Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VII • EXAMINATION – SUMMER • 2014**

**Subject Code: 172401** **Date: 22-05-2014**

**Subject Name: Power Electronics Systems Modeling**

**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.**

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|---|---|---|---|
| **Q.1** | (a) | Draw and Explain the block diagram of Power Electronics System with reference to modeling. | **07** |
| | (b) | State inductor volt-second balance principle and explain its use in buck converter. | **07** |
| **Q.2** | (a) | Explain DC transformer model with necessary equations and figures. | **06** |
| | (b) | 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 it's graph. | **08** |
| | | **OR** | |
| | (b) | For a given buck converter, if the input voltage is 50 V, Mark Space Ratio is 0.25, Switching frequency is 100 kHz and load resistance is 10 Ω, calculate the value of $V_o$ and I. Also find out the value of C such that the peak output voltage ripple ΔV is 5% of $V_0$. | **08** |
| **Q.3** | (a) | Discuss different types of modeling methods with their merit and demerits. | **07** |
| | (b) | List the major steps of engineering design process. Explain each in brief. | **07** |
| | | **OR** | |
| **Q.3** | (a) | What do you mean by small signal approximation? Explain with appropriate example. | **06** |
| | (b) | Why is AC modeling required? Discuss non-linearity in electrical system. Explain perturbation and linearization w.r.t. power electronics. | **08** |
| **Q.4** | (a) | Develop the state space model of a buck converter. Draw necessary figures. | **08** |
| | (b) | Define the following: Modeling, Controllability, SISO, Normalization, Impulse Response, Linerization | **06** |
| | | **OR** | |
| **Q. 4** | (a) | Explain the difference between ideal and physical models of AC transformer. Draw neat diagrams. | **06** |
| | (b) | Develop the state space model of a boost converter along with necessary figures. | **08** |
| **Q.5** | (a) | What is Canonical Circuit Model? Explain the manipulation of buck-boost converter model into canonical form. | **07** |
| | (b) | Explain the graphical construction of series impedances using a series R-C network. | **07** |
| | | **OR** | |
| **Q.5** | (a) | Explain the close loop speed control of DC motor using power electronics converter. | **07** |
| | (b) | Explain the state space model of a full bridge inverter. | **07** |

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