

2056
M.E. Electrical Engineering (Power Systems)
Second Semester
EE-8201 (PS): Power Systems Dynamics and Stability

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt any five questions.

x-x-x

I.

- a) Explain the rotor angle stability phenomenon in synchronous machines connected to an infinite bus.
- b) A synchronous generator delivers power $P = (EV/X) \sin\delta$. Derive the condition for steady-state stability limit and explain the physical significance of maximum power transfer. (2x5)

II.

- a) Derive the swing equation of a synchronous machine starting from basic principles. Clearly explain the meaning of inertia constant H.
- b) A generator delivers 0.8 p.u. power before a disturbance. During a fault the maximum power transfer reduces to 0.4 p.u. and after fault clearing it becomes 1.2 p.u. Using the equal area criterion determine whether the system remains stable. (2x5)

III.

- a) Explain the Euler method for solving swing equations. Discuss its limitations in power system stability studies.
- b) Describe the Runge-Kutta fourth order method and explain why it is preferred in transient stability analysis. (2x5)

IV.

- a) Explain the classical model of synchronous machine used in transient stability studies. State all assumptions.
- b) Discuss the modelling of excitation systems and explain their impact on system stability. (2x5)

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V.

- a) Explain the concept of multimachine stability and discuss the difficulties in its analysis.
- b) Derive the extended equal area criterion for a two-machine system. (2x5)

VI.

- a) Explain the state space representation of power system dynamic models.
- b) Discuss the role of eigenvalues and modal analysis in determining small signal stability. (2x5)

VII.

- a) Explain the concept of mode shapes and participation factors in multimachine systems.
- b) Discuss the impact of excitation system on small signal stability with suitable mathematical representation. (2x5)

VIII.

- a) Derive and explain PV curve and QV curve used in voltage stability analysis.
- b) Explain the following methods used in voltage stability analysis:
 - i) Loadability limit
 - ii) Sensitivity analysis
 - iii) Continuation power flow method(4,6)

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