

Code No: M0224/R07

**Set No. 1**

**IV B.Tech I Semester Regular Examinations, November 2012**  
**HVDC TRANSMISSION**  
**( Electrical & Electronics 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. With the help of a neat schematic circuit diagram, explain the operation of a 3- $\phi$  6, pulse, Graetz's circuit when working as rectifier. Also draw the voltage and current wave form to scale of the above circuit when the firing angle  $\alpha = 0$  and hence estimate the following:
  - (a) DC Output Voltage [3]
  - (b) Peak inverse Voltage [3]
  - (c) R.M.S value of the secondary current of converter transformer [4]
  - (d) Peak to peak ripple [3]
  - (e) Utility factor of the converter transformer. [3]
3. (a) With schematic diagram, explain the concept of constant current control of HVDC converters. [8]
- (b) Draw the block diagram and explain the working principle of Constant Extinction Angle Control. [8]
4. What is meant by reactive power control? Explain in detail how it is achieved. [16]
5. (a) Derive the mathematical model of d.c. link controllers of a d.c. link. [8]
- (b) Write the mathematical model of a d.c. converter. [8]
6. (a) Explain the principle of current interruption in d.c. circuit breakers. What are the various types of possible circuit breakers. [10]
- (b) Discuss the importance of Corona loss in DC transmission. [6]
7. Write short notes on the following: [8+8=16]
  - (a) Telephone influence factor.
  - (b) Harmonic distortion.
8. What are the main design objectives of filters in HVDC station? Discuss the design of single tuned filter. [16]

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1. (a) Discuss the disadvantages of D.C. transmission system. How these disadvantages are overcome in the modern technology? [8]  
(b) Explain the reliability of D.C. transmission system. Discuss the two measures of system reliability. [8]
2. Analyse a 3 -  $\phi$  bridge rectifier with grid control and overlap angle less than  $60^\circ$  and explain how reactive power can be controlled in a converter. Explain by giving neat sketches and wave forms. [16]
3. Discuss in detail, the desirable features of HVDC converter control. Also, sketch the characteristics of a control scheme. [16]
4. A rectifier has no load ideal DC voltage equal to 276.75KV. The dc current is 1.5KA. The actual DC voltage is 250KV. Calculate the reactive power absorbed by the rectifier. In the above problem, if the inverter in the HVDC system is at actual DC voltage of 246.25KV and the no load ideal DC voltage is 275.53KV, calculate the reactive power absorbed by the inverter. [16]
5. Derive and explain the solution of AC/DC load flow problem using simultaneous method. [16]
6. (a) Explain the fault clearing process in H.V.D.C. poles. Explain how are the H.V.D.C. equipment protected against prolonged short circuit currents though there is no H.V.D.C. circuit breaker on H.V.D.C. pole side. [10]  
(b) Explain the protection provided for DC line . [6]
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. 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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Answer any FIVE Questions  
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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. With the help of a neat schematic circuit diagram, explain the operation of a 3 -  $\phi$  6, pulse, Graetz's circuit when working as rectifier. Also draw the voltage and current wave form to scale of the above circuit when the firing angle  $\alpha = 0$  and hence estimate the following:
  - (a) DC Output Voltage [3]
  - (b) Peak inverse Voltage [3]
  - (c) R.M.S value of the secondary current of converter transformer [4]
  - (d) Peak to peak ripple [3]
  - (e) Utility factor of the converter transformer. [3]
3. Write short notes on the following [8+8=16]
  - (a) Constant Alpha control
  - (b) Inverse cosine control.
4. (a) Explain why the inverter end requires higher reactive power supply than the rectifier end? [8]  
(b) On what factors is the reactive power requirement of a converter system depend? [8]
5. Obtain the mathematical model of a d.c. network and d.c. converter, including converter controller. [16]
6. (a) Explain the fault clearing process in H.V.D.C. poles. Explain how are the H.V.D.C. equipment protected against prolonged short circuit currents though there is no H.V.D.C. circuit breaker on H.V.D.C. pole side. [10]  
(b) Explain the protection provided for DC line . [6]
7. Why are harmonics generated in HVDC converter and what are the problems associated with the harmonics. Suggest some remedial measures. [16]

Code No: M0224/R07

**Set No. 3**

8. Draw the loci of Network impedance and filter impedance and analyze the impact of network impedance or admittance on the design of single tuned filter. [16]

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Code No: M0224/R07

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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. Draw the schematic diagram of a typical HVDC converter station with 2 six pulse converter units and explain the function of each component. [16]
3. Discuss the effect of source inductance on the HVDC converter system performance. [16]
4. Discuss the constant reactive power characteristics and constant Leading power factor characteristics with regard to HVDC converter control. [16]
5. (a) Obtain the mathematical models of a d.c. link. [8]  
(b) Draw the flowchart of AC/DC load flow. [8]
6. (a) Explain the fault clearing process in H.V.D.C. poles. Explain how are the H.V.D.C. equipment protected against prolonged short circuit currents though there is no H.V.D.C. circuit breaker on H.V.D.C. pole side. [10]  
(b) Explain the protection provided for DC line . [6]
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 filter configurations that are employed for HVDC converter station? Give design aspect of one such filter. [16]

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