Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**M. E. - SEMESTER – III • EXAMINATION – WINTER 2012**

**Subject code: 734501** **Date: 30/12/2012**

**Subject Name: Application of Power Electronics to Power System**

**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.**

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|---|---|---|---|
| **Q.1** | **(a)** | List the FACTS devices. Give a classification of series, shunt and Hybrid FACTS devices. Mention the advantages of FACTS devices over conventional compensating methods. | **07** |
| | **(b)** | Explain significance of reactive power control. Also Compare Series and Shunt Capacitor compensators. | **07** |
| **Q.2** | **(a)** | With suitable diagram describe the Thyristor Controlled Reactor (TCR) also discuss its applications in the power system | **07** |
| | **(b)** | Explain the operating characteristic of TCR with voltage control and how under voltage problem can be resolved using FC - TCR. **OR** | **07** |
| | **(b)** | Explain V – I characteristic of TSC – TCR with and without voltage control | **07** |
| **Q.3** | **(a)** | Compare P-δ curve as a parametric function of Series compensation provided by SSSC and Series capacitor | **07** |
| | **(b)** | Briefly describe the working of a Thyristor Controlled Transformer (TCT) | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Discuss Capability of SSSC to provide Real Power Compensation | **07** |
| | **(b)** | Explain the construction and working of a UPFC | **07** |
| **Q.4** | **(a)** | Explain the "direct" output voltage control scheme based on internal voltage (magnitude and angle) control at a sustained dc capacitor voltage for implementation of STATCOM. Draw relevant schematic block diagram and waveforms. | **07** |
| | **(b)** | Show that for the operating load angle δ =35°, the var rating of series compensator is around 10% of that required of a shunt compensator for the same change in power transfer. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Explain the application of STATCOM for damping of power oscillations in a power system. Discuss the control strategy used. | **07** |
| | **(b)** | Using relevant phasor diagram and equations, explain how a shunt connected switching converter type var generator can be used as a bidirectional active-reactive power compensator based on the principle of operation of STATCOM. | **07** |
| **Q.5** | **(a)** | Explain the principle of operation of basic Thyristor-Controlled Series Capacitor (TCSC) scheme. | **07** |
| | **(b)** | State and explain any one application of TCSC in power system. | **07** |
| | | **OR** | |
| **Q.5** | **(a)** | Draw and explain reactance ($X_{TCSC}$) vs thyristor firing delay angle ($\alpha$) characteristics of TCSC. | **07** |
| | **(b)** | Draw and explain compensating voltage vs line current characteristics of TCSC in voltage control mode and reactance control mode. | **07** |

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