

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 $\alpha = 105^\circ$ and $\alpha = 150^\circ$. **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 ϕ . Also comment on result. **07**
(b) Define and explain following in brief. **07**
a) SVC b) FACTS controller c) UPFC d) IPFC

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**
