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Total number of printed pages – 2

B. Tech  
PEEE 5408

Seventh Semester (Special) Examination – 2013

HIGH VOLTAGE DC TRANSMISSION

BRANCH : EEE, ELECTRICAL

QUESTION CODE : D 465

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which are compulsory and any **five** from the rest.  
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10
- (a) State the advantages of HVDC transmission over EHVAC transmission for bulk power transmission.
- (b) What are the limitations of a dc line ?
- (c) Why are SCRs used as converter elements in HVDC valves ?
- (d) What are the advantages of using IGBTs over SCRs for HVDC converters ?
- (e) State the necessary conditions for a converter for operation as an inverter.
- (f) What do you mean by overlap angle ( $\mu$ ) as applied to converter operation ?
- (g) How is power reversal in dc link achieved ?
- (h) What is constant power control in a HVDC system ?
- (i) What are the adverse effects caused due to the presence of harmonics in HVDC system ?
- (j) Why are filters not needed on the dc side with HVDC voltage source converter schemes ?
2. (a) A 250 kV double circuit line rated for 250 MVA, at 0.8 power factor is converted into a dc line. There are 14 standard disk insulators on the line and are rated 10 kV (rms). Estimate i. The voltage rating of the dc line with same insulators ii. Maximum dc power transfer capability. 5

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- (b) With a neat schematic diagram, state the various apparatus required for HVDC station and explain the function of each. 5
3. Explain the 12-pulse valve arrangement in HVDC converters using thyristors. How is triggering, protection and voltage equalization during switching achieved in such converter? 10
4. (a) Derive the equations for power flow in an HVDC link. How are the losses estimated? 5  
 (b) Obtain the expressions for the output voltage and direct current of a converter working as a rectifier with a delay angle  $\alpha$  and commutation angle  $\mu$ . 5
5. (a) Explain the necessity of VDCOL control used in HVDC system. 5  
 (b) What do you understand by extinction angle control? What are its limitations under asymmetrical fault? 5
6. (a) What are noncharacteristics harmonics in HVDC system? How are they generated? 5  
 (b) What is the effect of different control modes of HVDC converters on harmonics and their relative magnitudes? 5
7. (a) Explain the working of band pass filter used in HVDC system. Give its design. 5  
 (b) What are the different aspects to be considered for parallel operation of converters? Explain. 5
8. Write short notes on any **two** of the following : 5×2  
 (a) HVDC-VSC transmission system  
 (b) Harmonics in Voltage Source Converter  
 (c) DC filters  
 (d) Control of power in MTDC system.

