Total No. of Questions : 8] **SEAT No. :**

P3600 **[Total No. of Pages : 2**

[4959]-1075

B.E. (Electrical Engineering)

HVDC AND FACTS

(2012 Pattern) (Elective - III(b))

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right indicate full marks.***
3) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
4) ***Assume suitable data, if necessary.***

Q1) a) Explain rectifier operation in HVDC systems with ignition delay angle and commutation overlap angle. Derive equations for Δ Vd and Vd. **[10]**

b) What is HVDC Light System? What are the characteristics features of HVDC light system? Explain Control and Power transfer characteristics of VSC based HVDC system. **[10]**

OR

Q2) a) Explain inverter operation in HVDC systems with extinction angle and overlap angle. Derive necessary equations. **[10]**

b) Explain protection against over voltages in HVDC system. Explain advantages of Single wire ground return (SWGR) system and also state why negative pole is preferred in SWGR systems. **[10]**

Q3) a) With suitable diagram explain DC link converter topologies. **[8]**

b) Explain different mechanisms used for controlling harmonic generation in converter used in HVDC systems. **[8]**

OR

Q4) a) Explain AC controller based structures. **[8]**

b) i) Explain operation of back to back converters.
ii) Compare current source converter and voltage source converters. **[8]**

P.T.O.

Q5) a) Draw a practical structure of TCSC and explain principle of operation and different operating modes of TCSC. **[9]**

b) i) In TCSC, reactance of TCR branch is twice the capacitive reactance. Compute X_{TCSC}/X_C and I_{TCR}/I_L. Also specify whether TCSC operation is Capacitive or inductive with justification. **[4]**

ii) Compare STATCOM with SVC. **[5]**

OR

Q6) a) Explain principle of Operation of STATCOM. Draw relevant phasor diagrams. **[9]**

b) i) In TCSC, reactance of TCR branch is half the capacitive reactance. Compute X_{TCSC}/X_C and I_{TCR}/I_L. Also specify whether TCSC operation is capacitive or inductive with justification. **[4]**

ii) Explain Applications of SVC. **[5]**

Q7) a) With neat structure explain principle of operation of UPFC. **[8]**

b) Explain relevant phasor diagrams illustrating transmission control capabilities of UPFC. **[8]**

OR

Q8) a) Explain the overall control structure of UPFC. **[8]**

b) Explain Power flow studies in UPFC embedded systems and operational constraints. **[8]**