

**IV B.Tech II Semester Regular Examinations, April/May - 2017 FACTS: FLEXIBLE  
ALTERNATING CURRENT TRANSMISSION SYSTEMS (Electrical and Electronics  
Engineering)**

Time: 3 hours

Max. Marks: 70

*Question paper consists of Part-A and Part-B*

*Answer ALL sub questions from Part-A*

*Answer any THREE questions from Part-B*

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**PART-A (22 Marks)**

1. a) Distinguish between transient stability and steady state stability in power flow systems. [4]
- b) Mention the importance of self commutating converters? [3]
- c) Write the three important objectives of shunt compensation. [3]
- d) What is meant by switched transients in thyristor switched capacitor? [4]
- e) What are the characteristics differences between TSSC and TCSC? [4]
- f) Mention the practical applications of IPFC. [4]

**PART-B (3x16 = 48 Marks)**

2. a) Discuss the various categories of FACTS controllers in brief. [8]
- b) Describe the parameter trade-off of high power devices. [8]
3. a) Explain the three phase full-wave bridge converter with necessary waveforms. [8]
- b) Enumerate the relative merits and demerits of current source converters over voltage source converters. [8]
4. a) Explain the concept of end of line voltage support to prevent voltage stability in shunt compensation. [8]
- b) Describe any of the variable impedance type static VAR generators. [8]
5. a) Discuss the implementation of the VAR reserve control. [8]
- b) Enumerate the operating features of STATCOM. [8]
6. a) Explain the power oscillation and sub synchronous oscillation damping in series capacitive compensation. [8]
- b) Describe the configuration and characteristics of basic thyristor-switched series capacitor. [8]
7. a) Explain the implementation of the UPFC by back-to-back voltage sourced converters. [8]
- b) Discuss the variation of real and reactive powers in IPFC schemes. [8]



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**PART-A (22 Marks)**

1. a) Mention the voltage and current ratings of high power devices. [4]
- b) What are the effects of harmonics in a three phase bridge converter. [4]
- c) What is meant by power oscillations damping? [3]
- d) Draw the V-I characteristics of thyristor switched capacitor and explain. [4]
- e) Write any three functional requirements of series compensation. [3]
- f) What is a stand-alone series and shunt compensation? [4]

**PART-B (3x16 = 48 Marks)**

2. a) Explain various loading capability limits in power flow systems. [8]
- b) Describe relative importance of different types of controllers. [8]
3. a) Enumerate single phase full-wave bridge converter operation. [8]
- b) Discuss three-phase current source converter operation in brief. [8]
4. a) Explain midpoint voltage regulation for line segmentation using shunt compensation. [8]
- b) Emphasize features of thyristor controlled reactor. [8]
5. a) Obtain transfer function of static VAR compensator and mention its compensation effect on stability. [8]
- b) Explain necessary modifications in static VAR generation characteristics due to regulation slope. [8]
6. a) Draw and explain the impedance versus delay angle characteristics of TCSC. [8]
- b) Discuss improvement of transient stability using series compensation on transmission systems. [8]
7. a) Describe dependence of real and reactive power flow control in UPFC. [8]
- b) Write a comparison between IPFC and UPFC. [8]

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**R13**

**Set No. 3**

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*Answer ALL sub questions from Part-A*

*Answer any THREE questions from Part-B*

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**PART-A (22 Marks)**

1. a) Write the importance of controllable parameters in AC power flow systems. [4]
- b) Mention the various types of current source converters. [4]
- c) What is meant by controllable VAR generation? [3]
- d) Why static compensator not used as perfect voltage regulator? [3]
- e) Write the objectives of series compensation. [4]
- f) List out the technical benefits of UPFC. [4]

**PART-B (3x16 = 48 Marks)**

2. a) Explain the dynamic stability considerations of an interconnected transmission system. [8]
- b) Discuss the losses and speed of switching of high power devices. [8]
3. a) Describe the voltage-sourced converter concept with necessary schematics. [8]
- b) Explain the square wave voltage harmonics for a single phase bridge converter. [8]
4. a) Discuss the improvement of voltage stability using shunt compensation. [8]
- b) Write a comparison between thyristor controlled reactor and thyristor switched reactor. [8]
5. a) Write a comparison between STATCOM and SVC in the following (i) V-I characteristics (ii) transient stability. [8]
- b) What is meant by power oscillation damping? Explain its functional control implementation. [8]
6. a) Explain the operation of basic GTO-controlled series capacitor. [8]
- b) Discuss the configuration and operation of TCSC. [8]
7. a) Describe the basic operating principles and concepts of UPFC. [8]
- b) Explain the control structure of IPFC. [8]



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**Set No. 4**

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**PART-A (22 Marks)**

1. a) What are the requirements of high speed power devices? [4]
- b) What is the principle of voltage source converter? [4]
- c) List out the requirements of shunt compensation. [3]
- d) Mention the various control approaches in static VAR generation. [4]
- e) Write the basic principle difference between series and shunt compensation. [4]
- f) Explain the any three applications of UPFC. [3]

**PART-B (3x16 = 48 Marks)**

2. a) Discuss the technical benefits of FACTS technology. [8]
- b) Explain the power flow considerations of a transmission interconnected systems. [8]
3. a) Describe the operation of three-phase full-wave bridge converter. [8]
- b) Distinguish between voltage source and current source converters. [8]
4. a) Describe the basic thyristor switched capacitor and its operation. [8]
- b) Explain the power oscillation damping in shunt compensation. [8]
5. a) Discuss the operation of STATCOM with a neat diagram and characteristics. [8]
- b) Write a short note on transient stability enhancement using STATCOM and SVC. [8]
6. a) Enumerate the basic operating control schemes of TSSC and TCSC. [8]
- b) Discuss the effect of series capacitive compensation in transmission lines. [8]
7. a) Describe the various transmission control capabilities of UPFC. [8]
- b) Explain the basic two-converter Interline Power Flow Controller scheme. [8]

