Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E –II[st] SEMESTER–EXAMINATION – JULY- 2012

Subject code: 1720705 Date: 10/07/2012

Subject Name: Application of Power Electronics in Power Systems

Time: 10:30 am – 13:00 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 mid-point voltage of a symmetrical lossless transmission line as a function of power flow on it. **07**

(b) Explain the FC-TCR configuration. Explain operating characteristic without step down transformer and losses in FC-TCR. **07**

Q.2 **(a)** Explain Thyristor Controlled Transformer. **07**

(b) Explain the basic working principle of UPFC. **07**

OR

(b) Explain (a) Load Compensation and (b) System Compensation and its effect on transmission line and load side. **07**

Q.3 **(a)** For a given 1000 kV, 50 Hz, 1000 km long, symmetrical transmission line with l = 0.85 mH/km, c = 13.5 nF/km mid- point compensated line, the operating load angle δ can be varied from 20° to 58°. Find the MVAR capacity range for unlimited var compensator. V_{mc} is to be held at 1.02 pu. Also comment on result. **07**

(b) Explain with the help of suitable diagram working principle of STATCOM and it VI characteristic. **07**

OR

Q.3 **(a)** For a given 765 kV, 50 Hz, 750 km long, symmetrical transmission line with l =0.9 mH/km, c = 12.1 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 to be 1.03 pu and injected reactive power (Q_v).The value of load angle δ is 35°. Also comment on results. **07**

(b) Define SSR. What is the significance of SSR mitigation. **07**

Q.4 **(a)** Explain effect of power-transfer capacity for series compensator. **07**

(b) Define and explain following in brief. **07**
a). TCR b). TSC, c). TSSR, d). FACTs

OR

Q.4 **(a)** Show that for the operating load angle δ=35°, the var net rating of the series compensator is around 10% of that required of a shunt compensator for the same change in power transfer. **07**

(b) Explain different practical switching strategies with the help of capacitor current, capacitor voltage and supply voltage waveforms for TSC. **07**

Q.5 **(a)** Explain Harmonic performance of TCSC. **07**

(b) Draw and explain the block diagram of a typical TCSC power control structure. **07**

Q.5 **(a)** Derive expression of net reactance of the TCSC in per units of the nominal reactance of the fixed capacitor (X_C). **07**

(b) Discuss TCSC impedance at sub-synchronous frequencies. **07**

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