Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER II (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2720721 **Date: 31/05/2016**

Subject Name: Application of Power Electronics to Power System

Time:10:30 am to 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 the expression of power for a lossless transmission line. Use usual notations. Also, explain why absorption and generation of reactive power are not equal in the line unlike active power.	**07**
	(b)	Explain the effect of series compensation on power transfer capacity of transmission line. What are the key factors which need to be considered seriously for the application of series compensation?	**07**
Q.2	**(a)**	Explain the role of phase-shifting transformer in context of conventional control mechanism.	**07**
	(b)	Define and explain following in brief. a) SVC b) FACTS controller c) UPFC d) IPFC	**07**
		OR	
	(b)	Explain Multilevel VSC-Based STATCOM and state its salient features.	**07**
Q.3	**(a)**	For a given 765 kV, 50 Hz, 700 km long, symmetrical lossless transmission line with l=0.85 mH/km, c = 13.1 nF/km mid- point compensated line, find uncompensated real power (P_s), compensated real power (P_{comp}) with unlimited capacity compensator at midpoint for mid point voltage of 1.02 pu and injected reactive power (Q_v).The value of load angle δ is 30°. Also, comment on results.	**07**
	(b)	Draw and explain voltage-current characteristic of a TCR without voltage controller.	**07**
		OR	
Q.3	**(a)**	For a given 1200 kV, 50 Hz, 1000 km long, symmetrical transmission line with l=0.87 mH/km, c = 14.1 nF/km mid- point compensated line the realistic midpoint 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 1.015 pu. Also, comment on result.	**07**
	(b)	Draw and explain operating characteristic of a TCR with voltage controller.	**07**
Q.4	**(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)	Compare STATCOM and synchronous condenser.	**07**
		OR	
Q.4	**(a)**	Explain the working principle of UPFC and its various modes of operation with suitable applications.	**07**
	(b)	Explain the principle of operation of SSSC and various operating modes for power exchange.	**07**
Q.5	**(a)**	Draw the waveforms of current through TCR, voltage across thyristor and voltage across inductor for firing angle α = 90°, α = 150° and α = 180°.	**07**
	(b)	Explain the basic principle of TCSC. Also explain different modes of TCSC operation.	**07**
		OR	

Q.5	**(a)**	Explain the basic concepts of NGH-SSR damping scheme.	**07**
	(b)	Explain how collapsing of voltage is taken care in TCSC installed line. What is the significance of performance factor?	**07**

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