Seat No.: _____ Enrolment No._____

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. a) UPFC b) STATCOM c) SVC d) FACTS controller	**07**
		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 ŭ 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 ŭ 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 Ŭ = 90°, Ŭ = 105°, Ŭ = 150° and Ŭ = 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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