Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– I (OLD course)• EXAMINATION – SUMMER 2015

Subject Code: 714504 **Date: 16/05/2015**

Subject Name: Modeling and Analysis of Electric Machines

Time: 10:30 am to 1:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain energy and co-energy. Derive relationship for them if current and displacement as variables and flux linkage and displacement as variables. **07**

(b) The dimensions of the relay system are shown in figure 1B. The magnetic field intensity in the core material (Cast Steel) for a flux density of 1.0T is 670AT/m. The coil has 250 turns, and the coil resistance is 5 ohms. For a fixed air-gap length l_g = 4 mm, a dc source is connected to the coil to produce a flux density of 1 Tesla in the air-gap. Calculate The voltage of the dc source and the stored field energy. **07**

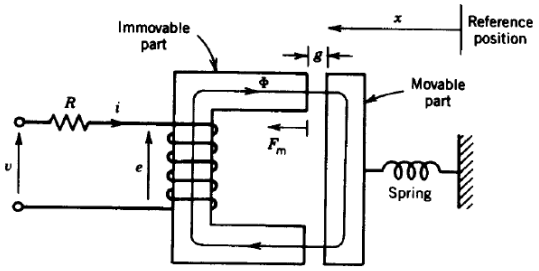

Fig. 1B Relay System

Q.2 **(a)** Derive voltage equation to represent two magnetically coupled circuits with leakage. Assume magnetic system to be linear. **07**

(b) Draw and explain torque speed characteristics of Permanent Magnet Brushless DC Machine. **07**

OR

(b) Derive voltage equations of salient pole synchronous machine in rotor reference frame variables. **07**

Q.3 **(a)** Explain the basic configuration of rotating electromagnetic system and derive the equation of field energy for linear magnetic system **07**

(b) Compare the Electromagnetic force and Electrostatic force and derive the expression of them for electro mechanical system having one electrical and one mechanical input. **07**

OR

Q.3 **(a)** Discuss the significance of reference frame theory used in the analysis of electrical Machine. Derive the transformation matrix Ks for transforming stationary circuit variables into to direct and quadratic axis variables. **07**

	(b)	Derive the transformation equation of stationary circuit variables having an element only into arbitrary reference frame.	**07**
Q.4	**(a)**	Derive winding inductances and voltage equations for two pole, three phase and star connected induction machines.	**07**
	(b)	Derive voltage and torque equations in machine variable for Permanent Magnet Brushless DC Machine.	**07**

OR

Q.4	**(a)**	Explain steady state analysis of three phase symmetrical induction machine. Derive the expression of stator voltage and rotor voltage in steady state condition.	**07**
	(b)	Explain starting operation of shunt connected DC machine supplied from a constant voltage source.	**07**
Q.5	**(a)**	Explain electromechanical energy conversion system in electric drives.	**07**
	(b)	The phases of a three phase circuit consist of equal resistance, inductance and capacitances are connected in parallel. The phases are not coupled. Write the current equation in the arbitrary reference frame.	**07**

OR

Q.5	**(a)**	Write a short note on Switch Reluctance Motor.	**07**
	(b)	Explain the working principle of Permanent Magnet Synchronous Machine. Discuss the different types of PMSM.	**07**

****