

GUJARAT TECHNOLOGICAL UNIVERSITY

BE-7 SEMESTER – OLD PAPER – S22 TO S25 – QUESTION BANK

Subject Name & Code:

Power System Dynamics and Control- 3170915

Unit 1: Basic Concepts and Review of Classical Methods

Repeated Questions:

1. What is meant by speed governing system?
 - Appeared in: W23 (Q1a, 03 marks), S23 (Q3a, 03 marks), W24 (Q3a, 03 marks)
2. State basic assumptions made in steady state analysis of an alternator.
 - Appeared in: W23 (Q1b, 04 marks), S23 (Q3b, 04 marks), S25 (Q3a, 03 marks)
3. Define steady state stability and transient stability. / Differentiate between steady state and transient stability of power system network.
 - Appeared in: W24 (Q1b, 04 marks), S25 (Q2b, 04 marks), W22 (Q1b, 04 marks)
4. Draw and explain the functional block diagram of an excitation control system. / Draw general functional block diagram of an excitation control system and explain the function of each block.
 - Appeared in: W23 (Q2c OR, 07 marks), S23 (Q2c OR, 07 marks), S22 (Q2c OR, 07 marks), S25 (Q1c, 07 marks), W24 (Q2c OR, 07 marks), W22 (Q4c, 07 marks)
5. Briefly explain the procedure of small signal analysis.
 - Appeared in: W23 (Q3a OR, 03 marks), S23 (Q3a OR, 03 marks), S25 (Q4b, 04 marks)
6. Explain the equal area criterion for single machine infinite bus system with the help of power angle curves.
 - Appeared in: W24 (Q3c, 07 marks), W22 (Q5c, 07 marks), S25 (Q5c OR, 07 marks)

Other Important Questions:

1. What is the main purpose of the power system dynamics study?
 - Appeared in: S25 (Q1b, 04 marks), W22 (Q1a, 03 marks)
2. With the help of a neat block diagram, explain different operating states of a typical power system network.
 - Appeared in: W24 (Q1c, 07 marks), S24 (Q2c OR, 07 marks), W22 (Q3c, 07 marks)
3. Define power system stabilizer (PSS). / What is the basic function of power system stabilizer?

- Appeared in: S22 (Q1a, 03 marks), S23 (Q1a, 03 marks), S25 (Q2a, 03 marks), W22 (Q3a, 03 marks)
- 4. **Define the Classification of stability and Explain any one in details. / Give the classification of power system stability studies.**
 - Appeared in: S23 (Q3b OR, 04 marks), S24 (Q2a, 03 marks), S25 (Q4c, 07 marks)
- 5. **What is voltage stability? Explain with neat diagrams.**
 - Appeared in: S23 (Q3c OR, 07 marks), S25 (Q4c, 07 marks)
- 6. **Derive the swing equation of a single generator connected to infinite bus in per unit form.**
 - Appeared in: S25 (Q2c OR, 07 marks), W24 (Q2c, 07 marks), W22 (Q1c, 07 marks)
- 7. **Explain Single Pole Switching.**
 - Appeared in: W23 (Q4a, 03 marks)
- 8. **Explain PID Governor.**
 - Appeared in: W23 (Q4b, 04 marks)
- 9. **Briefly describe voltage instability with the help of a PV diagram.**
 - Appeared in: W23 (Q4c, 07 marks)
- 10. **Mention the common assumptions in transient analysis of a multi-machine system.**
 - Appeared in: W23 (Q4a OR, 03 marks), S25 (Q5a, 03 marks)
- 11. **Explain the Mechanical hydraulic control system.**
 - Appeared in: W23 (Q4b OR, 04 marks)
- 12. **Explain Reactor Switching.**
 - Appeared in: W23 (Q5a, 03 marks)
- 13. **Explain any one model of the steam turbine.**
 - Appeared in: W23 (Q5b, 04 marks)
- 14. **Explain the transient stability improvement by series compensation.**
 - Appeared in: W23 (Q5c, 07 marks)
- 15. **Explain PV and QV curves with neat diagrams.**
 - Appeared in: W23 (Q5b OR, 04 marks)
- 16. **What is PSS? Explain with neat block diagram.**
 - Appeared in: W23 (Q5c OR, 07 marks)
- 17. **What do you mean by power system dynamics? State the advantages of power system dynamic analysis.**
 - Appeared in: S24 (Q1a, 03 marks)

