Name : .....

Roll No. : .....

Invigilator's Signature : .....

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

2012

POWER SYSTEM DYNAMICS AND 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 × 1 = 10

i) Which of the following is correct ?

a) $x''_d > x_d$ b) $x''_d = x_d$

c) $x''_d < x_d$ d) $x''_d > x'_d$

ii) Subtransient reactance (x''_d) is used to determine the current affer fault during the first

a) 1 sec b) 0·02 sec

c) 0·04 sec d) none of these.

iii) The inductance of a transmission line decreases with

a) increase in line length

b) increase in load current

c) decrease in diameter of the line conductor

d) decrease is spacing between conductors.

iv) Sustained oscillation occurs for AVR with

a) high gain & high time constant

b) high gain & low time constant

c) low gain & low time constant

d) loow gain & high time constant.

v) 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 does not signify anything.

vi) The effect of series capacitive compensation is

a) to decrease the virtual surge impedance of the line

b) to decrease the effective length of the line

c) to increase the virtual surge impedance loading of the line

d) all of these.

vii) At natural loading of a transmission line the receiving end power factor is

a) leading

b) lagging

c) unity.

viii) Shunt capacitor is used to

a) improve voltage b) improve power factor

c) both of these d) none of these.

ix) Insulation of EHV line is designed based on

a) Corona b) Lightning voltage

c) Switching voltage d) all of these.

x) If Z_C = characteristic impedance and Z_L = load impedance then which one is the condition for infinite line ?

a) $Z_L > Z_C$

b) $Z_L = Z_C$

c) $Z_L < Z_C$

xi) Which one of the following matrices reveals the topology of power system network ?

a) Bus incidence matrix

b) Bus impedance matrix

c) Primitive impedance matrix

d) Primitive admittance matrix.

xii) The power-angle characteristics of a machine infinite bus system is give by $P = 2 \sin \delta$. It is operating at $\delta = 30^\circ$. The synchronizing power co-efficient is

a) 1·0 b) 2·0

c) $\sqrt{3}$ d) $\frac{1}{\sqrt{3}}$.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

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

3. Give a comparative study between series and shunt compensation in power system. 5

4. Define voltage stability. How does it differ from Rotor-Angle stability ? 2 + 3

5. Discuss briefly the different methods for load compensation. 5

6. Explain the term 'Sub-synchronous Resonance' and briefly mention the remedies to overcome it. 5

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Describe the 'Heffron-Phillips" model of a single machine infinite bus system with suitable block diagram.

   b) What are the implications of K_1 – K_6 parameters in Heffron-Phillips model ? 9 + 6

8. a) Derive the expression for the magnitude of the maximum receiving-end voltage at voltage stability limit.

   b) Obtain the expression for the maximum power angle at voltage stability limit from the voltage stability limit equation. 8 + 7

9. a) Show that for a lossless line, Q - V and P – δ represent pairs of closely coupled quantities.

   b) Prove that $\left(\frac{dQ}{dV}\right) = -\frac{E}{X}$ where the symbols have their usual significance. Also show that for high values of power angle, $\left(\frac{dQ}{dV}\right)$ approaches zero and indicates loss of stability. 5 + 10

10. a) Discuss briefly the principle of operation of SVC and STATCOM and give a comparison between them.

    b) How are the loads modelled in power system studies ? 10 + 5

11. a) Discuss the effect of exciter on small signal stability.

    b) What is Power System Stabilizer ? Explain its role in enhancing small signal stability of power system. Also mention the different forms of realization of Power System Stabilizer. 5 + 10