Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER I (OLD) – • EXAMINATION – SUMMER 2016

Subject Code: 714504N **Date:21/05/2016**

Subject Name: Modeling and Analysis of Electric Machines

Time:02:30 pm to 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.**

Q.1	**(a)**	Explain electromechanical energy conversion system used in electric drives.	**07**
	(b)	Derive an expression between energy and co-energy, where current and displacement are as variables in the system.	**07**
Q.2	**(a)**	Explain the computer simulation of symmetrical induction machine in stationary reference frame using appropriate block diagram.	**07**
	(b)	Derive voltage equations of salient pole synchronous machine in rotor reference frame variables.	**07**
		OR	
	(b)	Derive voltage equation to represent two magnetically coupled circuits with leakage. Assume magnetic system to be linear. Draw equivalent T- circuit with coil 2 as the reference coil.	**07**
Q.3	**(a)**	Explain the dynamic Performance of Permanent Magnet DC machine during starting.	**07**
	(b)	Derive voltage and torque equation of BLDC machine in rotor reference frame variables.	**07**
		OR	
Q.3	**(a)**	Explain the reference frame theory used in the analysis of electrical Machine in details. 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)**	Explain the procedure for transforming the variables of stator reference frame in to the synchronously rotating magnetic frame.	**07**
	(b)	Explain the significance of Perk's transformation in the analysis of any electrical 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)	Prove that for an electromagnetic system, the mechanical work done is equal to the area enclosed between the two magnetization curves at open and closed positions of the armature and the $\psi - i$ locus during the armature movement.	**07**
Q.5	**(a)**	Derive voltage equations for 2 pole, 3 phase and star connected induction machine.	**07**

	(b)	With the help of neat and clean diagram, explain the computer simulation of 3-phase synchronous machine into rotor reference frame.	**07**

OR

Q.5	**(a)**	Derive state equations for shunt connected DC machine.	**07**
	(b)	Explain the mathematical model of switch reluctance motor.	**07**

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