



B.E DEGREE EXAMINATIONS: NOV/DEC 2022

(Regulation 2018)

Seventh Semester

DEPARTMENT OF ELECTRICAL AND ELECTRONICS

U18EEE0022 -- HVDC AND FACTS

COURSE OUTCOMES

- CO1** Understand the importance of HVDC Transmission and HVDC converters
CO2 Explain the concepts of converter circuits and analyze simple problems.
CO3 Categorize the harmonics and explain the concepts of filters.
CO4 Demonstrate the various shunt compensation techniques in FACTS.
CO5 Demonstrate the various series compensation techniques in FACTS.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

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|--|-----|-------------------|
| 1. What are the merits of HVDC transmission system? | CO1 | [K ₂] |
| 2. Name few HVDC transmission projects in India with ratings. | CO1 | [K ₂] |
| 3. Draw the graph showing Power transfer capability Vs Distance for HVDC and HVAC systems. | CO2 | [K ₂] |
| 4. Draw the equivalent circuit of HVDC System and give its DC current equation. | CO2 | [K ₂] |
| 5. What are the different types of filters used in AC side of HVDC transmission systems? | CO3 | [K ₂] |
| 6. What are the orders of harmonics present on AC side of 12 pulse HVDC converter station? | CO3 | [K ₂] |
| 7. Distinguish between series and shunt Compensators in Transmission system. | CO4 | [K ₂] |
| 8. Draw the VI characteristics of SVC. | CO4 | [K ₂] |
| 9. Give some applications of TCSC. | CO5 | [K ₂] |
| 10. What is the working principle of UPFC in HV transmission systems? | CO5 | [K ₂] |

Answer any FIVE Questions:-

PART B (5 x 16 = 80 Marks)

(Answer not more than 400 words)

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|--|------|-----|-------------------|
| 11. a) Explain how HVDC systems are better than HVAC systems related with Power loss, Stability , Charging Currents and Ferrantti Effects? | (10) | CO1 | [K ₂] |
| b) Draw the model of 12 pulse HVDC converter station configuration. | (6) | CO1 | [K ₃] |

12. a) Explain with neat sketch the working of different types of HVDC links. (10) CO2 [K2]
b) Give the merits and demerits of different types of HVDC links. (6) CO2 [K2]
13. a) An HVDC link delivers DC power with AC line voltage to the rectifier of 400 kV and that of an inverter at 393 kV. Taking $\alpha = 10^\circ$ and $\gamma = 15^\circ$ and the DC resistance of the line as 20Ω , calculate (i) The DC voltage at both the ends. (ii) the DC link current (iii) the power delivered (iv) losses in the link. (10) CO2 [K3]
b) Draw the basic rectifier and inverter characteristics of HVDC converter station. (6) CO2 [K2]
14. a) With neat sketch explain the different types of filter configurations in HVDC systems. Also draw the impedance characteristics of the filters used. (10) CO3 [K2]
b) Draw the layout of harmonic filters on AC side of HVDC system. (6) CO3 [K2]
15. a) Explain the working of STATCOM with neat sketches. (10) CO4 [K2]
b) What are the drawbacks of SVC over STATCOM? (6) CO4 [K2]
16. a) With neat sketches explain the characteristics, working, and Output waveforms of TCSC. (10) CO5 [K3]
b) Compare SSSC and TCSC. (6) CO5 [K2]