18. **Analyze the power system steady-state stability and discuss the concept of eigenvalue.**
 - Appeared in: S24 (Q2c, 07 marks)
19. **Define transient stability and explain the need for transient stability analysis of a power system network.**
 - Appeared in: S24 (Q3b OR, 04 marks)
20. **Why the excitation system is required? Give the classification of excitation systems.**
 - Appeared in: S24 (Q3a OR, 03 marks)
21. **Analyze the synchronizing and damping torque without an automatic voltage regulator (AVR).**
 - Appeared in: S24 (Q3b OR, 04 marks)
22. **What is a Power System Stabilizer (PSS)? Discuss the need for using PSS for dynamic studies.**
 - Appeared in: S24 (Q5a OR, 03 marks)
23. **Discuss in detail the use of HVDC links and static VAR controllers (SVCs) for power system stabilization.**
 - Appeared in: S24 (Q5b OR, 04 marks)

Unit 2: Modelling of Synchronous Machine

Repeated Questions:

1. **Briefly describe Park's transformation and explain its importance in power system modeling and analysis. / Describe the significance of Park's transformation. / What is Park's transformation? Discuss the advantages of this transformation.**
 - Appeared in: W23 (Q1c, 07 marks), S22 (Q1c, 07 marks), S23 (Q1c, 07 marks), S25 (Q1a, 03 marks), W24 (Q4c, 07 marks), S24 (Q3a, 03 marks)
2. **Draw the systematic/schematic diagram for 3-phase synchronous machine.**
 - Appeared in: W23 (Q2a, 03 marks), S22 (Q2a, 03 marks), S23 (Q2a, 03 marks), S25 (Q3b, 04 marks), W24 (Q4a, 03 marks), W22 (Q2a, 03 marks)
3. **Write the advantages of using per unit system for modelling of synchronous machine. / Write the preference of using per unit system.**
 - Appeared in: W24 (Q1a, 03 marks), S25 (Q4a, 03 marks), W22 (Q5a, 03 marks)
4. **Express the stator voltage equation in dq-axis. / Define Per unit Stator Voltage Equation.**
 - Appeared in: S25 (Q4b OR, 04 marks), W24 (Q4b OR, 04 marks), W22 (Q3b OR, 04 marks)
5. **Explain three- Damper winding model with figure. / Discuss the role of Damper winding in synchronous generators' performance analysis.**
 - Appeared in: S22 (Q2b, 04 marks), S23 (Q2b, 04 marks), S24 (Q1b, 04 marks)

Other Important Questions:

1. **Mention the names of load models used in dynamic analysis. Describe any two of them in detail. / Explain in the types of load models used in power system analysis. / Give a classification of load models used in power system analysis. Briefly explain any one load model in detail.**
 - Appeared in: W23 (Q2c, 07 marks), S22 (Q1b, 04 marks), S23 (Q1b, 04 marks), S23 (Q2c, 07 marks)
2. **Define Per unit Stator Voltage Equation.**
 - Appeared in: W23 (Q2b, 04 marks)
3. **Explain Field Shorting Circuit.**
 - Appeared in: W23 (Q3b, 04 marks)
4. **What is Sub-Synchronous Resonance (SSR)? Explain any one SSR mitigation technique. / Briefly describe the phenomenon of Sub-Synchronous Resonance. Describes two techniques for SSR mitigation.**
 - Appeared in: W23 (Q3c, 07 marks), S23 (Q3c, 07 marks), S25 (Q3c, 07 marks)
5. **Explain Surge Impedance Loading.**
 - Appeared in: W23 (Q3a OR, 03 marks)
6. **Explain Under excitation Limiter.**

