Code No: **RT42023C**   **R13**   **Set No. 1**

IV B.Tech II Semester Regular/Supplementary Examinations, April/May - 2019
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) Why electrical transmission systems are interconnected? Explain. [4]
   b) What are voltage sourced converters? Why voltage sourced converters are preferred for FACTS application. [4]
   c) What is reactive power? What is its significance? Discuss the sources of reactive power. [4]
   d) What are the advantages of thyristor switched capacitors compared to fixed capacitors? [4]
   e) What are the objectives of series compensation? [3]
   f) What is meant by unified controller? [3]

PART–B *(3x16 = 48 Marks)*

2. a) A power of 1600 MW is flowing through two parallel paths having line impedances of 10Ω and 6Ω respectively. The full load capacity of each of the low impedance line is 900 MW. (i) Find the power flow through each of the line, and (ii) How much reactance is to be added in the low impedance line to remove the overloading on the line? [8]
   b) What are the benefits of FACTS controllers? List different types of FACTS controllers? [8]

3. a) With a neat circuit diagram and necessary waveforms, discuss the working of a single-phase bridge converter. [10]
   b) What are harmonics? What are their sources? How to measure the harmonics? [6]

4. a) What are the objectives of reactive shunt compensation? [4]
   b) Explain how midpoint voltage regulation of a transmission line increases the power transfer capacity of the lines. Also explain how it provides power oscillation damping. [12]

5. a) What is a STATCOM? Discuss its construction and working. [8]
   b) Compare between fixed capacitor thyristor controlled reactor (FC-TCR) with thyristor switched capacitor thyristor controlled reactor (TSC-TCR). [8]

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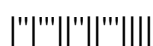
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6.   Explain the working of thyristor controlled series capacitor (TCSC). Draw and discuss their V-I operating characteristics in voltage control mode and reactance control mode. Also discuss the applications of TCSC.   [16]

7. a)   What are the advantages of combined shunt and series controller than the individual controllers?   [6]
   b)   With a neat diagram, explain the operation and applications of UPFC.   [10]

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Code No: **RT42023C**   **R13**   **Set No. 2**

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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
*****

PART–A *(22 Marks)*

1. a) Why GTOs are preferred over SCRs and IGBTs for FACTS application? Discuss. [4]
   b) What are the sources of harmonics in the power systems? What are the effects of harmonics? [4]
   c) Define reactive power. How the synchronous machines were used for reactive power compensation? [4]
   d) What is the use of thyristor switched capacitor? What are the precautions to be taken while operating thyristor switched capacitor? [4]
   e) Why series compensation is more effective than shunt compensation? [3]
   f) What is the use of interline power flow controller? [3]

PART–B *(3x16 = 48 Marks)*

2. a) What are FACTS controllers? How power flow can be controlled in transmission lines using FACTS? List different types of FACTS controllers. [8]
   b) Consider that a two line parallel transmission is transmitting power from surplus generation area to the deficit area. If the line reactances are 8Ω and 12Ω respectively, how much is the power flowing through each of the lines if the total power transmitted is 1000MW. If each line rated only for 500MW, how much reactance is to be added to the overloaded line to avoid the overloading. [8]

3. a) Differentiate between voltage sourced and current sourced converters. Also mention the applications of voltage sourced converters. [8]
   b) With a neat circuit diagram, explain the operation of a three-phase current sourced converter. [8]

4. a) Discuss how end of line voltage support improves voltage stability in radial lines. [8]
   b) What are the methods of controllable VAR generation? With a neat schematic and waveforms, discuss the working of thyristor switched reactor. [8]

5. Discuss in detail the working of a Thyristor Switched Capacitor – Thyristor Switched Reactor (TSC–TCR). Also draw and discuss their V-I operating characteristics. [16]

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6. a) Explain how series compensation improves power transfer capacity of transmission line. [8]
    b) Discuss the working of Thyristor Switched Series Capacitor (TSSC). [8]

7.   What is unified power flow controller (UPFC)? Explain its principle, operation and applications. [16]

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Code No: **RT42023C**   **R13**   **Set No. 3**

