Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

I SEMESTER M.TECH (POWER ELECTRONICS & DRIVES)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: MODELLING AND ANALYSIS OF POWER ELECTRONIC SYSTEMS AND ELECTRICAL MACHINES [ELE5123]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 01 December 2016** **MAX. MARKS: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A. A toroid core having radius 10cm is wound by 100 turn coil. The core has an air gap of 1mm. The radius of the cross section is 5mm. Leakage factor is 1.2 and a dc current of 500mA is flowing through the wire. Determine the flux in the core and the self-inductance of the coil. Neglect fringing effect. Take the relative permeability of core as 800. ***05***

1B. Derive the dynamic model of a two phase cylindrical rotating machine from basic principles. Transform all quantities to the stator side. ***05***

2A. Transform the three phase quantities(abc) to two phase quantities(dqo). Prove that the transformation is mmf and power invariant. ***05***

2B. Explain the different reference frames used to model the 3 phase induction machine. Highlight the advantages and applications of each reference frame. ***05***

3A. From the basic principles derive the dynamic model of a separately excited dc machine. Represent the model in the block diagram form. (The field current is kept constant). ***05***

3B. 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 $\hat{\imath}_{load}(s)$.

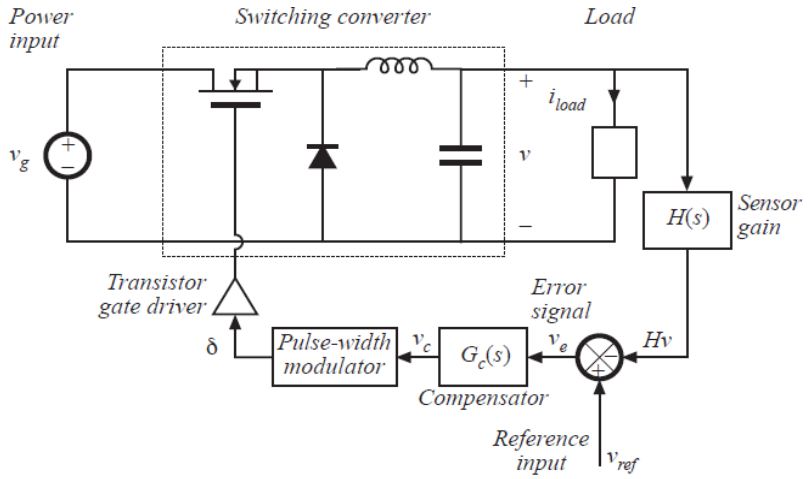

Fig.1 ***05***

4A. A flyback converter operates in continuous conduction mode. The MOSFET has on-resistance R_{on}, and diode has a constant forward voltage drop V_D.

a) Derive a complete steady state equivalent circuit model.

b) Derive an analytical expression for the converter efficiency. ***06***

4B. Cascade a boost and buck converter realized using SDPT switches. Simplify the circuit in such a way that only one SPDT switch is used. Replace the SPDT switch with semiconductor switch. ***04***

5. A boost converter is operated in continuous conduction mode.

a) Determine the nonlinear averaged equation of this converter.

b) Construct an equivalent circuit that corresponds to the boost converter small-signal ac equations.

c) Manipulate your circuit to canonical form.

Derive analytical expressions for the control-to-output and line-to-output transfer functions $G_{vd}(s)$ and $G_{vg}(s)$ assuming capacitor esr r_c in series with the capacitor. Express your results in standard normalized form. ***10***