- Appeared in: **W23 (Q3b OR, 04 marks)**
- 7. **Briefly explain synchronizing and damping torque analysis. / Describe the damping torque analysis.**
 - Appeared in: **W23 (Q3c OR, 07 marks), W23 (Q3a, 03 marks)**
- 8. **Using Park's transformation derive voltage equation of synchronous machine.**
 - Appeared in: **S23 (Q4b, 04 marks)**
- 9. **Describe the classification of load models used in power system.**
 - Appeared in: **S25 (Q3a OR, 03 marks)**
- 10. **Express in detail Transient Analysis of a Synchronous Machine**
 - Appeared in: **S25 (Q3b OR, 04 marks)**
- 11. **Briefly explain Equivalent Circuits of Synchronous Machine with the determination of Parameters of Equivalent Circuits**
 - Appeared in: **S25 (Q4c OR, 07 marks)**
- 12. **Describe the steps for calculating initial conditions of a synchronous generator. / Explain the steps for calculating initial conditions of a synchronous generator with phasor diagram.**
 - Appeared in: **S25 (Q5b OR, 04 marks), W24 (Q5c, 07 marks), W22 (Q5c OR, 07 marks)**
- 13. **State the assumptions made in classical model of the synchronous generator in steady state stability analysis. / Explain the necessary assumptions made in the classical model of the synchronous generator for steady-state stability analysis.**
 - Appeared in: **W24 (Q2b, 04 marks), S24 (Q2b, 04 marks), W22 (Q3b, 04 marks)**
- 14. **Discuss with reasons: Load are modelled as constant impedance in stability studies. / Why load is consider as a constant impedance model?**
 - Appeared in: **W24 (Q3a, 03 marks), S23 (Q5b, 04 marks), S24 (Q5a OR, 03 marks), W22 (Q5a OR, 03 marks)**
- 15. **Briefly discuss short circuit tests of synchronous machine.**
 - Appeared in: **W24 (Q3b, 04 marks), W22 (Q5b OR, 04 marks)**
- 16. **Explain power invariant form of park's transformation.**
 - Appeared in: **W24 (Q3b OR, 04 marks), W22 (Q4b, 04 marks)**
- 17. **Explain general model for speed governor for steam turbine using neat block diagram.**
 - Appeared in: **W24 (Q3c OR, 07 marks), S25 (Q2c, 07 marks), W22 (Q2c OR, 07 marks)**
- 18. **Explain modelling of transmission network using π equivalent circuit.**
 - Appeared in: **W24 (Q4b, 04 marks), W22 (Q5b, 04 marks)**

19. **Explain the static load representation in electrical power systems, incorporating its mathematical formulation.**
 - Appeared in: W24 (Q4c OR, 07 marks)
20. **State the assumptions made in derivation of the basic equation of a synchronous machine.**
 - Appeared in: W24 (Q5a, 03 marks), W22 (Q3a OR, 03 marks)
21. **List various models of synchronous machine based on the windings used in dq-axis.**
 - Appeared in: W24 (Q5b, 04 marks), W22 (Q4b OR, 04 marks)
22. **What are the types of excitation systems?**
 - Appeared in: W24 (Q5a OR, 03 marks), W22 (Q4a, 03 marks)
23. **What specific base quantities are typically selected for the per unit conversion of stator dq-winding quantities in synchronous machines?**
 - Appeared in: W24 (Q5b OR, 04 marks)
24. **Draw and explain the equivalent circuit of a salient pole synchronous generator. Also, explain various time constants of the equivalent circuit.**
 - Appeared in: S24 (Q1c, 07 marks)
25. **Define per unit system and obtain the per unit values of a power system network components from their rated values.**
 - Appeared in: S24 (Q3c OR, 07 marks)
26. **Enlist and differentiate the generator models suggested by the IEEE Task Force report published in 1986.**
 - Appeared in: S24 (Q4a, 03 marks)
27. **What are the various data required for synchronous machines? Discuss the tests performed on synchronous machines to obtain such data.**
 - Appeared in: S24 (Q4b, 04 marks)
28. **Discuss in detail the application of synchronous generator Model 1.1 as suggested by the IEEE Task Force. / Explain application of Model 1.1.**
 - Appeared in: S24 (Q4c, 07 marks), S23 (Q5a, 03 marks), S25 (Q5a OR, 03 marks)
29. **Explain polynomial representation of static load.**
 - Appeared in: W22 (Q2b, 04 marks)
30. **A generator is connected to an infinite bus through an external impedance of jX_e . The generator is represented by a voltage source $E_g \angle \delta$ in series with a reactance X_g . If $E_g = E_b$ (infinite bus voltage) = 1.0, $X_e = -0.5$, $X_g = 0.3$ (all in p.u), for $P_b = 1.0$ p.u, find the equilibrium value of δ , in the range of $(-\pi, \pi)$. Test their stability (P_b is the received power at the infinite bus). Assume infinite bus angle as zero.**
 - Appeared in: W22 (Q2c, 07 marks) (Numerical Problem)

Unit 3: Excitation and Prime Mover Controllers

Repeated Questions:

