

**IV B.Tech II Semester Regular Examinations, Apr/May 2006****HVDC TRANSMISSION****(Electrical & Electronic Engineering)****Time: 3 hours****Max Marks: 80**

**Answer any FIVE Questions**  
**All Questions carry equal marks**

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1. (a) For a fixed power of transmission explain how the economic choice of voltage level is selected in D.C. transmission system. [8]  
(b) Explain the technological development in control and protection, for better performance and reliability of D.C. transmission system. [8]
2. (a) Draw the connection diagram of two,  $3\phi$  converter transformers to a 12 pulse converter bridge. [8]  
(b) What is meant by firing angle delay and commutation delay ? Draw the waveforms for voltage and current in a 6 pulse Graetz circuit with  $\alpha = 30^\circ$  and  $\mu = 15^\circ$ . [8]
3. Discuss the effect of source inductance on the HVDC converter system performance. [16]
4. Explain in detail, the concept of reactive power requirement in HVDC converters. [16]
5. Write a short notes on
  - (a) Modelling of H.V.D.C. links [8]
  - (b) P.U. system for d.c. quantities [8]
6. (a) State and explain why H.V.D.C. circuit breakers are not necessary in main poles of H.V.D.C. system. [8]  
(b) Sketch a complete single line diagram of D.C. side of H.V.D.C. substation and indicate various surge arresters. [8]
7. It is required to eliminate harmonics of order 10 and below 10 other than fundamental in a 12 pulse converter. Suggest a suitable transformer configuration and derive an equation for primary current of transformer. [16]
8. What are the various types of filters that are employed in HVDC converter station? Discuss them in detail. [16]

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1. Write Technical notes on the following. [8+8=16]
  - (a) Back-to-Back HVDC coupling system.
  - (b) Back to back DC link along with AC feeder.
2. Draw the schematic circuit diagram of a 6 - pulse Graetz's circuit and explain its principle of operation. [16]
3. Discuss in detail the effect of source inductance on HVDC systems. [16]
4. Describe the method of Compensation of reactive power in HVDC substation .Draw simple single line schematics for each. [16]
5. (a) Classify the solution methodology for AC-DC load flow and explain. [8]  
(b) Explain the per unit system for DC quantities. [8]
6. (a) Explain the necessity of smoothing reactor in D.C. line. [8]  
(b) Show that the value of the d.c. reactor required to prevent commutation failure is given by  $L_d = \frac{\Delta V_d}{\Delta I_d} \Delta t$ . [8]
7. What do you understand by characteristic harmonics in HVDC System? Using fourier analysis obtain equation for primary current of transformers connected to 12 pulse converter. [16]
8. What are the various types of filters that are employed in HVDC converter station? Discuss them in detail. [16]

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1. (a) For a fixed power of transmission explain how the economic choice of voltage level is selected in D.C. transmission system. [8]  
(b) Explain the technological development in control and protection, for better performance and reliability of D.C. transmission system. [8]
2. For a  $3-\phi$ , 6 pulse Graetz's circuit, draw the timing diagram considering overlap angle is less than  $60^\circ$  and without overlap for the following: . [16]
  - (a) Voltage across load
  - (b) Voltage across any two pair of conduction values
3. Discuss the effect of source inductance on the HVDC converter system performance. [16]
4. Discuss the various sources of reactive power for HVDC converters. [16]
5. (a) Classify the solution methodology for AC-DC load flow and explain. [8]  
(b) Explain the per unit system for DC quantities. [8]
6. (a) What are the basic principles of over current protection. [8]  
(b) Discuss the various faults exist in converter station? Explain. [8]
7. What is the reason for using star-star and star-delta transformer configurations for 12 pulse converter. Derive an equation for primary current using fourier analysis. [16]
8. What are the various types of filters that are employed in HVDC converter station? Discuss them in detail. [16]

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1. What is the need for interconnection of systems? Explain the merits of connecting HVAC systems by HVDC tie-lines? [16]
2. Draw the schematic circuit diagram of a 6 - pulse Graetz's circuit and explain its principle of operation. [16]
3. Write short notes on the following: [8+8=16]
  - (a) Combined characteristics of Rectifier and Inverter
  - (b) Constant - Minimum - Ignition -Angle Control
4. Discuss the constant reactive power characteristics and constant Leading power factor characteristics with regard to HVDC converter control. [16]
5. Obtain the mathematical model of a d.c. network and d.c. converter, including converter controller. [16]
6. (a) What are the basic principles of over current protection. [8]  
(b) Discuss the various faults exist in converter station? Explain. [8]
7. What do you understand by characteristic harmonics in HVDC System? Using fourier analysis obtain equation for primary current of transformers connected to 12 pulse converter. [16]
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