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

Question Paper Code : 91469

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Seventh Semester

Electrical and Electronics Engineering

EE6004 – FLEXIBLE AC TRANSMISSION SYSTEMS

(Regulations 2013)

Common to PTEE 6004 – Flexible AC Transmission Systems for B.E. (Part-Time) Seventh Semester -Electrical and Electronics Engineering (Regulations – 2014)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. State why compensation is required for transmission lines.
2. Depict the variation of midpoint voltage for
   i) Loading equal to surge impedance loading
   ii) Loading less than surge impedance loading
   iii) Loading greater than surge impedance loading
3. Compare Fixed Capacitor and SVC.
4. What are the applications of TCSC ?
5. What is the advantages of multi module TCSC when compared to single module TCSC ?
6. Differentiate how the compensation offered by TCSC and SSSC varies with line current.
7. Draw the schematic diagram of STATCOM connected to midpoint of transmission line.
8. Draw the P-δ curve of SSSC.
9. What is meant by controller interaction ?
10. What could be the control objective for tuning the FACTS devices ? Name any one.

PART – B (5×13=65 Marks)

11. a) i) Derive the expressions for real and reactive power flow through an uncompensated short transmission line. (7)

ii) Derive an expression for midpoint voltage for an uncompensated transmission line. (6)

(OR)

b) Consider a 735kV symmetrical lossless transmission line with l = 0.932 mH/km, c = 12.2 nF/km and a line length of 800 km. Frequency is 50 Hz. If a SVC is installed at the midpoint to regulate the midpoint voltage at 1.05 p.u. with a rating of – 600 MVAR to + 400 MVAR. Calculate the loading limits for which the SVC would regulate the bus voltage.

12. a) Deduce the practical switching strategies of Thyristor Switched Capacitor (TSC).

(OR)

b) Prove the capability SVC to enhance the synchronizing torque of the power system.

13. a) i) Explain in detail the basic principle of operation of TCSC. (7)

ii) Explain the different modes of TCSC operation. (6)

(OR)

b) Consider the SMIB system in which the synchronous machine is generating 0.95 p.u. MW 0.35 MVAR. The terminal voltage is 1 at angle of 29°. The machine transient reactance is 0.25 p.u. and the transmission line reactance is 0.6 p.u. Calculate the value of net reactance offered by the TCSC and the voltage that has to be injected by the TCSC to enhance the damping ratio to 0.15 p.u.

14. a) Discuss the principle of operation of UPFC with schematic with schematic diagram and VI plot. Deduce the P and Q expressions as a function of UPFC parameters.

(OR)

b) Deduce the operable region of SMIB system with UPFC compensation in PQ-plane, considering the transmission line reactance as 0.6 p.u. for

$\delta = 30°$, $\rho = 20°$, $V_{pq} = 0.5$

$\delta = 30°$, $\rho = 40°$, $V_{pq} = 0.5$

15. a) Explain any linear control technique for coordinating power system controllers and FACTS controllers.

(OR)

b) Explain about the controller interaction between multiple SVCs that are located in a power system.

PART – C **(1×15=15 Marks)**

16. a) Consider a SMIB system in which the synchronous machine is generating 0.95 MW and 0.35 MVAR at a terminal voltage of 1 p.u. at angle of 36. The machine transient reactance is 0.25 p.u. and the transmission line reactance is 0.6 p.u. If the damping ratio has to be 0.12 calculate how the voltage injected by SSSC has to be modulated.

(OR)

b) Consider a transmission line a STATCOM is connected at midpoint of the line. Assume that both end voltages are regulated at 1 p.u. the transmission line reactance is 0.8 p.u. Calculate the current that must be injected by STATCOM to maintain the midpoint voltage at 1.01 p.u. When the load at receiving end is varied from 0 to 0.9 p.u.
