GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2013

Subject code: 1720705   **Date: 03-06-2013**
Subject Name: Application of Power Electronics in Power System
Time: 10.30 am – 01.00 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) Discuss relative importance of controllable parameters regarding the possibilities of power flow control. **07**

Q.2 **(a)** Explain Selective Harmonic-Elimination Modulation (SHEM) technique used in BVSI. **07**

(b) Define and explain following in brief. **07**
a) UPFC   b) STATCOM   c) SVC   d) FACTS controller

OR

(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**

Q.3 **(a)** For a given 735 kV, 50 Hz, 950 km long, symmetrical transmission line with l = 0.95 mH/km, c = 12.1 nF/km mid- point compensated line, the operating load angle   can be varied from 20° to 55°. Find the MVAR capacity range for var compensator. The mid-point voltage V_{mc} is to be held at 1.08 p.u. Also comment on result. **07**

(b) Explain the basic concepts of NGH-SSR damping scheme. **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 = 12.5 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 1.03 p.u. and injected reactive power (Q_v).The value of load angle   is 30°. Also comment on results. **07**

(b) Explain TCSC constant-angle (CA) controller model in detail. Also draw the block diagram of CA controller with PI regulator. **07**

Q.4 **(a)** Write the operating principle of IPFC and also list its applications. **07**

(b) Draw the waveforms of current through TCR, voltage across thyristor and voltage across inductor for firing angle   = 90°,   = 105°,   = 150° and   = 180°. **07**

OR

Q.4 **(a)** Explain series and shunt compensation and their advantages and disadvantages. **07**

(b) Explain losses occurred in single module and multi-module TCSC in detail. **07**

Q.5 **(a)** Compare synchronous condenser and STATCOM. **07**

(b) Explain operating characteristic of FC-TCR with step down transformer. **07**

OR

Q.5 **(a)** Explain the steady-state model and characteristics of STATCOM. **07**

(b) Derive expression of net reactance of the TCSC in per units of the nominal reactance of the fixed capacitor (X_C). Also draw the variation of per-unit TCSC reactance as a function of firing angle. **07**

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