Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2014

Subject code: 1720705 Date: 20-06-2014

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)**	Series compensation of long transmission line is less popular due to limitations imposed by series capacitors. Justify the statement.	**07**
	(b)	Draw the waveforms of supply voltage, voltage across capacitor V_C, current through capacitor, voltage across switch for TSC under the two conditions: (1) initial voltage across capacitor $V_{C0} = 2V_m$, (2) $V_{C0} = V_m$. Also show the instant at which thyristors are made ON to get transient free switching. After turning on the thyristors, TSC is required to turn off after two zero crossings of V_C. Show the instant at which thyristors must be turned off. V_m is peak value of supply voltage.	**07**
Q.2	**(a)**	Derive the expression for incremental rating of the shunt capacitor compensation in long symmetrical lossless transmission line.	**07**
	(b)	Discuss capability characteristics for multi-module TCSC.	**07**
		OR	
	(b)	Determine the net reactance of the TCSC in per units of X_C.	**07**
Q.3	**(a)**	For a given 765 kV, 50 Hz, 850 km long, symmetrical lossless transmission line with l=0.935 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 1.025 pu and injected reactive power (Q_v).The value of load angle ŭ is 30°. Also comment on results.	**07**
	(b)	Derive expression of the mid-point voltage of a symmetrical lossless transmission line as a function of power flow.	**07**
		OR	
Q.3	**(a)**	For a given 1000 kV, 50 Hz, 1000 km long, symmetrical transmission line with l =0.825 mH/km, c = 13.5 nF/km mid- point compensated line the realistic mid-point VAR compensator is incorporated and rated to operate from -750 to 0 MVAR. Find the working operating range for mid-point voltage and operating load angle δ. V_{mc} is to be held at 1.02 pu. Also comment on result.	**07**
	(b)	Discuss NGH-SSR damping scheme. Also draw main components of the NGH damper prototype and its arrangement.	**07**
Q.4	**(a)**	Compare STATCOM and synchronous condenser.	**07**
	(b)	Explain the operating principle of UPFC with the help of vector diagram.	**07**
		OR	
Q.4	**(a)**	Explain the steady state model of STATCOM using conventional notations.	**07**
	(b)	Draw and explain voltage-current characteristic and current characteristics of TSC-TCR.	**07**
Q.5	**(a)**	Draw and explain IEEE First Benchmark System and its components. List methods used for analysis of SSR and explain any one in detail.	**07**
	(b)	Explain conventional control mechanism in ac power system.	**07**

OR

Q.5	**(a)**	Explain the basic principle of damping. Also explain H_∞ method based TCSC PSDC design.	**07**
	(b)	Explain Enhanced TCSC power control structure.	**07**

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