Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2013

Subject code: 1720703 **Date: 03-06-2013**

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 Terminal voltage equation for round rotor alternator considering armature reaction.	**07**
	(b)	Derive equation for power delivered for round and salient pole rotor, discuss effect of saliency on P_G (δm) curve.	**07**
Q.2	**(a)**	Derive Mutual Inductance matrix for synchronous machine.	**07**
	(b)	Explain how synchronous machine can be model in terms of equivalent circuit. Also derive equation for instantaneous power output.	**07**
		OR	
	(b)	Derive equation for direct axis and quadrate axis voltages (V_d , V_q) for non synchronous operation of alternator, considering balance terminal voltages with $V_a(t) = \sqrt{2}\ |V|\ \mathrm{Cos}(\omega_0 t + \angle V)$; The rotation of the generator rotor is described by $\omega_0 t + (\pi/2) + \delta$.	**07**
Q.3	**(a)**	For a synchronous machine balanced 3-phase supply developed steady state equation for machine. Also draw a phasor diagram of steady state model.	**07**
	(b)	State and explain the conditions for synchronizing alternator with infinite bus considering fixed i_f and fixed mechanical power i / p.	**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 speed governing system and model of speed-governing system for hydro turbines.	**07**
Q.4	**(a)**	Why load is considered as a constant impedance model. Justify your answer.	**07**
	(b)	Explain transmission line modeling by D-Q transformation using α-β variables.	**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 **e**quivalent circuit	**07**
	(b)	Explain control characteristics of SVC. Draw block diagram of SVC controller and develop its mathematical model.	**07**
Q.5	**(a)**	Find out transfer function of a synchronous machine connected to an infinite bus. Also represent its overall block diagram. How its characteristics equations are used to find stability criterion for with and without AVR.	**07**
	(b)	Carryout small signal analysis of rotor of synchrouns machine with its mechanical equations and torque angle loop. Develop all mathematical equations and also include flux decay representation in its block diagram.	**07**
		OR	

Q.5	**(a)**	State assumption made multi machine system and develop simplified system model for the same.	**07**
	(b)	Write short note on Hopf Bifurcation.	**07**

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