Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

II SEMESTER M.TECH (POWER ELECTRONIC SYSTEMS AND CONTROL)

END SEMESTER EXAMINATIONS, MAY 2016

MODELING AND SIMULATION OF POWER ELECTRONIC SYSTEMS [ELE 508]

REVISED CREDIT SYSTEM

Time: 3 Hours 07 MAY 2016 MAX.MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitable assumed.

1 An ideal Buck-Boost converter is operated in continuous conduction mode.

a) Construct an equivalent circuit that corresponds to the Buck-Boost converter small-signal ac equations.

b) Manipulate your circuit to canonical form. ***10***

2A Explain the effect of RHPZ (right hand plane zero) on converter systems. ***03***

2B A non-ideal Buck converter has inductor winding resistanceR_L, MOSFET 'ON' resistance R_{on} and diode forward voltage drop V_D.

1). Derive an equivalent circuit model for this converter.

2). Derive an expression for the non-ideal voltage conversion ratio $\frac{V}{V_g}$ and efficiency ŋ. ***07***

3A. The equivalent circuit model of a closed loop converter system is shown in Fig.1.Express the output voltage variation $\hat{v}(s)$ as a linear combination of control input variation $\hat{d}(s)$, power input variation $\hat{v}_g(s)$ and load current variation$\hat{\imath}_{load}(s)$.

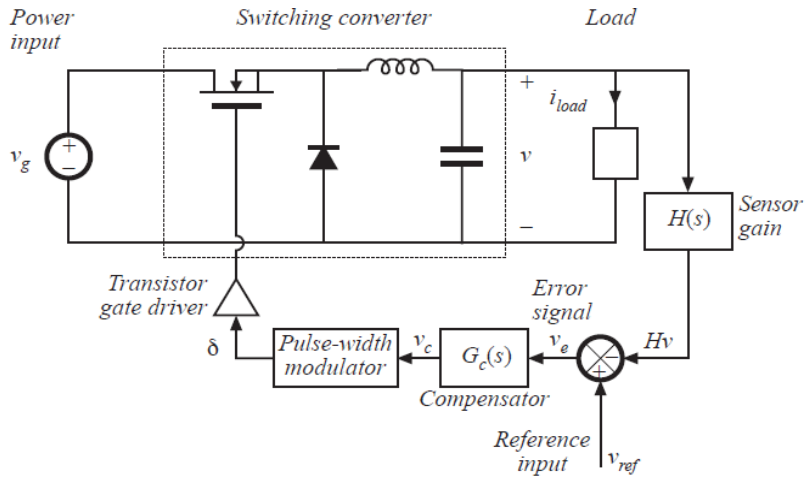

Fig.1 ***05***

3B. A rotating electrical machine has 2 coils on the stator and one coil on the rotor. Develop an electromechanical mathematical model of the machine. The two stator coils are in quadrature and the rotor coil can be represented as fictitious stationary coil in the axis of one of the stator coils. ***05***

4A. Shown in Fig.2 is the Bode plot $T_u(s)$ of an uncompensated switching converter with gain cross over frequency $f_c = 1.84KHz$ and gain margin GM = 4.73⁰. Design a Type-2 controller to obtain a gain margin of GM = 52⁰ and gain cross over frequency $f_c = 5KHz$.

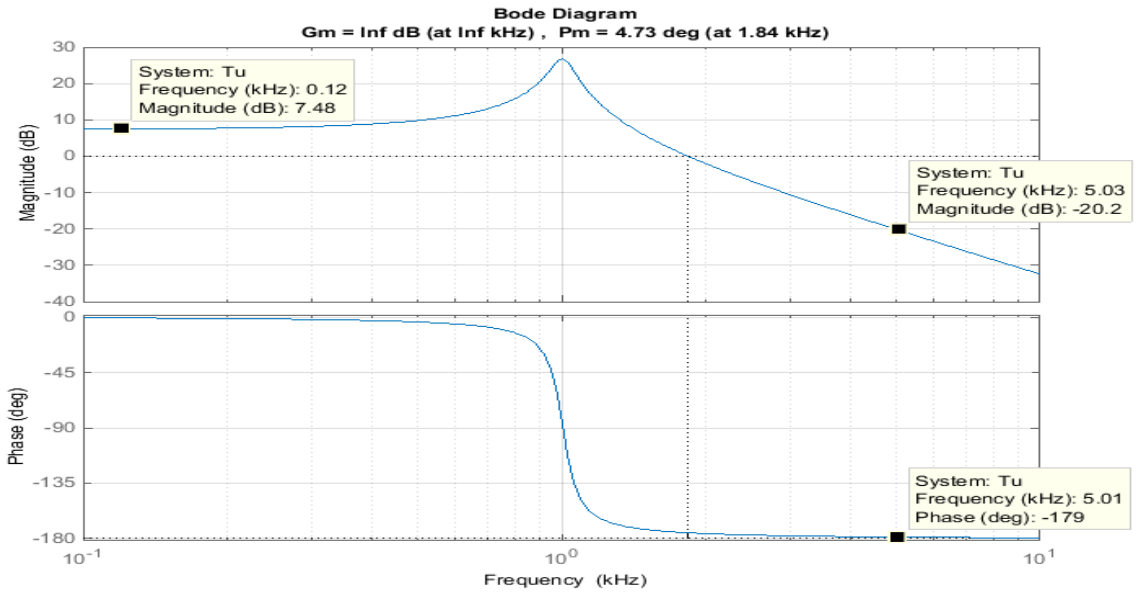

Fig.2 ***05***

4B. Develop an mmf and power invariant, mathematical transformation to transform three phase quantities to two phase. ***05***

5A. Describe the different reference frames used in modeling induction machines. State examples for each reference frame. ***05***

5B. Explain the advantage of obtaining per-unit model of electrical systems. Starting from the d-q model of the induction machine, obtain the per unit model of the induction machine by choosing suitable base quantities. (Do not derive the d-q model. Start from the d-q model equations). ***05***

6A. Explain the structure of the control system of speed control in a separately excited dc machine using armature voltage control, with the help of a block diagram. The control should be such that the armature current should also be controlled. Describe the nature and functionality of each block in the block diagram. ***05***

6B. Obtain the model of a three phase fully controlled ac to dc converter in Laplace domain, the input being the control signal and the output being the load voltage.

Describe a schematic for implementation of a system which receives the control signal and provides gating pulse to thyristors in the three phase fully controlled ac-dc converter. ***05***