Course Syllabi: UEE631: HVDC Transmission Systems (L : T : P :: 3 : 0 : 0)

1. **Course number and name**: UEE631: HVDC Transmission Systems

2. **Credits and contact hours**: 3.0 and 3

3. **Text book, title, author, and year**

   Text Books / Reference Books
   - *Arrillaga, J., HVDC Transmission, IEE Press (2007).*
   - *Edwart, K., Direct Current Transmission (Vol. 1), John Wiley and Sons (2008).*
   - *Padiyar, K.R., HVDC Power Transmission System, New Age International (P) Limited, Publishers (2008).*
     Arrillaga, J. and Smith, B.C., AC to DC Power System Analysis, IEE Press (2008).

   a. Other supplemental materials
      - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)

   DC power transmission technology: Introduction, Comparison of HVAC and HVDC transmission system, Applications of DC transmission, Description of DC transmission system, Configurations, Modern trends in DC transmission.
   Analysis of HVDC converters: Pulse number, Choice of converter configuration, Simplified analysis of Graetz circuit, Converter bridge characteristics, Characteristics of a twelve-pulse converter, Detailed analysis of converters with and without overlap.
   Converter and HVDC system control: General, Principles of DC link control, Converter control characteristics, System control hierarchy, Firing angle control, Current and extinction angle control, Starting and stopping of DC link, Power control, Higher level controllers.
   Converter faults and protection: Converter faults, Protection against over-currents, Over-voltages in a converter station, Surge arresters, Protection against over-voltages.
   Smoothing reactor and DC line: Introduction, Smoothing reactors, DC line, Transient over voltages in DC line, Protection of DC line, DC breakers, Monopolar operation, Effects of proximity of AC and DC transmission lines.
   Reactive power control: Reactive power requirements in steady state, Sources of reactive power, Static VAR systems, Reactive power control during transients, Harmonics and filters, Generation of harmonics, Design of AC filters, DC filters.
   Component models for the analysis of ac/dc systems: General, Converter model, Converter control, Modelling of DC network, Modelling of AC networks.
   Power flow analysis in AC/DC systems: General, Modelling of DC links, Solution of DC load flow, Discussion, Per unit system for DC quantities.

5. **Specific goals for the course**
   After the completion of the course, the students will be able to:
   - Choose intelligently AC and DC transmission systems for the dedicated application(s).
   - Identify the suitable two-level/multilevel configuration for high power converters.
   - Select the suitable protection method for various converter faults.
   - Identify suitable reactive power compensation method.
   - Decide the configuration for harmonic mitigation on both AC and DC sides..

6. Brief list of topics to be covered

- DC power transmission technology
- Analysis of HVDC converters
- Converter and HVDC system control
- Converter faults and protection
- Smoothing reactor and DC line
- Reactive power control
- Component models for the analysis of ac/dc systems
- Power flow analysis in AC/DC systems