Enrolment No._

GUJARAT TECHNOLOGICAL UNIVERSITY BE- VIIth SEMESTER-EXAMINATION – MAY/JUNE- 2012

Subject code: 172401

Subject Name: Power Electronics Systems Modelling

Time: 02:30 pm – 05:00 pm

Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- (a) Define modeling. Draw and Explain the block diagram of Power Electronics System **Q.1** 07 with reference to modeling.
 - State inductor voltage-second balance principle and explain its use in buck converter. 07 (b)
- 0.2 Explain the concept of controllability and observability of the system. Find the 07 (a) complete state controllability of a converter whose state-space equation

is given by $\begin{bmatrix} x1\\ x2 \end{bmatrix} = \begin{bmatrix} 1 & 1\\ 0 & -1 \end{bmatrix} \begin{bmatrix} x1\\ x2 \end{bmatrix} + \begin{bmatrix} 1\\ 0 \end{bmatrix} u$

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

OR

- (b) Explain the modeling of the boost converter inclusion of semiconductor conduction 07 losses. Draw the waveform for inductor voltage and capacitor current.
- 0.3 (a) Explain the working of the CUK converter with neat circuit diagram and necessary 07 waveforms. Explain the graph for DC conversion ratio M (D) with duty cycle.
 - (b) For buck converter following data given are: Input voltage = 48 V, Mark Space Ratio 07 =0.25, Switching Frequency = 100 KHz, Load Resistance = 6 Ω . Determine V₀ and I. Calculate the value of L that will make the peak inductor current ripple $\Delta_{\rm I}$ equal to 10 % of the average inductor current I.

OR

- Q.3 (a) Explain working of open loop control with feedforward for an up/down convertor 07 with necessary circuit and waveform.
 - (b) For boost converter following data given are: Input voltage = 12 V, Mark Space Ratio 07 =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 V₀.
- (a) **Q.4** Explain the basic AC modeling approach using buck boost converter example and 07 draw the average inductor voltage and inductor current waveform. 07
 - Develop state space model of basic buck converter. (b)

OR

- (a) What is canonical circuit model? Explain the development of canonical circuit model **Q.4** 07 based on physical arguments. 07
 - Develop state space model of buck boost converter. (b)
- Derive and plot the control-to-output transfer function for circuit of small signal Q.5 (a) 07 equivalent circuit model of buck boost converter.
 - (b) Draw and explain the modeling of PWM.

OR

- Derive and plot the line-to-output transfer function for circuit of small signal 07 Q.5 (a) equivalent circuit model of buck boost converter.
 - (b) Derive the transfer function for armature controlled DC Motor and develop block 07 diagram for the same.

Date: 24/05/2012

Total Marks: 70

07