

--	--	--	--	--	--	--	--	--	--



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal-500043, Hyderabad

B.Tech VII SEMESTER END EXAMINATIONS (REGULAR/SUPPLEMENTARY) - DECEMBER 2022

Regulation: R18

## HVDC TRANSMISSION

Time: 3 Hours (ELECTRICAL AND ELECTRONICS ENGINEERING) Max Marks: 70

Answer FIVE Questions choosing ONE question from each module

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

### MODULE – I

- (a) Summarize about HVDC links. Explain the types of HVDC links and its purpose with neat diagrams. [BL: Understand| CO: 1|Marks: 7]

(b) A 220kV double circuit line rated for 250 MVA, at 0.8 p.f is converted into DC line. There are 14 std. disc insulator on line and are rated 10KV(RMS) or 14KV peak. Estimate:

  - The voltage rating of the DC line with same insulators.
  - Maximum DC power transfer capability. [BL: Apply| CO: 1|Marks: 7]
- (a) Discuss the comparison of AC and DC transmission in detail with reference to

  - Economics
  - Technical performance
  - Reliability [BL: Understand| CO: 1|Marks: 7]

(b) A 400KV DC transmission line to be compared with a 750kV 3-phase EHV system for equal power transmission. Estimate the insulation levels and the ratio of line losses in both the systems. [BL: Apply| CO: 1|Marks: 7]

### MODULE – II

- (a) Explain the complete analysis of six pulse Graetz converter circuit with overlap for two valve conduction. [BL: Understand| CO: 2|Marks: 7]

(b) Develop the expression for input power, output power and power factor of 12-pulse bridge converter with delay angle  $\alpha$ . Assume there is no overlap. [BL: Apply| CO: 2|Marks: 7]
- (a) List the assumptions made to develop the equivalent circuit of converter. Illustrate the individual characteristics of a rectifier and an inverter with sketch. [BL: Understand| CO: 2|Marks: 7]

(b) A 3-phase fully controlled 6- pulse converter has a source reactance of  $0.3\Omega/\text{ph}$  and operating from 400V 3-phase 50Hz supply. The converter is operating as rectifier with firing angle  $60^\circ$ . Determine the load voltage and overlap angle when the load current is 100A. Determine  $\mu$  and load voltage if  $\alpha$  is reduced to  $30^\circ$  and load changed to 30A. [BL: Apply| CO: 2|Marks: 7]

### MODULE – III

- (a) Mention the sources of reactive power. Explain the importance of reactive power control in power systems. [BL: Understand| CO: 3|Marks: 7]

- (b) Write about current controllers used in HVDC system. With a neat block diagram, explain the working of constant extinction angle control. [BL: Understand| CO: 3|Marks: 7]
6. (a) Recall the term detuning and state its importance in the design of filters for HVDC systems. [BL: Understand| CO: 4|Marks: 7]
- (b) Examine the construction and operation of VSC and discuss in detail about the input/output characteristics of VSC. [BL: Understand| CO: 4|Marks: 7]

#### MODULE – IV

7. (a) Elucidate in detail about sub synchronous oscillation damping in HVDC transmission. [BL: Understand| CO: 5|Marks: 7]
- (b) What is transient stability in HVDC system? Explain about direct method employed for determining transient stability. [BL: Understand| CO: 5|Marks: 7]
8. (a) Write about power modulation for low frequency oscillations and also explain about reactive power modulation. [BL: Understand| CO: 5|Marks: 7]
- (b) Demonstrate about voltage stability in AC/DC systems. Explain with the help of single machine system. [BL: Understand| CO: 5|Marks: 7]

#### MODULE – V

9. (a) Discuss about faults that occur in multi terminal direct current(MTDC) system and with the help of block diagram and write power control in MTDC systems. [BL: Understand| CO: 6|Marks: 7]
- (b) Infer the sequential procedure followed in paralleling of converter. Identify the difference between series and parallel MTDC systems. [BL: Understand| CO: 6|Marks: 7]
10. (a) How is current order control done in MTDC systems? With respect to 3-4 terminal MTDC, explain converter operation and control. [BL: Understand| CO: 6|Marks: 7]
- (b) Describe the need for modular multi level converters (MMC). With a neat diagram write the working of MMC for MTDC applications. [BL: Understand| CO: 6|Marks: 7]

– o o ○ o o –