

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**