1. **Explain excitation system. / What are the basic functions of excitation system?**
 - Appeared in: S23 (Q4a OR, 03 marks), W22 (Q4a OR, 03 marks)
2. **What are the types of excitation systems? / Give the classification of excitation systems.**
 - Appeared in: W24 (Q5a OR, 03 marks), W22 (Q4a, 03 marks), S24 (Q3a OR, 03 marks)

Other Important Questions:

1. **Explain Under excitation Limiter.**
 - Appeared in: W23 (Q3b OR, 04 marks)
2. **Explain PID Governor.**
 - Appeared in: W23 (Q4b, 04 marks)
3. **Explain the Mechanical hydraulic control system.**
 - Appeared in: W23 (Q4b OR, 04 marks)
4. **Explain any one model of the steam turbine.**
 - Appeared in: W23 (Q5b, 04 marks)
5. **Analyze the synchronizing and damping torque without an automatic voltage regulator (AVR).**
 - Appeared in: S24 (Q3b OR, 04 marks)

Unit 4: Transmission Lines, SVC and Loads

Repeated Questions:

1. **Explain transmission line modeling by D-Q transformation using α - β variables.**
 - Appeared in: W24 (Q5c OR, 07 marks), S23 (Q4c, 07 marks), S24 (Q5c OR, 07 marks), S25 (Q3c OR, 07 marks), W22 (Q4c OR, 07 marks)
2. **Why load is considered as a constant impedance model? / Discuss with reasons: Load are modelled as constant impedance in stability studies.**
 - Appeared in: S24 (Q5a OR, 03 marks), S23 (Q5b, 04 marks), W24 (Q3a, 03 marks), W22 (Q5a OR, 03 marks)
3. **Explain polynomial and exponential representation of static load. / Explain polynomial representation of static load.**
 - Appeared in: S24 (Q5b OR, 07 marks), W22 (Q2b, 04 marks)

Other Important Questions:

1. **Explain classification of Braking.**
 - Appeared in: S23 (Q4a, 03 marks), S23 (Q5a OR, 03 marks)
2. **Briefly explain : Discrete Control of HVDC Links.**
 - Appeared in: S23 (Q4c OR, 07 marks)
3. **Compare voltage and angle stability. How to carry out integrated analysis of the same.**
 - Appeared in: S23 (Q5c, 07 marks)
4. **Explain any one method for analysis of voltage instability.**
 - Appeared in: S23 (Q5b OR, 04 marks)
5. **Briefly explain: Dynamic Braking.**
 - Appeared in: S23 (Q5c OR, 07 marks), S25 (Q5c, 07 marks)
6. **What is the compensation of a transmission line? Which compensation (series or shunt) is suitable for a transmission line? Justify your answer.**
 - Appeared in: S24 (Q4a OR, 03 marks)
7. **List the methods of static VAR compensations (SVCs). Explain any one in detail.**
 - Appeared in: S24 (Q4b OR, 04 marks)
8. **Discuss in detail the control characteristic of SVC. / Draw the control characteristic and briefly explain the Static Var Compensator.**
 - Appeared in: S24 (Q4c OR, 07 marks), S25 (Q5b, 04 marks), W23 (Q4c OR, 07 marks)
9. **Discuss in detail the use of HVDC links and static VAR controllers (SVCs) for power system stabilization.**
 - Appeared in: S24 (Q5b OR, 04 marks)

Unit 5: Dynamics of a Synchronous Generator Connected to Infinite Bus

Repeated Questions:

1. **Explain the steps for calculating initial conditions of a synchronous generator with phasor diagram. / Describe the steps for calculating initial conditions of a synchronous generator.**
 - Appeared in: W24 (Q5c, 07 marks), W22 (Q5c OR, 07 marks), S25 (Q5b OR, 04 marks)
2. **Explain application of Model 1.1. / Discuss in detail the application of synchronous generator Model 1.1. / Demonstrate the application of Model 1.1.**
 - Appeared in: S23 (Q5a, 03 marks), S24 (Q4c, 07 marks), S25 (Q5a OR, 03 marks)
3. **Briefly explain: Dynamic Braking.**
 - Appeared in: S23 (Q5c OR, 07 marks), S25 (Q5c, 07 marks)

Other Important Questions:

1. **Explain the transient stability improvement by series compensation.**
 - Appeared in: W23 (Q5c, 07 marks)
2. **Explain in detail any two sub-synchronous resonance (SSR) mitigation techniques.**
 - Appeared in: S24 (Q5c OR, 07 marks)
