Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER • 2013

Subject code: 1720705 Date: 31-12-2013

Subject Name: Application of Power Electronics in Power Systems

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)**	Derive an expression for apparent power(S) in terms of real(P) and reactive power(Q) at sending and receiving end lossless transmission line.	**07**
	(b)	Discuss relative importance of controllable parameters regarding the possibilities of power flow control.	**07**
Q.2	**(a)**	For a given 765 kV, 50 Hz, 850 km long, symmetrical transmission line with l = 0.92 mH/km, c = 12.5 nF/km mid- point compensated line, the V_{mc} is to be held at 1.03 p.u., the realistic mid-point VAR compensator, rated to operate from -700 to +600 MVAR. Find the working operating range for mid-point voltage and operating load angle δ. Also comment on result.	**07**
	(b)	Explain operating characteristics of TCR.	**07**
		OR	
	(b)	Explain the response of TCSC including factors affecting the response time.	**07**
Q.3	**(a)**	Discuss the comparison of losses for FC-TCR, TSC-TCR and MSC-TCR.	**07**
	(b)	Discuss TCSC impedance at sub-synchronous frequencies.	**07**
		OR	
Q.3	**(a)**	Derive expression of net reactance of the TCSC in per units of the nominal reactance of the fixed capacitor (X_C).	**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)**	Explain single phase TCR. Derive the expression of the fundamental component of current and also discuss harmonics contents present in TCR current.	**07**
	(b)	Enlist merits and demerits series and shunt compensator for symmetrical lossless transmission line.	**07**
		OR	
Q.4	**(a)**	Explain the V-I and X-I capability characteristics of the multi module TCSC for continuous time application, short duration implementation and 1-10s.	**07**
Q.4	**(b)**	Explain effect of power-transfer capacity for series compensator.	**07**
Q.5	**(a)**	What is SSR? Explain the IEEE First Benchmark System with a STATCOM for SSR damping.	**07**
	(b)	Why UPFC is called so? Explain its basic working principle.	**07**
		OR	
Q.5	**(a)**	Explain multilevel VSC-based STATCOM and its associated problems.	**07**
	(b)	Explain basic working principle of IPFC. Also explain its advantages.	**07**

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