

IV B.Tech II Semester Regular Examinations, Apr/May 2008

HVDC TRANSMISSION

(Electrical & Electronic Engineering)

Time: 3 hours

Max Marks: 80

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

1. Write Technical notes on the following. [8+8]
 - (a) Back-to-Back HVDC coupling system.
 - (b) Back to back DC link along with AC feeder.
2. (a) Draw the connection diagram of two, 3ϕ converter transformers to a 12 pulse converter bridge. [8]
 - (b) What is meant by (i) 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. Draw and explain a block diagram of the Hierarchical levels of controls of HVDC transmission system. [16]
4. Explain in detail, the concept of reactive power requirement in HVDC converters. [16]
5. Obtain the mathematical model of a d.c. network and d.c. converter, including converter controller. [16]
6. (a) Explain the sequence of converter control actions and bipolar to mono polar transfers during D.C. line fault clearing in a bipolar H.V.D.C. system. [10]
 - (b) State the various abnormal operating conditions in a thyristor converter valve. [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]
 - (a) Back-to-Back HVDC coupling system.
 - (b) Back to back DC link along with AC feeder.
2. (a) Clearly explain how harmonics are produced and obtain the expression for rms value of the fundamental component of the current. [8]
(b) Obtain a relation between firing angle and power factor angle in a 3- ϕ bridge rectifier. [8]
3. With steady state equivalent circuit, explain the principle of control of a Two terminal DC link. [16]
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. Write short notes on
 - (a) Protection against over voltages [6]
 - (b) Commutation failure in inverter [5]
 - (c) Arc through [5]
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. Derive an equation for harmonic voltage and current for single tuned filter and discuss the influence of network admittance on design aspects. [16]

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1. (a) Compare the power transfer capacities of A.C. and D.C. transmission systems when an existing A.C. line is converted into D.C. line, with following conditions: [4+4]
 - i. Same current and insulating level.
 - ii. Same percentage losses and insulation level.(b) Prove that insulation required for D.C. system is 0.866 times that required for A.C. system. Assume the power transmitted, percentage losses and size of conductors are same for both systems. [8]
2. Draw the schematic circuit diagram of a 6 - pulse Graetz's circuit and explain its principle of operation. [16]
3. Explain in detail the converter control characteristics of HVDC systems. [16]
4. With block diagram, discuss the principle of operation of a basic power controller. [16]
5. (a) Compare simultaneous and sequential methods of power flow analysis. [8]
(b) Draw the flow chart for AC/DC load flow. [8]
6. Analyse commutation failure in detail with the help of neat diagrams. [16]
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. Write Technical notes on the following. [8+8]
 - (a) Back-to-Back HVDC coupling system.
 - (b) Back to back DC link along with AC feeder.
2. Analyse a 3 - ϕ bridge rectifier with grid control and overlap angle less than 60° and explain how reactive power can be controlled in a converter. Explain by giving neat sketches and wave forms. [16]
3. With block diagram, explain the hierarchical control structure for a DC link. [16]
4. Describe the method of Compensation of reactive power in HVDC substation .Draw simple single line schematics for each. [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 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. Mention the configurations and impedance characteristics of various types of filters. Give design aspects of single tuned filter. [16]
