

**GUJARAT TECHNOLOGICAL UNIVERSITY****ME SEMESTER II EXAMINATION – SUMMER 2017****Subject Code: 2720721****Date: 30/05/2017****Subject Name: Application of Power Electronics to Power System****Time: 02:30 PM to 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) Series compensation of long transmission line is less popular due to limitations imposed by series capacitors. Justify the statement. **07**
- (b) Explain GTO Controlled Series Capacitor (GCSC) in detail. **07**
- Q.2** (a) Draw the waveforms of current through TCR, voltage across TCR and voltage across inductor for firing angle  $\alpha = 90^\circ$ ,  $\alpha = 105^\circ$ . Consider single phase TCR. **07**
- (b) Derive the expression for incremental rating of the shunt capacitor compensation in long symmetrical lossless transmission line. **07**
- OR**
- (b) Explain the Mechanically Switched Capacitor – Thyristor Controlled Reactor. **07**
- Q.3** (a) Define and explain following: **07**
- i. Lossless symmetrical line
  - ii. Electrical length of line
  - iii. SSR
  - iv. Degree of compensation
- (b) Explain conventional control mechanism in ac power system. **07**
- OR**
- Q.3** (a) Derive expression of the mid-point voltage of a symmetrical lossless transmission line as a function of power flow. **07**
- (b) For a given 865 kV, 50 Hz, 900 km long, symmetrical transmission line with  $l = 0.92$  mH/km,  $c = 12.5$  nF/km mid- point compensated line the realistic midpoint Var compensator is incorporated and rated to operate from -750 to +250 MVar. Find the working operating range for mid-point voltage and operating load angle  $\delta$ .  $V_{mc}$  is to be held at 1.025 pu. Comment on result also. **07**
- Q.4** (a) Compare STATCOM and SVC as FACTS devices. **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**
- OR**
- Q.4** (a) Enlist 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**
- (b) Explain TCSC constant-current (CC) controller model. Also, discuss steady state control characteristic of the CC control. **07**
- Q.5** (a) Write the concepts of various power-flow control functions of UPFC using phasor diagrams. Enlist applications of it. **07**
- (b) Compare various SVCs such as FC-TCR, TSC-TCR and MSC-TCR. **07**
- OR**
- Q.5** (a) Draw and explain schematic of UPFC using back-to-back VSCs. Also, enlist variable constraints with UPFC. **07**
- (b) Explain the basic working principle of SSSC? Also, discuss transmitted power versus Transmission angle characteristic of SSSC. **07**

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