20PE014 - HIGH VOLTAGE DC TRANSMISSION

UNIT – I **L- 12**

Introduction& types of HVDC Links

Introduction to HVDC transmission, Comparison between HVAC and HVDC systems - Economic, technical- Power Handling Capabilities of HVDC Lines and reliability, limitations, Types of HVDC links - Monopolar, Bipolar and Homopolar links, Components of HVDC transmission system. Applications of HVDC lines, Basic Conversion principle.

UNIT – II **L- 12**

Converter Operation & Analysis

Analysis of HVDC Converters- Rectifier and Inverter operation of Graetz circuit without and with overlap angle. Complete Equivalent circuit of HVDC link. Complete characteristics of converter as Rectifier and Inverter. Analysis of 12-pulse converter. Power flow in HVDC Links.

UNIT – III **L- 12**

Control of HVDC Converter & Systems

Basic principles of HVDC system control, necessity of control in HVDC link, power reversal, Basic controllers - constant current and constant extinction, power control, high level controllers. Firing angle control- Individual phase control and equidistant firing angle control. Summary of converter control.

UNIT – IV **L- 12**

MTDC Systems, Harmonics and Filters

Multi-terminal DC links and systems- series, parallel and series parallel systems, their operation. Harmonics in HVDC system - Characteristic and uncharacteristic harmonics - Troubles due to harmonics – Harmonic filters - Active and passive filters - Reactive power control of converters.

UNIT – V **L- 12**

Over voltages, Converter Faults and Protection in HVDC Systems

Over voltages due to disturbances on DC side, AC side & internal converter side. Converter faults- misfire, arc through, commutation failure, over current protection - valve group, and DC line protection. Over voltage protection of converters, surge arresters.

TEXT BOOKS:

1. Padiyar, K.R., ‘HVDC transmission systems’, Wiley Eastern Ltd., 2010.
2. Kamakshaiah, S and Kamaraju, V, ‘HVDC Transmission’, 1st Edition, Tata McGraw Hill Education (India), Newdelhi 2011.

REFERENCES:

1. Kimbark, E.W., ‘Direct Current Transmission-vol.1’, Wiley Inter science, New York, 1971
2. Arrilaga, J., ‘High Voltage Direct Current Transmission’, 2nd Edition, Institution of Engineering and Technology, London, 1998.
3. Vijay K. Sood, ‘HVDC and FACTS Controllers’, Kluwer Academic Publishers, New York, 2004.
4. E.Uhlman, “Power Transmission by Direct Current”, Springer Verlag, Berlin Helberg, 1985.