

B.Tech IV Year II Semester (R15) Regular Examinations April 2019

**POWER SYSTEM DYNAMICS & CONTROL**

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

**PART – A**

(Compulsory Question)

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- 1 Answer the following: (10 X 02 = 20 Marks)
  - (a) Identify the impact of stability problem on power system operation and control.
  - (b) Define transient stability.
  - (c) Derive the q-axis equivalent circuit of the synchronous machine.
  - (d) State park transformation matrix.
  - (e) Draw the functional block diagram of an IEEE Type 1 excitation system.
  - (f) Briefly explain about power system stabilizer (PSS).
  - (g) What are the factors affecting voltage instability and collapse?
  - (h) List out the problems associated with torsional oscillations.
  - (i) Identify the major factors that contribute to the power system instability.
  - (j) How reactor switching will improve the transient stability?

**PART – B**

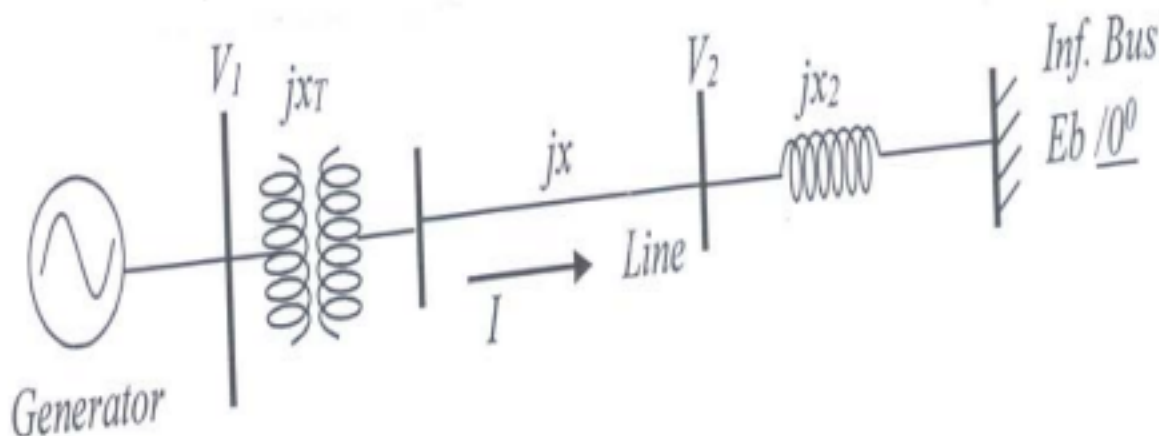
(Answer all five units, 5 X 10 = 50 Marks)

**UNIT – I**

- 2 Derive the criterion for steady state stability of classical model and give your remarks based on Eigen value analysis when mechanical power ' $P_m$ ' is varied.

**OR**

- 3 A single machine is connected to a load centre through a transmission line as shown in figure below. The load centre is represented by a reactance connected to an infinite bus. The generator is initially operating with  $P_e = 1.0$  pu and the magnitude of voltages  $V_1$  and  $V_2$  are 1.0 p.u each. Find the maximum step increase in the mechanical power that will not cause transient instability. Use equal area criterion. Assume  $x_g = 0.3$ ,  $x_T = 0.1$ ,  $x = 0.4$ ,  $x_2 = 0.1$ .



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**UNIT – II**

- 4 Write down the flux linkage and voltage equations of a synchronous machine and there from derive the electromagnetic torque equation.

**OR**

- 5 A synchronous machine delivers 1.0 p.u power at 0.8 pf lagging at its terminals. It is connected to an infinite bus of voltage 1.0 p.u through an external impedance  $Z_e = 0.05 + j0.5$  p.u. The reactance of the machine are  $x_d = 1.4$  p.u,  $x_q = 1.1$  p.u and  $x'_d = 0.25$  p.u. The armature resistance is negligible. Determine  $E'q$  of the machine.

**UNIT – III**

- 6 Draw the block diagram of IEEE Type 1 excitation system and derive state equations.

**OR**

- 7 Explain the mathematical modeling of:  
 (a) Governor for hydraulic turbine.  
 (b) Single reheat tandem-compound steam turbine.

**UNIT – IV**

- 8 Using small signal analysis, obtain stator algebraic equations and rotor mechanical equations in linearized form.

**OR**

- 9 Derive generator equation with center of inertia as reference and explain the advantages.

**UNIT – V**

- 10 Explain in detail about the tuning procedure for power system stabilizer (PSS).

**OR**

- 11 Explain the applications of PSS based on the various modes of oscillation in a practical power system.

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