

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURAJADA VIZIANAGARAM
IV B. Tech I Semester Advanced Supplementary Examinations March 2025

FLEXIBLE ALTERNATING CURRENT TRANSMISSION SYSTEMS

(ELECTRICAL & ELECTRONICS ENGINEERING)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from Each unit

All Questions Carry Equal Marks

UNIT-I

1. a) Describe the significance of dynamic stability in an AC power system. How do power system oscillations impact stability, and what measures are taken to maintain stability? [7M]
b) Briefly describe the working principles of different types of FACTS controllers, such as SVC, STATCOM, and UPFC. Highlight one advantage of each controller. [7M]
(OR)
2. a) Explain the concept of active and reactive power flow in an AC system. How do they influence the efficiency and stability of power transmission? [7M]
b) Compare the thermal, voltage, and stability limits in an AC system. How do these factors constrain power flow, and what techniques are used to overcome these constraints? [7M]

UNIT-II

3. a) Describe the workings of a three-phase current source converter (CSC). How does it differ from a Voltage Source Converter regarding operation and control? [7M]
b) What are the advantages of using a 12-pulse configuration in a VSC over a standard 6-pulse configuration? Discuss its impact on harmonics and system efficiency. [7M]
(OR)
4. a) Illustrate the working of a three-phase full-wave bridge converter with a circuit diagram. Discuss its application in high-power systems. [7M]
b) Explain how switching devices in CSCs handle high currents. What are the challenges in terms of losses and thermal management? [7M]

UNIT-III

5. a) Is STATCOM Superior to SVC in harmonic performance and dynamic response? Why? Provide its applications in power systems. [7M]
b) Discuss the role of SVC and STATCOM in improving voltage stability during grid disturbances. Which device performs better, and why? [7M]
(OR)
6. a) Write the key differences between SVC and STATCOM of voltage regulation, reactive power control, and response time. [7M]
b) Explain how an SVC can damp power oscillations in a transmission line. What limitations does it face compared to a STATCOM? [7M]

UNIT-IV

7. a) Explain how an SSSC provides reactive power compensation in series with the transmission line. Discuss its impact on voltage regulation and power flow control. [7M]
b) Explain the concept of series capacitive compensation in transmission lines. How does it improve power transfer capability and reduce line impedance? [7M]

(OR)

8. a) Describe the principle of operation of a Static Synchronous Series Compensator (SSSC). How does it differ from variable impedance series compensators? [7M]
b) Compare the GTO Thyristor Controlled Series Capacitor (GSC) and the Thyristor Controlled Series Capacitor (TCSC) in terms of functionality, efficiency, and applications [7M]

UNIT-V

9. Describe the working of the series and shunt converters in a UPFC. Discuss how their coordinated operation enables flexible power flow control, voltage stabilization, and oscillation damping. [14M]

(OR)

10. Draw the schematic diagram of an Interline Power Flow Controller (IPFC) and explain its operating principles. How does it balance power flows between multiple transmission lines and improve overall system performance? [14M]
