Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER-1 (NEW) EXAMINATION – WINTER 2016

Subject Code: 2714504 **Date:06/01/2017**

Subject Name: Modeling and Analysis of Electric Machines

Time: 2:30 pm to 5:00 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)**	Derive voltage and torque equation of salient pole synchronous machine in phase variable.	**07**
	(b)	For a singly excited magnetic system, derive the relation for the magnetic stored energy in terms of reluctance.	**07**
Q.2	**(a)**	Derive voltage equation to represent two magnetically coupled circuits with leakage. Assume magnetic system to be linear. Draw equivalent T-circuit with coil1 as the reference coil.	**07**
	(b)	Explain the computer simulation of three phase synchronous machine into rotor reference frame using suitable block diagram.	**07**
		OR	
	(b)	Explain the computer simulation of three phase symmetrical induction machine in balanced stator and rotor condition in arbitrary reference frame.	**07**
Q.3	**(a)**	Prepare time domain block diagram pertaining to DC series motor	**07**
	(b)	Draw and explain the steady state torque speed characteristic of a singly excited induction machine. Discuss the effect of frequency on the steady state torque speed characteristic.	**07**
		OR	
Q.3	**(a)**	Describe the dynamic performance of electromechanical system with necessary diagrams during step changes in supply voltage.	**07**
	(b)	Derive block diagram of shunt connected DC machine using dynamic equation. Find out transfer function of Wr(s)/Va(s) for shunt connected DC machine	**07**
Q.4	**(a)**	For a 4-pole, 3 phase symmetrical induction machine, derive the voltage equations in machine variables. Then, derive the expression for the electromagnetic torque in stator reference frame.	**07**
	(b)	Obtain the expression of torque in terms of flux linkages and d-q currents for Synchronous rotating reference frame.	**07**
		OR	
Q.4	**(a)**	Obtain the equivalent d-q model of induction machine in rotor reference frame. Support your answer with necessary diagrams.	**07**
	(b)	Write the voltage equations in the capacitive and resistive elements together. Determine the voltages in qd0 frame and hence obtain the impedance matrix into qd0 frame.	**07**
Q.5	**(a)**	Derive transformation matrix K_s for transforming a stationary circuit abc variable into d_s and q_s axis variables.	**07**
	(b)	Derive the steady state voltage equation for the 2 phase brushless DC machine.	**07**
		OR	
Q.5	**(a)**	Explain the mathematical model of switch reluctance motor.	**07**
	(b)	Derive the torque speed characteristics of PMBL machine and define common mode of operation.	**07**

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