

8E1914

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B. Tech. VIII-Sem. (Main/Back) Exam. April-2026

Electrical Engineering

8EE4-11 HVDC Transmission System

Time: 3 Hours

Maximum Marks: 70

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL

2. NIL

PART – A

[10×2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

- Q.1 Differentiate between point-to-point and back-to-back HVDC systems.
- Q.2 Why is HVDC preferred for submarine cable transmission?
- Q.3 Differentiate between two-level and ~~three~~-level VSC.
- Q.4 What is the function of Phase Locked Loop (PLL)?
- Q.5 Define the role of ground electrodes.

- Q.6 Differentiate between synchronous and asynchronous HVDC links.
- Q.7 What are the advantages of VSC-based MTDC systems?
- Q.8 Why does elimination of skin effect in DC not always guarantee lower losses?
- Q.9 If firing angle is increased beyond a limit, why does a converter start behaving like an inverter?
- Q.10 Corona exists in AC lines - why is its behavior different in DC lines?

PART – B

[5×4=20]

(Analytical/Problem solving questions)

Attempt any five questions

- Q.1 Discuss the limitations of AC transmission that led to the development of HVDC systems.
- Q.2 Explain the working of a six-pulse converter with waveform description.
- Q.3 If extinction angle reduces from 20° to 10° , explain numerically how inverter margin is affected (assume simple proportional relation).
- Q.4 Discuss the challenges involved in DC fault interruption.
- Q.5 Explain the working principle of Modular Multilevel Converter (MMC).
- Q.6 A 6-pulse converter draws AC current of 500 A. Calculate approximate DC current assuming ideal conditions.
- Q.7 Explain how VSC controls both active and reactive power independently.

PART - C

[3×10=30]

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any three questions

- Q.1 A transmission system requires black-start capability and operation in weak grids. Analyze whether LCC or VSC is more suitable and justify your choice.
- Q.2 Derive and explain the relationship between firing angle, extinction angle, and DC voltage, and discuss practical limits.
- Q.3 Discuss the role of smoothing reactors, filters and reactive power sources in improving HVDC system performance. <https://www.rtuonline.com>
- Q.4 An HVAC system losses 12% power, while HVDC losses 7% for same transmission. If power sent = 1000 MW:
- (i) Calculate received power in both cases.
 - (ii) Justify HVDC preference quantitatively.
- Q.5 An HVDC system has: DC voltage = 600 kV, Current = 2.5 kA, Line resistance = 15Ω , find: (i) power sent, (ii) line loss, (iii) receiving end power, (iv) efficiency.
- Comment on impact of increasing voltage on efficiency.
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