

**M. Tech.-I (Electrical -Power System) (CBCS – 2015 Course) :**

**SUMMER - 2019**

**SUBJECT: FACTS AND HVDC**

Day: Saturday  
Date: 18/05/2019

**S-2019-3390**

Time: 11.00 AM TO 02.00 PM  
Max Marks: 60

**N.B.:**

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Answer to both the sections should be written in **SAME** Answer book.
- 4) Use of non-programmable **CALCULATOR** is allowed.
- 5) Draw neat and labeled diagram **WHEREVER** necessary.
- 6) Assume suitable data if necessary.

**SECTION-I**

- Q.1** Describe following terms for power flow in AC transmission system. (10)  
i) transient stability ii) voltage stability iii) power system oscillations

**OR**

Compare VSI and CSI fed converters. Discuss control issues in power converters. (10)

- Q.2** Draw schematic diagram of FC-TCR and explain its principle of operation with mathematical expression. Sketch its V-I characteristics. (10)

**OR**

Draw schematic diagram of STATCOM and explain principle of operation. Compare SVC and STATCOM. (10)

- Q.3** Draw UPFC configuration. What are the operational constraints of UPFC? (10)

**OR**

Explain the operation of UPFC when connected at sending end. (10)

**SECTION-II**

- Q.4** The HVDC link has the following parameters  $X_{cr} = X_{ci} = 28$  ohm,  $R_{dc} = 30$  ohm. The ac line voltage to the rectifier terminals is 320 kV when delivering 500 MW at 335kV DC. The inverter operates with an extinction angle at  $21^\circ$ . Calculate. (10)

- i) The delay angle of rectifier.
- ii) The ac line current and power factor at rectifier terminals.

**OR**

Explain the causes of reactive power absorbed by HVDC converter substation. Find DC output voltage of 12 pulse converter bridge with delay angle of  $15^\circ$  and overlap angle of  $30^\circ$ . AC line voltage is 300 KV with converter transformer ratio of 0.5. (10)

- Q.5** What are the advantages/ limitations of monopolar mode with ground return and monopolar mode with metallic return? (10)

**OR**

Compare series and parallel type multi terminal HVDC system. Draw neat sketch and state applications. (10)

- Q.6** Describe HVDC station control in lead station and trail station using block diagram. (10)

**OR**

What are the objectives of HVDC system control? Draw schematic diagram of current control in two terminal HVDC system and explain its operation. (10)