

Code No. M0224

**R07****Set No. 1**

IV B.Tech I Semester Supplementary Examinations, February/March, 2012

**HVDC TRANSMISSION**

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

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1. a) Draw schematic diagram of a typical HVDC converter station and explain the functions of Various components available. [8]  
b) Prove that insulation required for a bipolar D.C. system is 0.866 times that required for 3- Phase, 3 wire A.C. system. Assume that power transmitted, percentage losses and size of Conductors are same for both systems. [8]
2. With the help of a neat circuit diagram explain the operation of a 3-phase, 6-pulse, Graetz's Circuit when operating with a firing angle of  $30^0$ . Also draw the following waveforms to scale  
When working as a rectifier with  $\alpha=30^0$ .
  - i) Output d.c. voltage
  - ii) Valve current
  - iii) Secondary phase current of the converter transformer. And hence estimate the average
  - iv) d.c. voltage on the output side. [16]
3. Explain the individual characteristics of a Rectifier and an Inverter with neat sketches. [16]
4. Discuss about synchronous condensers and static VAR system for reactive power compensation in HVDC system. [16]
5. a) Explain the sequential method for AC-DC power flow. [8]  
b) Derive the mathematical model of DC converter and DC network. [8]

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6. a) Explain the necessity of smoothing reactor in a DC line. [8]  
b) Discuss the operation of surge arrestors for overvoltage protection of HVDC systems. [8]
7. What do you understand by characteristic Harmonics in HVDC system? Using Fourier analysis obtain the equation for primary current of transformers connected to a 12 pulse converter. [16]
8. a) Discuss about various types of AC filters which will be employed for a HVDC link. [8]  
b) Explain in detail the design aspects of a single tuned filter. [8]

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**Code No. M0224****R07****Set No. 2****IV B.Tech I Semester Supplementary Examinations, February/March, 2012****HVDC TRANSMISSION****(Electrical and Electronics Engineering)****Time: 3 hours****Max. Marks: 80**

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

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1. a) Draw the layout of a Bi-polar HVDC substation and briefly discuss about various Components present. [8]  
b) What are the merits & demerits of HVDC power transmission? [8]
2. Explain the principle of operation of a 6 - pulse Graetz's circuit with a neat diagram. [16]
3. Explain in detail the converter control characteristics of HVDC systems. [16]
4. Explain the different methods of compensation of reactive power in HVDC substation with neat single line schematics. [16]
5. a) Derive the mathematical model of dc converter of a dc link. [8]  
b) Draw the flow chart for AC/DC load flow. [8]
6. a) What are the sources for over voltages in HVDC system? How are they controlled?[8]  
b) What are the factors that result in communication failures? Show that DC voltage becomes zero during commutation failure. [8]
7. a) Discuss about characteristic and non- characteristic harmonics which occur in d.c. link? [10]  
b) What are the adverse effects of harmonics on the operation of a d.c. link. [6]
8. Write short notes on  
a) DC circuit breakers  
b) Smoothing reactors  
c) High pass filters [6+5+5]

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**R07****Set No. 3**

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**HVDC TRANSMISSION**

(Electrical and 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. Draw the circuit diagram, voltage and current waveforms of a 3-phase 6 pulse uncontrolled bridge rectifier and derive the expression for  
i) Average DC Voltage  
ii) Total VA rating of valves and transformer. [16]
3. a) Explain the effect of source inductance on HVDC systems. [8]  
b) Explain in detail the converter control characteristics of a HVDC Systems. [8]
4. Discuss the constant reactive power characteristics and constant leading power factor Characteristics with regard to HVDC converter control. [16]
5. a) Classify the solution methodology for AC-DC load flow with proper explanation. [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. Give reasons for selecting star-star and star-delta transformer configuration instead of two Star-star configuration for 12 pulse converter. Derive an equation for primary current. [16]
8. What are the various filter configurations that are employed for HVDC converter station? Give in detail the design aspects of one such filter. [16]

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**R07****Set No. 4**

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**HVDC TRANSMISSION**

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 80

Answer any FIVE Questions  
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1. Compare the power transfer capacities of A.C. and D.C. transmission systems when an exciting A.C. line is converted into D.C. line, with following conditions:
  - (i) Same current and insulating level.
  - (ii) Same percentage losses and insulation level. [16]
2. Prove that the average valve rating of a 3-phase, two way bridge rectifier is  $2.094 P_d$  with the help of a relevant waveforms, where  $P_d$  is the d.c. power. Mention the assumptions made. [16]
3. a) Explain in detail about individual phase control firing scheme. Also list the drawbacks of this scheme [8]  
b) Explain the hierarchical control structure of a DC link with the help of a neat block diagram [8]
4. Explain different sources of reactive power to meet the reactive power requirement of Converters. [16]
5. Derive and explain the solution of AC/DC load flow problem using simultaneous method. [16]
6. a) Explain the operation of surge arrestors for converter protection. [8]  
b) Explain the basic principles of over current protection. [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. Write short note on the following:
  - a) Voltage source converters
  - b) HVDC circuit breakers
  - c) Over voltage protection of converters. [6+5+5]