GUJARAT TECHNOLOGICAL UNIVERSITY ME - SEMESTER-II EXAMINATION – SUMMER 2015

Subject Code: 2720721Date: 01/06/2015Subject Name: Application of Power Electronics to Power SystemTime: 02:30 PM to 05:00 PMTotal Marks: 70

Instructions:

- 1. Attempt all questions.
- 2. Figures to the right indicate full marks.
- 3. Make suitable assumptions wherever necessary and mention it clearly in your solution.
- Q.1 (a) Describe conventional control mechanism to control power flow in ac system.
 (b) Derive an expression of power for lossless distributed line.
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- Q.2 (a) Describe the various objectives of shunt compensation.
 - (b) Draw and explain IEEE first benchmark system and its components. List methods07 used for analysis of SSR and explain any one in detail.

OR

- (b) Explain why the VAR net rating of the series compensator is much less than 07 that of required for a shunt compensator for the same change in power transfer.
- Q.3 (a) Draw the current waveform through Thyristor, voltage across it and inductor 07 for firing angle $\alpha = 90^{\circ}$ and 150° for single-phase TCR. Consider supply voltage as reference.
 - (b) For a given 1000 kV, 50 Hz, 600 km long, symmetrical transmission line with l = 0.95 mH/km and c = 12.5 nF/km mid- point compensated line, the V_{mc} is to be held at 1.02 *p.u.* using the realistic mid-point VAR compensator, rated to operate from -500 to +1000 MVAR. Find the working operating range for midpoint voltage and operating load angle δ . Also comment on result.

OR

- Q.3 (a) Draw the waveforms of voltage across capacitor V_c , current through capacitor, 07 current thorough inductor, and voltage across switch for TSC when initial voltage across capacitor $V_{c0} = 2V_m$. Also, show the instant at which Thyristors should be turned ON to get transient free switching. After turning on the Thyristors, TSC is required to turn off after two consecutive zero crossings of V_c . Show the instant at which Thyristors must be turned off. V_m is peak value of supply voltage. Assume line-current is constant and sinusoidal.
 - (b) For a given 735 kV, 50 Hz, 800 km long, symmetrical lossless transmission line with l = 0.85 mH/km and c = 14.1 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 1.025 *p.u.* and injected reactive power (Q_v). The value of load angle δ is 30°. Also, comment on results.
- Q.4 (a) Explain GTO controlled series capacitor (GCSC) and compare with TCR?
 (b) What is capacitor-voltage control? Explain its significance in STATCOM?
 07 Explain with the help of suitable waveforms.

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OR

Q.4	(a) (b)	Determine the net reactance of the TCSC in per units of X_C . Compare various FACTs controllers based on the primary role they are designed for. Also, compare them with other alternative(s) if any exists based on their cost and other factors.	07 07
Q.5	(a) (b)	Explain the basic working principle of SSSC? Explain the working principle of UPFC and its various modes of operation with suitable applications.	07 07
		OR	
Q.5	(a)	Explain capability of SSSC providing real power compensation.	07
	(b)	How does IPFC differ from SSSC? Explain its benefits and salient features	07

supported with either appropriate case study or situation.