

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – II • EXAMINATION – WINTER • 2013****Subject code: 1720703****Date: 31-12-2013****Subject Name: Power System Dynamics and Control****Time: 10.30 am – 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Derive equation for power delivered for round and salient pole rotor; discuss effect of saliency on PG-Delta (m) curve. **07**
(b) Derive Terminal voltage equation for round rotor alternator considering armature reaction **07**
- Q.2** (a) Explain how synchronous machine can be model in terms of equivalent circuit. Also derive equation for instantaneous power output. **07**
(b) Derive Mutual Inductance matrix for synchronous machine. **07**
- OR**
- (b) For a synchronous machine balanced 3-phase supply developed steady state equation for machine. also draw a phaser diagram of steady state model **07**
- Q.3** (a) A generator is a synchronized to an infinite bus $i_F = 1000$ amp (actual) at synchronization. $V_\infty = 1 \angle 0^\circ$ and $X_s = 1.5$. with i_F unchanged the steam valves at the turbine are adjusted until $P_G = 0.2$. Find (a). I_a (b) with P_G unchanged, i_F is increased to 1600 amp(actual) find I_a . **07**
(b) Using Park transformation derive the voltage equation of synchronous machine also state importance of Park transformation **07**
- OR**
- Q.3** (a) Draw general functional block diagram of an excitation control system. And explain the function of each block. **07**
(b) Draw and explain the functional block diagram of the mechanical-hydraulic governing system, electro-hydraulic speed governing system and general model for speed governor for steam turbine. **07**
- Q.4** (a) Explain transmission line modeling by D-Q transformation using α - β variables. **07**
(b) Explain control characteristics of SVC. Draw block diagram of SVC controller and develop its mathematical model. **07**
- OR**
- Q.4** (a) Develop dynamic model of synchronous machine with field circuit and one equivalent damper winding on q axis (model 1.1) develop all equations of stator and rotor and draw its equivalent circuit **07**
- Q.4** (b) Classify load models and explain dynamic load model in detail. **07**
- Q.5** (a) Write short note on Hopf Bifurcation. **06**

- (b) Carryout small signal analysis of rotor of synchronous machine with its mechanical equations and torque angle loop. Develop all mathematical equations and also include flux decay representation in its block diagram. **08**

OR

- Q.5** (a) State conditions for synchronizing the alternator with infinite bus considering fixed mechanical power input. How alternator acts as a condenser to control reactive power? **06**
- (b) State assumption made multi machine system and develop simplified system model for the same. **08**
