Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – VII • EXAMINATION – WINTER 2012

Subject code: 172401 Date: 26/12/2012

Subject Name: Power Electronics systems & Modeling

Time: 10.30 am - 01.00 pm Total Marks: 70

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Notations / symbols used have their usual meanings.**

Q.1 **(a)** What is a Transfer Matrix & how it is obtained from state-space equations. **07**

(b) Develop State-space model of the Buck-Boost converter. **07**

Q.2 **(a)** Derive the expression of duty cycle for boost converter with the help of capacitor charge second principle. **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**

OR

(b) Obtain transfer function of separately exited DC shunt motor. **07**

Q.3 **(a)** Normalize the differential equation given below with respect to a frequency of 10 Hz and derive the subsequent state-space model. **07**

$$\ddot{x} + a\dot{x} + bx = f(t).$$

The system parameters are a=10,b=10000,f(t)=100cos(20πt).

(b) Derive small signal AC model for buck-boost converter. **07**

OR

Q.3 **(a)** Explain the principle of inductor volt second balance and capacitor ampere second balance. **07**

(b) How the review of bode plot is useful in analysis of converters ? **07**

Q.4 **(a)** What is small ripple approximation and how it is useful in converter analysis ? **07**

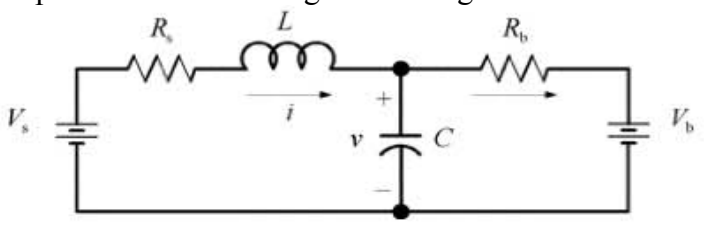
(b) Derive transfer function of DC generator. **07**

OR

Q.4 **(a)** Derive small signal linearized equation that describes variation in inductor current. **07**

Q.4 **(b)** Obtain state space model for 1-phase bridge inverter **07**

Q.5 **(a)** Derive state space for the following circuit diagram. **07**



(b) Derive the equation for the selection of value of inductor for a boost converter so that the desired current ripple Δi_L is attained. **07**

OR

Q.5 **(a)** Find the state-space model of the second-order differential equation. **07**

$$\ddot{x} + a\dot{x} + bx = f(t).$$

(b) Find the complete state controllability of a converter whose state-space equation is given by **07**

$$\begin{bmatrix} \dot{x}1 \\ \dot{x}2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$$

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