

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**ME Semester –II Examination Dec. - 2011**

**Subject code: 1720705****Date: 14/12/2011****Subject Name: Application of Power Electronics in Power Systems****Time: 02.30 pm – 05.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Explain (a) Load Compensation and (b) System Compensation and its effect on transmission line and load side. **07**
- (b)** Compare and justify STATCOM and Synchronous Condenser and SVC. **07**

- Q.2 (a)** Explain different operating characteristic of TSC-TCR. **07**
- (b)** For a given symmetrical long transmission line, a designer wants to maintain mid-point voltage to be near to end point voltages. Derive the expression for the mid point voltage of symmetrical line as a function of power flow. **07**

**OR**

- (b)** Explain three phase TCR with the help of suitable diagram. Also discuss about different current harmonic components in detail. **07**

- Q.3 (a)** For a given 735 kV, 50 Hz, 750 km long, symmetrical transmission line with  $l = 0.935$  mH/km,  $c = 12.3$  nF/km mid- point compensated line, the operating load angle  $\delta$  can be varied from  $20^\circ$  to  $58^\circ$ . Find the MVAR capacity range for var compensator.  $V_{mc}$  is to be held at 1.05 pu. Also comment on result. **07**
- (b)** Explain series and shunt compensation and their advantages and disadvantages. **07**

**OR**

- Q.3 (a)** For a given 735 kV, 50 Hz, 1000 km long, symmetrical transmission line with  $l = 0.95$  mH/km,  $c = 13$  nF/km mid- point compensated line, find uncompensated real power ( $P_s$ ), compensated real power ( $P_{comp}$ ) with unlimited capacity compensator at midpoint with maintained mid point voltage to be 1.05 pu and injected reactive power ( $Q_v$ ). The value of load angle  $\delta$  is 30 deg. Also comment on results. **07**
- (b)** Explain with the help of suitable diagram working principle of STATCOM and its VI characteristic. **07**

- Q.4 (a)** Explain Multilevel VSC-Based STATCOM and state its salient features. **07**
- (b)** Explain the Mechanically Switched Capacitor – Thyristor controlled Reactor. **07**

**OR**

- Q.4 (a)** Explain the basic principle of TCSC. Also explain different modes of TCSC operation. **07**

(b) How is smooth variation in the line reactance obtained with the help of TCSC? Also explain its capability characteristics. 07

Q.5 (a) Explain transient stability model of TCSC. Also discuss the TCSC reactance constraints with the help of reactance capability curve for variable reactance model of a multimodule TCSC. 07

(b) Explain TCSC constant-current (CC) controller model. Also discuss steady state control characteristic of the CC control. 07

**OR**

Q.5 (a) Define and explain following in brief. 07

a) STATCOM, b) TCR, c) IPFC, d) TSSC

(b) Explain basic concepts of Thyristor Controlled Braking Resistor (TCBR). 07

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