

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

**WINTER - 2018**

**SUBJECT: FACTS AND HVDC**

Day: Wednesday  
Date: 05/12/2018

**W-2018-3125**

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) Answers to both the sections should be written in the **SEPARATE** answer books.
- 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 the use of Shunt reactors and series reactors for increase in power transmission capacity of transmission system with neat diagram and mathematical equation. **(10)**

**OR**

What are the benefits of FACTS technologies? **(10)**

**Q.2** A three phase ,400kV, 50 Hz, 900km line is operating with  $V_s=V_r=V=1$  pu and  $\delta=60^\circ$  .A SVC is connected at the midpoint of the line to increase the power transfer capability. The limit on the control range are  $\delta=30^\circ$  and  $\delta=90^\circ$  **(10)**

a) Find the limits of SVC susceptance if the slope of the control characteristics is i) 0.0pu ii) 0.05 pu.

b) What is the maximum power flow in the line for  $X_s=0.05$ .

Data: Base impedance  $Z_n=300$ ohms and phase constant  $\beta =0.06^\circ$  per km

**OR**

State the objectives of shunt compensation and explain mid point voltage regulation for line segmentation and end of line voltage support to prevent voltage stability **(10)**

**Q.3** Explain how UPFC can independently control real and reactive power flow with neat diagram **(10)**

**OR**

Explain control scheme of UPFC with neat diagrams **(10)**

**SECTION-II**

**Q.4** What are the technical considerations of selection of HVDC over HVAC transmission system? Describe in detail. What are the limitations of it? State the region of HVDC installation in India and its specifications. **(10)**

**OR**

Draw schematic diagram of bipolar HVDC link with all components .State functions of each component in the system **(10)**

**Q.5** What is the need of multi terminal HVDC system? Sketch different configurations and types of multiterminal HVDC. Describe its operation. **(10)**

**OR**

Explain the function of Metallic Return Transfer Breaker and its switching sequence for changeover from monopolar mode with earth return to Metallic return with neat diagram **(10)**

**Q.6** What are the different protective zones in HVDC transmission system? State stepwise procedure for fault clearing in HVDC system **(10)**

**OR**

What are the types of faults in converter unit? Describe and explain what type of protection is provided for convertor unit? **(10)**

\* \* \* \* \*