## **GUJARAT TECHNOLOGICAL UNIVERSITY** ME - SEMESTER–I(New course)• EXAMINATION – WINTER- 2015

Subject Code: 2714504 Date: 04/0 Subject Name: Modeling and Analysis of Electric Machines			1/2016	
Tir	Time:2:30 pm to 5:00 pm Total Marks:			
Inst	ructio 1. 2. 3.	ons: Attempt all questions. Make suitable assumptions wherever necessary. Figures to the right indicate full marks.		
Q.1	(a)	Derive the expression of the electromagnetic force and electrostatic force for electromechanical system having one electrical and one mechanical input.	07	
	(b)	Derive equation for transformation between two reference frames.	07	
Q.2	(a)	The transformation of 2 phase set to the arbitrary reference frame is	07	
	(b)	Using the transformation given, express the voltage equation in the arbitrary reference frame for a 2 phase inductive circuit if $L_a = L_b = L$ . Develop equivalent circuit for steady state operation of a symmetrical induction machine with equation.	07	
	(b)	Develop equivalent circuit of a synchronous machine in the arbitrary reference frame with equation.	07	
Q.3	(a) (b)	Prepare time domain block diagram for DC. Shunt machine. Derive voltage equation to represent two magnetically coupled circuits with leakage. Assume magnetic system to be linear. Draw equivalent T-circuit with coil 1 as the reference coil.	07 07	
Q.3	(a)	Prepare time domain block diagram and derive state equation for permanent	07	
	(b)	magnet DC machine. Derive winding inductance and voltage equation for induction machine. Mention assumption made for derivation.	07	
Q.4	(a)	The parameter of a 5 H.P. DC shunt machine are $R_f = 120 \Omega$ , $L_{FF} = 120 H$ , $L_{AF} = 1.8 H$ , $R_a = 0.6 \Omega$ , $L_{AA} = 0.012 H$ , $V_a = V_f = 240 V$ . Calculate the steady state rotor speed $\omega_c$ .	07	
	(b)	Derive voltage and torque equation of salient pole synchronous machine in phase variable.	07	
Q.4	(a)	The voltage vector are defined as $V_{as} = \cos t$ , $V_{bs} = 2t$ and $V_{cs} = \sin t$ . Determine $V_{qd0s}$ in the stationary reference frame. Assume $t = \frac{\pi}{2}$ sec.	07	
	<b>(b</b> )	Explain the computer simulation of three phase synchronous machine into rotor reference frame using suitable block diagram.	07	
Q.5	(a)	Explain the mathematical model of switch reluctance motor.	07	

(b) Derive voltage and torque equations in machine variable for permanent magnet 07 brushless dc machine.

## OR

- Q.5 (a) Derive the torque speed characteristics of permanent magnet brushless dc 07 machine and define common mode of operation.
  - (b) Explain the working principle of Permanent Magnet Synchronous Machine. 07 Discuss the different types of PMSM.

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