Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII • EXAMINATION – WINTER • 2014

Subject Code: 172401 **Date: 25-11-2014**

Subject Name: Power Electronics Systems Modeling

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)**	Discuss the concept of nonlinearity and the importance of perturbation & linearization with respect to power electronics giving an example.	**07**
	(b)	Discuss different types of modeling methods with their merit and demerits.	**07**
Q.2	**(a)**	Derive the expression of duty cycle for boost converter with the help of capacitor charge second principle.	**07**
	(b)	Develop the model of Armature controlled DC servo motor.	**07**
		OR	
	(b)	Explain DC transformer model with necessary equations and figures.	**07**
Q.3	**(a)**	Explain the modeling the boost converter inclusion inductor copper loss. Draw the waveform for inductor voltage and capacitor current waveforms.	**07**
	(b)	Derive small signal linearized equation that describes change in inductor current.	**07**
		OR	
Q.3	**(a)**	Explain the modeling of boost converter inclusion of semiconductor conduction losses. Draw the waveform for inductor voltage and capacitor current.	**07**
	(b)	Show that during transient period net change in inductor current over one switching period can be correctly predicted by use of average inductor voltage.	**07**
Q.4	**(a)**	Find out the steady state output voltage for a boost chopper using small-ripple approximation. Draw necessary diagrams & waveforms. Also derive the equation for voltage conversion ratio M (D) and draw its graph.	**07**
	(b)	What is a Transfer Matrix & how it is obtained from state-space equations?	**07**
		OR	
Q.4	**(a)**	Find out the steady state output voltage for a buck chopper using small-ripple approximation. Draw necessary diagrams & waveforms. Also derive the equation for voltage conversion ratio M (D) and draw its graph.	**07**
	(b)	How the review of bode plot is useful in analysis of converters?	**07**
Q.5	**(a)**	What is feedback control? Explain the closed loop of controlled rectifier with necessary circuit diagram and waveform.	**07**
	(b)	Find the state-space model of the second-order differential equation. $$\ddot{x} + a\dot{x} + bx = f(t).$$	**07**
		OR	
Q.5	**(a)**	What is linearization? Explain linearized circuit for an up/down converter in discontinuous conduction using necessary circuit, equation and waveform.	**07**

(b) Derive state space for the following circuit diagram.