

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 ΔV_d and V_d . [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]

