



IV B.Tech I Sem Regular End Examination, Nov/Dec 2022

HVDC Transmission

(EEE)

Time: 3 Hours.**Max. Marks: 70**

Note: 1. Question paper consists: Part-A and Part-B.

2. In Part – A, answer all questions which carries 20 marks.

3. In Part – B, answer any one question from each unit.

Each question carries 10 marks and may have a, b as sub questions.

PART- A**(10*2 Marks = 20 Marks)**

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|-------|---|----|-----|-----|
| 1. a) | Describe various types of HVDC systems | 2M | CO1 | BL2 |
| b) | Draw the schematic line diagram of a bipolar HVDC system and indicate all components of it. | 2M | CO1 | BL1 |
| c) | What is converter operation? Give the reasons for it. | 2M | CO2 | BL1 |
| d) | Explain how power control is achieved in HVDC system? | 2M | CO2 | BL2 |
| e) | Mention all the DC side variables used in AC/DC load flow studies. | 2M | CO3 | BL1 |
| f) | Mention the different methods used for AC/DC load flow studies. | 2M | CO3 | BL1 |
| g) | Explain about DC breakers. | 2M | CO4 | BL2 |
| h) | Compare the severity of Corona formation in AC and DC system. | 2M | CO4 | BL2 |
| i) | Distinguish between characteristic and non characteristic harmonics. | 2M | CO5 | BL2 |
| j) | Mention the main objectives of a filter used in HVDC link. | 2M | CO5 | BL1 |

PART- B**(10*5 Marks = 50 Marks)**

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|------|--|----|-----|-----|
| 2 a) | Give the economic feasibility analysis of HVDC transmission as compared to HVAC transmission in transmitting bulk power over long distances. | 5M | CO1 | BL1 |
| b) | Explain in detail various advantages of HVDC transmission. Also list out problems associated with it. | 5M | CO1 | BL4 |

OR

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|------|--|----|-----|-----|
| 3 a) | Explain the choice of converter configuration with neat diagrams | 5M | CO1 | BL4 |
| b) | Derive the expression for average direct voltage in case of 6-pulse HVDC converter operating with firing angle delay zero degrees and with no overlap. | 5M | CO1 | BL6 |
| 4 a) | Draw the HVDC converter control characteristics and explain the following converter control characteristics with the help of neat diagrams. | 5M | CO2 | BL4 |
| b) | Discuss briefly the sequence of HVDC control actions taken in case of increase or decrease of ac voltage on inverter side. | 5M | CO2 | BL2 |

OR

- 5 a) In HVDC system, show that the source side power factor is given by $\cos\phi = \cos\alpha$ in the case of two valve conduction mode with lossless operation. 5M C02 BL3
- b) Briefly discuss about the reactive power requirements of HVDC converters under steady state. Also explain various means employed to meet the reactive power requirements. 5M C02 BL2

- 6 Discuss briefly about the basic philosophy of DC power flow control in HVDC link. Also explain about the sequence of steps involved in starting and stopping a DC link. 10M C03 BL2

OR

- 7 Explain in detail the sequential method of AC/DC load flow. Give the relevant DC link modeling and control equations. 10M C03 BL4

- 8 a) List out and define various types of HVDC converter faults. 5M C04 BL1
- b) What is Commutation failure in HVDC converters? Briefly discuss about its cause and effects on the performance of the DC link operation. 5M C04 BL2

OR

- 9 a) Mention the various protection systems employed in HVDC system and explain overvoltage protection scheme employed in HVDC system. 5M C04 BL4
- b) Explain the objectives of DC link Reactor and give its design procedure. 5M C04 BL4

- 10 a) What are characteristic Harmonics? How they are related to converter pulse number? 5M C05 BL1
- b) Explain briefly about the adverse effects of harmonics in HVDC system. 5M C05 BL4

OR

- 11 a) What are the different types of filters used in HVDC converter station? Explain in brief about each of them. 5M C05 BL4
- b) Explain the design procedure of single tuned filter. 5M C05 BL4

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CO-Course Outcome

BL - Blooms Taxonomy Levels