

Code No. M0224 /R07

R07**Set No.1**

IV B.Tech I Semester Supplementary Examinations, February/March, 2011

HVDC TRANSMISSION

(Electrical & Electronics Engineering)

Time: 3 hours

Max. Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. a) Draw the schematic diagram of a Bi-polar HVDC converter station and explain the functions of various components available.
b) What are the disadvantages of DC transmission?
2. a) Draw the schematic of a 12-pulse converter and discuss its merits over 6-pulse converters.
b) A Graetz bridge operates with a delay angle of 15° . The leakage reactance of the transformer is 10Ω . The line to line voltage is 90 kV. Compute the direct voltage and overlap angle if $I_d = 2500$ A.
3. a) Explain the start-up procedure of a DC link with short pulse firing.
b) Explain Inverse cosine control scheme and mention its drawbacks.
4. a) Discuss about conventional control strategies for Reactive power control in HVDC link.
b) A back to back HVDC link with one bridge at each end is transmitting 100 MW with $V_d = 100$ kV. If $\alpha = 14^\circ$ and $\gamma = 16^\circ$, find ideal no-load direct voltage of rectifier (V_{dor}), ideal no-load direct voltage of inverter (V_{doi}), reactive power Q_r and Q_i . Assume R_{cr} and $R_{ci} = 12\Omega$.
5. a) Draw the converter controller model for a HVDC link and explain the same.
b) Compare simultaneous and sequential methods for AC-DC power flow.
6. a) What is the role played by smoothing reactors at the converter stations?
b) Discuss about the basic principles of over current protection in converters.

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7.
 - a) Discuss about characteristic and non-characteristic harmonics which occur in a d.c link.
 - b) What are the adverse effects of harmonics on the operation of a d.c link?

8. Write short notes on
 - a) Surge arrestors
 - b) Single tuned filters
 - c) High pass filters

FirstRanker

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R07**Set No.2**

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HVDC TRANSMISSION

(Electrical & Electronics Engineering)

Time: 3 hours

Max. Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. a) Discuss the relative merits of HVDC transmission systems over EHV transmission for bulk power transmission .
b) Explain in detail the recent technological developments in HVDC transmission?
2. Explain the working of a Graetz circuit with the help a neat schematic and relevant waveforms. Show that its aggregate valve rating is $2.094 P_d$, where P_d is dc power.
3. a) Draw the complete converter control characteristics and explain the process of power reversal.
b) Explain Pulse frequency control scheme for generation of firing pulses and mention its drawbacks.
4. a) Why Reactive power sources need to be employed in a converter station?
b) Discuss about the alternate control strategies which need to be adopted for reactive power control in HVDC links.
5. a) Explain the sequential method for AC-DC power flow
b) Derive the mathematical model of DC converter and DC network.
6. a) What are the sources for overvoltages in HVDC systems? How are they controlled?
b) What are the factors that result in commutation failure? Show that DC voltage becomes zero during commutation failure.
7. a) What do you understand by characteristic and non-characterisites harmonics in HVDC system?
b) Show that the lowest current harmonic generated in a 6-pulse Graetz converter is of the order 5^{th} and its magnitude is $1/5$ th of the fundamental. Mention the assumptions made.
8. Write short notes on
 - a) DC circuit breakers
 - b) Smoothing reactors
 - c) High pass filters

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R07**Set No.3**

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HVDC TRANSMISSION
(Electrical & Electronic Engineering)

Time: 3 hours

Max. Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. a) With neat sketches explain the different types of D.C. links available. Also discuss their relative merits and demerits.
 b) Compare the power carrying capabilities of a 3-phase, 3 wire AC transmission line with that of a Bi-polar D.C transmission line assuming that the insulation levels and conductor size are same in both the systems.
2. With the help of a neat diagram, explain the operation of a 12 pulse bridge rectifier. Sketch the relevant voltage and current waveforms.
3. a) Explain the necessity of "VDCOL" control in a HVDC link with the help of VI characteristics
 b) Explain the procedure of Energization and Deenergization of a converter bridge.
4. A back to back HVDC link with one bridge at each end is transmitting 100 MW with $V_d = 100$ kV. If $\alpha = 15^\circ$ and $\gamma = 18^\circ$
 - i) find ideal no-load direct voltage of rectifier (V_{dor}), ideal no-load direct voltage of inverter (V_{doi}), reactive power Q_r and Q_i . Assume R_{cr} and $R_{ci} = 12 \Omega$.
 - ii) If the DC link is controlled such that Q_i is kept at the value calculated above, find V_d , I_d , Q_r and γ for $P_d = 50$ MW.
5. a) Classify the solution methodology for AC-DC load flow and explain the same.
 b) Derive the mathematical model of d.c. converter and d.c. network of a HVDC link.
6. a) Explain the necessity of smoothing reactor in a DC line.
 b) Discuss the operation of surge arrestors for overvoltage protection of HVDC systems.

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7. a) What are the causes for non-characteristic harmonic generation in HVDC converters?
b) Show that the lowest voltage harmonic generated in a 6-pulse converter is of the order 6th . Also discuss the effect of pulse number on harmonics.

8. a) Discuss about various types of AC filters employed in HVDC systems. Also draw the their impedance characteristics.
b) Write short notes on
 - i) Size of filter
 - ii) Damped filter

FirstRanker

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Set No.4

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(Electrical & Electronic Engineering)

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**Answer any FIVE Questions
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1. a) Discuss the factors which need to be considered by a system planner to choose between HVDC and EHVAC transmission
b) What are the applications of HVDC transmission system? Also draw the different configurations for asynchronous interconnection.
2. With the help of a neat circuit diagram and waveforms explain the operation of a 3-phase, 6-pulse, Graetz's circuit when operating as an inverter. Also obtain the equivalent circuit for inverter operation.
3. a) With the help of a block diagram explain the hierarchical control structure for a DC link.
b) Explain clearly the procedure for start up of a DC link with both long-pulse and short-pulse firing.
4. a) Discuss the need for reactive power control in HVDC power stations.
b) Discuss how reactive power requirement is met using synchronous condensers and AC filters.
5. a) Explain the simultaneous method for AC-DC power flow.
b) Write short notes on DC load flow analysis.
6. a) Discuss in detail about the faults which occur in converters.
b) Explain the principle of operation of a DC circuit breaker.
7. What do you understand by characteristic harmonics in HVDC System? Using fourier analysis obtain equation for primary current of transformers connected to a 12 pulse converter.
8. a) Discuss about various types of AC filters which will be employed for a HVDC link.
b) Explain in detail the design aspects of a single tuned filter.