Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- VIIth SEMESTER–EXAMINATION – MAY/JUNE- 2012

Subject code: 172401 **Date: 24/05/2012**

Subject Name: Power Electronics Systems Modelling

Time: 02:30 pm – 05:00 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) Define modeling. Draw and Explain the block diagram of Power Electronics System with reference to modeling. **07**

(b) State inductor voltage-second balance principle and explain its use in buck converter. **07**

Q.2 (a) Explain the concept of controllability and observability of the system. Find the complete state controllability of a converter whose state-space equation is given by $\begin{bmatrix} \dot{x}1 \\ \dot{x}2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$ **07**

(b) Explain the modeling the boost converter inclusion inductor copper loss. Draw the waveform for inductor voltage and capacitor current waveforms. **07**

OR

(b) Explain the modeling of the boost converter inclusion of semiconductor conduction losses. Draw the waveform for inductor voltage and capacitor current. **07**

Q.3 (a) Explain the working of the CUK converter with neat circuit diagram and necessary waveforms. Explain the graph for DC conversion ratio M (D) with duty cycle. **07**

(b) For buck converter following data given are: Input voltage = 48 V, Mark Space Ratio =0.25, Switching Frequency = 100 KHz, Load Resistance = 6 Ω. Determine V_o and I. Calculate the value of L that will make the peak inductor current ripple Δ_I equal to 10 % of the average inductor current I. **07**

OR

Q.3 (a) Explain working of open loop control with feedforward for an up/down convertor with necessary circuit and waveform. **07**

(b) For boost converter following data given are: Input voltage = 12 V, Mark Space Ratio =0.75, Switching Frequency = 100 KHz, Load Resistance = 8Ω. Determine V_o and I. Design the value of C such that peak output voltage ripple ΔV is 0.1 V_o. **07**

Q.4 (a) Explain the basic AC modeling approach using buck boost converter example and draw the average inductor voltage and inductor current waveform. **07**

(b) Develop state space model of basic buck converter. **07**

OR

Q.4 (a) What is canonical circuit model? Explain the development of canonical circuit model based on physical arguments. **07**

(b) Develop state space model of buck boost converter. **07**

Q.5 (a) Derive and plot the control-to-output transfer function for circuit of small signal equivalent circuit model of buck boost converter. **07**

(b) Draw and explain the modeling of PWM. **07**

OR

Q.5 (a) Derive and plot the line-to-output transfer function for circuit of small signal equivalent circuit model of buck boost converter. **07**

(b) Derive the transfer function for armature controlled DC Motor and develop block diagram for the same. **07**

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