Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent Institution of MAHE, Manipal)

I SEMESTER M.TECH (POWER ELECTRONICS & DRIVES)

END SEMESTER EXAMINATIONS, NOVEMBER 2018

SUBJECT: MODELING AND ANALYSIS OF POWER ELECTRONIC SYSTEMS AND ELECTRICAL MACHINES [ELE 5123]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 27, November 2018** **Max. Marks: 50**

Instructions to Candidates:

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

1A. A 1000 turns coils wound on the limb A of the symmetric cast iron steel frame shown below. Cross-sectional area of the frame is 16 cm^2. Find the current through the coil in order to produce a total flux of 2 mWb in the air gap of the central limb B. Assume uniform flux density and all the flux lines pass straight across the air gap. Given air gap thickness 0.1 cm each and all the dimensions are in centimeters. Assume μ_r for cast steel is 900.

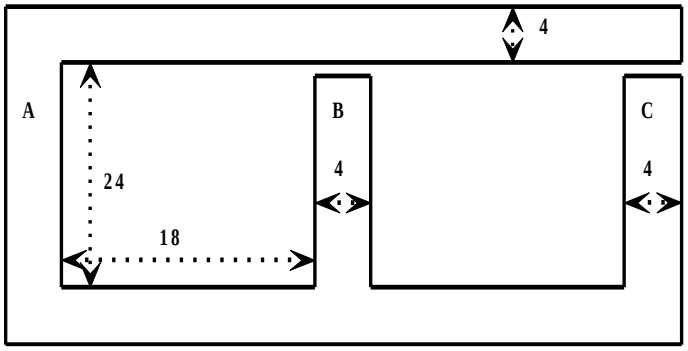

Fig .Q1A ***(05)***

1B. Derive the expression of Field Energy and electromagnetic Torque of an electromechanical system with two coils (stator & rotor) carrying current i_1 and i_2 ***(05)***

2A. A magnetic circuit is made of a circular ring of mean circumference of 100 cm. A saw cut across its cross section is made which is equivalent to an air gap of 2 mm. A coil of 2000 turns, wound on the ring, carries a current of 1 A resulting in a magnetic flux of 2.5 mWb in the air gap. If the relative permeability of iron is 800, calculate the cross sectional area of iron ring. Neglect fringing effect & leakage factor. ***(03)***

2B. Derive the small signal model of separately excited motor in state variable form ***(07)***

3A. Write the three phase voltage equations for both stator & rotor windings in three phase wound rotor induction motor ***(03)***

3B. Derive the expression for toque in field oriented control of induction motor (using synchronous reference frame). Explain how torque & speed are decoupled in this method of control. ***(07)***

4A. Derive an expression for self-inductance of distributed winding on the stator of a salient rotor & cylindrical stator machine ***(05)***

4B. For the circuit shown, the following specifications are given:

Input voltage Vg = 12 V

Output voltage V = – 5 V

Load resistance R = 2.5 Ohms

Switching frequency fs = 1/Ts = 200 kHz

All elements are ideal. Sketch the waveform of the MOSFET voltage $vQ1(t)$, including ripple. Find its peak value in volts. ***(05)***

5A. Derive an equivalent circuit for the boost dc-dc converter using the DC Transformer model approach. Assume all elements to ideal in nature ***(05)***

5B. For a Buck converter, derive an expression for the critical value of load resistance (R_{crit}) which decides the mode of operation of the converter. ***(05)***