Enrolment No./Seat No_____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE- SEMESTER–VI (NEW) EXAMINATION – WINTER 2024**

**Subject Code:3160921 Date:05-12-2024**

**Subject Name:HVDC Transmission Systems**

**Time:02:30 PM TO 05:00 PM Total Marks:70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

| | | | **MARKS** |
|---|---|---|---|
| **Q.1** | **(a)** | In a HVDC system, discuss the impact of delaying the firing angle of thyristors on 1) Average DC Voltage 2) Harmonic Characteristics | **03** |
| | **(b)** | With a schematic diagram, state the various apparatus required for the HVDC system. Discuss purpose of any one of them. | **04** |
| | **(c)** | Using a schematic diagram, describe the operation of a 3-phase, 6-pulse Graetz's circuit. | **07** |
| **Q.2** | **(a)** | Discuss how HVDC system can enhance the frequency stability. | **03** |
| | **(b)** | Compare performance of AC & DC system with regards to Economical & Technical Parameters. | **04** |
| | **(c)** | Describe the process involved in starting and stopping a DC link in a HVDC system. | **07** |
| | | **OR** | |
| | **(c)** | For a HVDC system discuss the firing angle control with appropriate firing scheme. | **07** |
| **Q.3** | **(a)** | Discuss in details the impact of Corona on the HVDC System. | **03** |
| | **(b)** | Compare: Synchronous & Asynchronous Link | **04** |
| | **(c)** | With appropriate diagram explain Selective Harmonic Elimination technique. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Explain mitigation steps for reducing the impact of Corona in HVDC Transmission networks. | **03** |
| | **(b)** | List out the advantages of utilizing asynchronous link for power transmission. | **04** |
| | **(c)** | Discuss in details how VSC is employed for real and reactive power control | **07** |
| **Q.4** | **(a)** | Discuss in details: Phase Locked Loop | **03** |
| | **(b)** | Describe Commutation Process. | **04** |
| | **(c)** | Explain mono-polar operation of HVDC | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Explain principles of DC Link Control in a VSC based HVDC system. | **03** |
| | **(b)** | Define the term Harmonics. Discuss characteristics harmonics generated in converter application. | **04** |
| | **(c)** | Compare the fault response mechanisms in LCC and VSC HVDC systems. | **07** |
| **Q.5** | **(a)** | Describe the impact of transient over-voltages on LCC HVDC systems. | **03** |
| | **(b)** | Explain principles of DC Link control in a LCC HVDC system. | **04** |
| | **(c)** | Discuss the working and requirements of MTDC. Enlist various types of MTDC used. | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | Explain how reactive power sources influence the stability of HVDC systems. | **03** |
| | **(b)** | Discuss in details: DC Circuit Breakers. | **04** |
| | **(c)** | Discuss: Modular multilevel converters | **07** |

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