IV B.Tech II Semester Regular/Supplementary Examinations, April/May - 2019
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) What limits the loading capacity of a transmission line? Explain briefly.   [4]
    b) Why GTOs are used in voltage sourced converters rather than SCRs? Discuss.   [4]
    c) Draw and explain the power-angle characteristics of a transmission line with
        ideal midpoint compensation.   [4]
    d) What are static VAR compensators? What are their advantages?   [4]
    e) List different series compensators.   [3]
    f) What are the parameters of the transmission line can be controlled by UPFC? [3]

PART–B *(3x16 = 48 Marks)*

2. Consider a mesh network in which generators at two different sites (A and B)
    are sending power to a load center (C) through a network consisting of three
    lines. The lines AB, BC and AC have continuous ratings of 1000 MW, 1250
    MW and 2000 MW respectively. One of the generators (at A) is generating
    2000 MW and the other is generating 1000 MW, a total of 3000 MW is
    delivered to load center. If the impedances of the line AB, BC and AC are 10, 5,
    and 10 respectively, (a) Find the power flowing through each of the line. (b) If a
    capacitor whose reactance is -5 ohms at the synchronous frequency is inserted
    in line AC, find the power flowing through each of the line. (c) If an inductor
    whose reactance is 7 ohm is inserted in series with line AB, find the power
    flowing through each of the line.   [16]

3. a) What are harmonics? Define total harmonic distortion.   [4]
    b) With a neat circuit diagram and necessary waveforms, discuss the working of a
        three-phase full-wave bridge converter. Comment on the harmonics produced
        by this converter.   [12]

4. a) What is the need for reactive power compensation in transmission systems?   [4]
    b) With a neat circuit diagram and necessary waveforms, discuss the operation of a
        Thyristor Controlled Reactor (TCR). Also represent their V-I operating area. [12]

5. With a neat diagram, explain the functional control scheme for Thyristor
    Switched Capacitor – Thyristor Switched Reactor (TSC–TCR). Also draw the
    loss versus output characteristics of TSC-TCR and discuss its advantages
    compared to FC-TCR.   [16]

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6. a) Discuss how series capacitive compensation improves the transient stability of a
line. [8]
   b) Discuss the working of a GTO thyristor controlled Series Capacitor (GSC). [8]

7. a) Differentiate between unified control and coordinated control schemes. [4]
   b) What is interline power flow controller? With a schematic diagram, explain its
working. Also list its applications. [12]

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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
*****

PART–A *(22 Marks)*

1. a) What is GTO? Draw its structure and explain its working.   [4]
    b) Discuss the principle of operation of a current sourced converter.   [4]
    c) Differentiate between thyristor switched reactor (TSR) and thyristor controlled reactor (TCR).   [4]
    d) Compare between SVC and STATCOM.   [4]
    e) Why some range of the firing angle delay is inhibited in the operation of TCSC? [3]
    f) What happens if a voltage perpendicular to the line current is injected at sending end of the line?   [3]

PART–B *(3x16 = 48 Marks)*

2. a) By considering a simple two machine transmission system, explain power flow through ac lines. Also derive the expression for active and reactive powers at both sending- and receiving ends.   [8]
    b) List and discuss different types of FACTS controllers. Give examples for each type and mention their applications.   [8]

3. a) Draw the shape of output voltage generated by a single-phase bridge converter and derive the expressions for rms values of fundamental and harmonic components.   [8]
    b) Explain the principle of a voltage sourced converter. Why voltage sourced converters are preferred than current sourced converters for FACTS application?   [8]

4. a) Explain the principle of midpoint voltage regulation of a transmission line. [8]
    b) Explain how midpoint voltage regulation for a transmission line increases the transient stability margin.   [8]

5. a) What is a STATCOM? Discuss its advantages and applications.   [8]
    b) What is the advantage of regulation slope control? Draw and explain the control scheme for STATCOM with regulation slope control.   [8]

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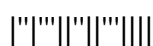
Code No: **RT42023C**   **R13**   **Set No. 4**

6. a) Explain the principle of operation of series capacitive compensation.   [8]
    b) Explain how it improves voltage stability and provides power oscillation
       damping.   [8]

7. a) Discuss the roles of shunt and series converters in unified power flow
       controller.   [6]
    b) With the help of phasor diagrams, explain how UPFC provides voltage
       regulation, line impedance compensation and phase shifting.   [10]

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