Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 70454

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Seventh Semester

Electrical and Electronics Engineering

EE 6004 – FLEXIBLE AC TRANSMISSION SYSTEMS

(Regulations 2013)

(Common to : PTEE 6004 – Flexible AC Transmission systems for B.E. (Part-Time) - Seventh Semester (Regulations-2014)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What are the objectives of FACTS controllers?

2. Why shunt compensation is always attempted at midpoint of transmission line?

3. What are the advantages of the slope in the SVC dynamic characteristic?

4. How many midpoint SVC's are required to enhance the maximum power transfer capability of the transmission line to thrice that of the uncompensated line?

5. List the different modes of TCSC operation.

6. Draw the VI capability characteristics for single-module TCSC.

7. Compare SSSC and TCSC.

8. Draw the schematic diagram of STATCOM.

9. What is the need for coordination of FACTs controllers?

10. What is the main problem with multiple SVCs in a power system network?

PART B — ($5 \times 13 = 65$ marks)

11. (a) Draw the single line diagrams of TCSC, STATCOM, SSSC and UPFC. (13)

Or

(b) What is meant by active and passive compensation? Discuss the effect of various types of passive compensation on power transmission capacity with necessary diagrams and expressions. (13)

12. (a) Describe the working principle of the two types of Static Var Compensators (SVC) with neat schematic diagrams. (13)

Or

(b) A 400 kV, 50 Hz, 600 km long symmetrical line is operated at the rated voltage.

(i) What is the theoretical maximum power carried by the line? What is the midpoint voltage corresponding to this condition? (4)

(ii) A series capacitor is connected at the midpoint of the line to double the power transmitted. What is its reactance? (4)

(iii) A shunt capacitor of value 450 ohms is connected at the midpoint of the line. If the midpoint voltage is 0.97, compute the power flow in the line corresponding to this operating point. Data : L = 1 mH/km, $c = 11.1 \times 10^{-9}$ F/km (5)

13. (a) Explain the basic principle and different operating modes of TCSC.

Or

(b) Discuss the application of TCSC for enhancement of power system damping.

14. (a) Explain the operating characteristics and VI characteristics of STATCOM. (13)

Or

(b) Explain the modeling procedure of SSSC in load flow and transient stability studies. (13)

15. (a) Explain SVS-SVC controller interactions. Illustrate the coordinated design SVC of controllers. (13)

Or

(b) Explain in detail genetic algorithm based tuning of controller gain parameters of SVCs. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Consider a transmission line in which STATCOM is connected at the midpoint. Assume that both end voltages are regulated at 1 pu. The line reactance is 0.8 pu. Calculate the current that must be injected by STATCOM to maintain midpoint voltage at 1.01 pu when load at the receiving end is varied from 0 to 0.9pu.

Or

(b) The synchronous machine shown in Fig.16(b) is delivering 0.8 puMW and 0.25 puMVAR at the infinite bus. The voltage of the infinite bus is 1+j0 pu. The generator is connected to the infinite bus through a line of reactance 0.65 pu. The machine transient reactance is 0.32 pu. A TCSC is connected in the transmission line to enhance the steady state power transfer. Calculate value of net reactance offered by TCSC and voltage that has to be injected by TCSC to enhance power transfer by 1 pu.

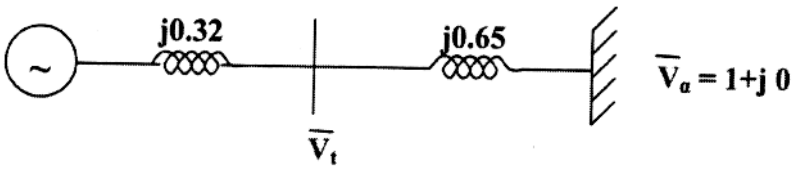

Fig. 16b