



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)

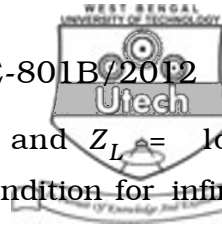
1. Choose the correct alternatives for any *ten* of the following :

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 after 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 in 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) low 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 ?
- $Z_L > Z_C$
 - $Z_L = Z_C$
 - $Z_L < Z_C$
- xi) Which one of the following matrices reveals the topology of power system network ?
- Bus incidence matrix
 - Bus impedance matrix
 - Primitive impedance matrix
 - 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
- 1.0
 - 2.0
 - $\sqrt{3}$
 - $\frac{1}{\sqrt{3}}$

GROUP – B

(Short Answer Type Questions)

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

- What do you mean by FACTS controller ? Mention the advantages of FACTS devices. 2 + 3
- Give a comparative study between series and shunt compensation in power system. 5
- Define voltage stability. How does it differ from Rotor-Angle stability ? 2 + 3
- Discuss briefly the different methods for load compensation. 5
- 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. $3 \times 15 = 45$

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 $P - \delta$ 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

