering
Academic Year -2025-26(Even Semester)****LESSON PLAN**

Program : Electrical Engineering Credit: 3 Contact: 3L
Course Name : HVDC Transmission
Course Code : PE EE 601B
Course Coordinator: Madhumita Kundu Mondal

Lectures Number	Topics to be covered	Text Books / Reference/Web References/Research Papers	Teaching Pedagogies
L1	Introduction to DC Power Transmission Technology, historical development	T1, R2, R3, W1, P1	1. Research Paper 2. Lecture 3. Quiz 4. Power Point Presentation
L2	Comparison of HVAC and HVDC transmission systems	T1, R2, R3, W2, W3, P1, P2	1. Research Paper 2. Lecture 3. Quiz 4. Power Point Presentation
L3	Applications and advantages of HVDC transmission	T1, R1, R4, W3, W4	1. Lecture 2. Quiz 3. Power Point Presentation
L4	Description and components of HVDC transmission system	T1, R3, W1, W3, P1, P3	1. Research Paper 2. Lecture 3. Quiz 4. Power Point Presentation
L5	HVDC configurations: Monopolar, Bipolar, Homopolar	T1, R2, R3, W1	1. Lecture 2. Quiz 3. Power Point Presentation
L6	Modern trends in DC transmission (VSC-HVDC overview)	T1, R3, W1, W3, P1, P4	1. Research Paper 2. Lecture 3. Quiz 4. Power Point Presentation
L7	Introduction to HVDC converters and pulse number	T1, R2, W1, W3, P1	1. Research Paper 2. Lecture 3. Quiz 4. Power Point Presentation
L8	Choice of converter configuration	T1, R2, R4, W1, W3	1. Lecture 2. Power Point Presentation

L9	Simplified analysis of Graetz circuit	T1, R2, R4, W1, W3	1. Lecture 2. Quiz 3. Power Point Presentation
L10	Converter bridge characteristics	T1, R3, W1, W3, P1	1. Research Paper 2. Lecture 3. Quiz 4. Power Point Presentation
L11	Six-pulse converter operation	T1, R2, R4, W1	1. Lecture 2. Quiz 3. Power Point Presentation
L12	Twelve-pulse converter characteristics	T2, R3	1. Lecture 2. Quiz 3. Power Point Presentation
L13	Converter analysis without overlap	T1, R1, R2, W1, W2	1. Lecture 2. Online video lectures 3. Power Point Presentation
L14	Converter analysis with overlap	T1, R1, R2, W1, W2	1. Lecture 2. Online video lectures 3. Power Point Presentation
L15	Numerical problems on HVDC converters	T1, R1, R2, W1, W2	1. Lecture 2. Online video lectures 3. Power Point Presentation
L16	Introduction to converter and HVDC system control	T1, R1, R3, W1, W3	1. Lecture 2. Online video lectures 3. Power Point Presentation
L17	Principles of DC link control	T1, R1, R2, W1, W2	1. Lecture 2. Online video lectures 3. Power Point Presentation
L18	Converter control characteristics	T1, R1, R2, W1, W2	1. Lecture 2. Online video lectures 3. Power Point Presentation
L19	Firing angle control	T1, R3, W2	1. Lecture 2. Online video lectures 3. Power Point Presentation
L20	Current control and extinction angle control	T1, R2, R4, W2	1. Lecture 2. Online video lectures 3. Power Point Presentation
L21	System control hierarchy	T1, R1, W2, P2	1. Research Paper 2. Lecture 3. Online video lectures 4. Power Point Presentation

L22	Starting and stopping of DC link	T1, R2, R4, W3, W4	1. Lecture 2. Online video lectures 3. Power Point Presentation
L23	Power control and higher-level controllers	T1, R1, W2, W3, P2	1. Research Paper 2. Lecture 3. Online video lectures 4. Power Point Presentation
L25	Converter faults and fault types	T1, R1, W2, W3, P1, P2	1. Research Paper 2. Lecture 3. Online video lectures 4. Power Point Presentation
L26	Protection against over-currents	T1, R1, W2, W3, P1, P2	1. Research Paper 2. Lecture 3. Online video lectures 4. Power Point Presentation
L27	Over-voltages in converter stations	T1, R2, R4, W2, W4	1. Lecture 2. Online video lectures 3. Power Point Presentation
L28	Introduction to smoothing reactors	T1, R3, R4, W3, W4	1. Lecture 2. Online video lectures 3. Power Point Presentation
L29	Design and functions of smoothing reactors	T1, R4, W2, W4	1. Lecture 2. Online video lectures 3. Power Point Presentation
L30	DC transmission lines and characteristics	T1, R2, R4, W3, W4	1. Lecture 2. Online video lectures 3. Power Point Presentation
L31	Transient over-voltages in DC lines	T1, R2, R3, W3, W4	1. Lecture 2. Online video lectures 3. Power Point Presentation
L32	Protection of DC lines and DC breakers	T1, R2, R4, W3, W4	1. Lecture 2. Online video lectures 3. Power Point Presentation
L33	Monopolar operation and proximity effects with AC lines	T1, R2, R4	1. Lecture 2. Power Point Presentation
L34	Reactive power requirements in steady state	T1, R2, R4	1. Lecture 2. Power Point Presentation

L35	Sources of reactive power and Static VAR systems	T1, R2, R4, P1	1. Research Paper 2. Lecture 3. Power Point Presentation
L36	Harmonics generation in HVDC converters	T1, R2, R3	1. Lecture 2. Power Point Presentation
L38	AC and DC filter design	T1, R2, R4, W3, W4	1. Lecture 2. Online video lectures 3. Power Point Presentation
L39	Power flow analysis in AC/DC systems, DC load flow and per unit system	T1, R2, R3, W1, W2	1. Lecture 2. Online video lectures 3. Power Point Presentation
L40	HVDC for Renewable Energy Integration (Gap beyond Syllabus)	P1, P2, P3, P4	Research Paper

Text Books:

T1. HVDC Power transmission systems , K.R. Padiyar , Third Edition, New Age International Publishers

Reference Books:

R1. Power Transmission by Direct Current, Erich Uhlmann, Fourth Indian Reprint, Springer International Edition, 2012.

R2. HVDC Transmission, S Kamakshaiah, V Kamaraju , 2nd Edition, Mcgraw Hill Education, 2020.

R3. Direct Current Transmission, E.W.Kimbark, Wiley–Blackwell; Volume 1 edition (1 January 1971)

R4. H.V.D.C Transmission , J Arrillaga , 1st Edition, The Institution of Engineering and Technology, 1998

Web References:

W1. nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/power-system/.../1_7.htm

W2. <http://www.digimat.in/nptel/courses/video/108102047/L21.html>

W3. nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/power-system/.../10_2.html

W4. nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/power-system/.../10_11.html

Research Papers References:

P1. HVDC Transmission: Technology Review, Market Trends and Future Outlook, <https://www.sciencedirect.com/science/article/abs/pii/S1364032119302837>

P2. Comprehensive review of commutation failure in HVDC transmission systems, <https://www.sciencedirect.com/science/article/abs/pii/S0378779621007495>

P3. HVDC Transmission and its Potential Application in Remote Communities: Current Practice and Future Trend, <https://ieeexplore.ieee.org/document/9693197>

P4. The VSC-HVDC Transmission System Performance Assessment, <https://iopscience.iop.org/article/10.1088/1742-6596/2570/1/012025/pdf>