Seat No.: _____ Enrolment No._____

GUJARAT *TECHNOLOGICAL UNIVERSITY*

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

Subject code: 1720705 Date: 04-12-2014

Subject Name: Application of Power Electronics in Power System

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 conventional control mechanism in ac power system.	**07**
	(b)	Explain single phase TCR. Draw the waveforms for current through TCR, voltage across thyristor and voltage across inductor for firing angle Ŭ= 105° and Ŭ= 150°.	**07**
Q.2	**(a)**	For a given 1100 kV, 50 Hz, 850 km long, symmetrical transmission line with l = 0.85 mH/km, c = 14.5 nF/km mid- point compensated line, the mid point voltage V_{mc} is to be held at 1.05 p.u., the realistic mid-point VAR compensator, rated to operate from -1000 to +1000 MVAR. Find the working operating range for mid-point voltage and operating load angle ŭ. Also comment on result.	**07**
	(b)	Define and explain following in brief. a) SVC b) FACTS controller c) UPFC d) IPFC	**07**
		OR	
	(b)	Draw and explain STATCOM and each block of its control system.	**07**
Q.3	**(a)**	Explain the basic principle of TCSC. Also explain different modes of TCSC operation.	**07**
	(b)	Explain TCSC constant-angle (CA) controller model in detail. Also draw the block diagram of CA controller with PI regulator.	**07**
		OR	
Q.3	**(a)**	Explain the basic concepts of NGH-SSR damping scheme.	**07**
	(b)	Explain the V-I and X-I capability characteristics of the single module TCSC for continuous time application, short duration implementation and 1-10s.	**07**
Q.4	**(a)**	Discuss the 12-pulse TCR and derive the TCR in 12-pulse arrangement with which maximum numbers of harmonics are cancelled.	**07**
	(b)	Draw and explain the V-I characteristics of STATCOM.	**07**
		OR	
Q.4	**(a)**	Draw and explain the block diagram of a typical TCSC power control structure.	**07**
	(b)	Compare STATCOM and SVC as FACTS devices.	**07**
Q.5	**(a)**	Derive the expression for mid-point voltage of a symmetrical transmission line as a function of power flow.	**07**
	(b)	List different analytical methods used for SSR analysis. State advantages and disadvantages of one of them. Also draw and explain the IEEE First Benchmark System with STATCOM for SSR damping.	**07**
		OR	
Q.5	**(a)**	Write the operating principle of UPFC and also list its applications.	**07**
	(b)	Prove that the net Var rating of the series compensator is much less than that required of a shunt compensator for the same change in power transfer.	**07**

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