Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH (EE)/SEP. SUPPLE/SEM-8/EE-801B/2012

2012
POWER SYSTEM DYNAMICS & CONTROL

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the following : $10 \times 1 = 10$

   i) Which of the following compensators directly improves system load ability ?

      a) S.V.C

      b) Shunt Capacitor

      c) Series Capacitor

      d) Synchronous Condenser.

   ii) Magnitude of power angle at voltage stability limit depends on

      a) power factor angle b) receiving end voltage

      c) sending end voltage d) none of these.

iii) Voltage stability limit is obtained when

a) the Jacobian of load flow equation is singular

b) the Jacobian of load flow equation is non-singular

c) the Jacobian of load flow equation does not signify anything

d) none of these.

iv) At natural loading of the power system transmission line the receiving end power factor is

a) leading b) lagging

c) unity d) either (b) or (c).

v) Synchronous motor can operate at

a) lagging power factor only

b) leading power factor only

c) unity power factor only

d) lagging, leading and unity power factor.

vi) Shunt capacitor is used to

a) improve voltage b) improve p.f

c) both of these d) none of these.

vii) The effect of series capacitance compensation is

a) to decrease the virtual surge impedance

b) to decrease the effective length of the line

c) to increase the virtual surge impedance loading

d) all of these.

viii) SSR phenomenon is

a) purely electrical b) purely mechanical

c) purely hydraulic d) both (a) and (b).

ix) Rapid changes is system voltage cause

a) flicker b) voltage dips

c) corona d) loss of synchronism.

x) Which of the following devices is used both under heavy load conditions and also under light load conditions ?

a) S.V.C

b) Shunt Capacitor

c) Series Capacitor

d) Synchronous Condenser.

xi) The deficit in reactive power can be encountered by

a) local reactive power support

b) generator terminal voltage increase

c) series capacitor installation

d) any of these methods.

(xii) The transmission losses in a line are

a) directly proportional to the voltage V

b) inversely proportional to the voltage V

c) directly proportional to V^2

d) inversely proportional to V^2.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What do you mean by FACTS Controller ? Mention the advantages of FACTS devices. 2 + 3

3. What do you mean by Series Compensation ? What are the advantages and disadvantages of Series Compensation ? 2 + 3

4. Define Voltage Stability. How does it differ from Rotor Angle Stability ? 2 + 3

5. Why do small oscillations appear in Power System Network ? What are the factors that govern the generation of small oscillations ? 2 + 3

6. A short line having an impedance of (1.5+j2.5) ohms interconnects two plants A & B, each plant operating at 11kV and the two voltages being equal in magnitude and phase. It is proposed to transfer 20 MW power at 0.8 power factor from plant A to B. Find the voltage boost needed at plant A to achieve this power transfer. 5

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Which factors causing Power System disturbances may lead to voltage collapse ?

   Find the capacity of static VAR compensator to be installed at a bus with +/- 6% voltage fluctuation. The short circuit capacity is 2500 MVA. 2 + 3

   b) How do you define "voltage stability limit"? Derive an expression for critical receiving end voltage for a two bus system. Also derive an expression of critical reactance and critical power angle at voltage stability limit. 2 + 4 + 4

8. a) Explain small signal stability of a single machine on infinite bus. 6

   b) What do you mean by SSR in power system operation ? What are the causes behind this phenomenon ? Suggest remedial measures to overcome the problem. 3 + 3 + 3

9. a) Deduce relation between voltage regulation, active power and reactive power in a two bus transmission system connected through a line. Hence show how the receiving end voltage is sensitive to the change in flow of reactive power at the receiving end load bus, assuming the line to be lossless. 3 + 3

b) Find out the expression for reactive power requirement for a long uncompensated transmission line. 4

c) The load at the receiving end of a three phase overhead line is 25 MW, power factor 0.8 lagging at a line voltage of 33 kV. A synchronous compensator is situated at a receiving end and voltage at both ends of the line is maintained at 33 kV. Calculate the MVAR of the compensator. The line has resistance of 5 ohms per phase and inductive reactance 20 ohms per phase. 5

10. a) Discuss the effects of passive series compensator and shunt compensator on surge impedance loading (SIL) of transmission line. What will be the effect on SIL if both the series and shunt compensators are used simultaneously ? 5 + 2

b) What is an S.V.C ? Explain its principle of operation. How would you model an S.V.C in power system ?

2 + 3 + 3

11. a) Explain with neat diagram, the operation of Thyristor controlled reactors and Thyristor switched capacitor. What do you mean by saturated reactors ? 4 + 3

b) How would you model a regulating transformer placed in a two bus system with a complex transformation ratio ? Form the relevant Y bus matrix. Under what condition is it used as magnitude control transformer and a phase angle control transformer ? 4 + 2 + 2