Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E –Ist SEMESTER–EXAMINATION – JULY- 2012

Subject code: 714504N **Date: 11/07/2012**

Subject Name: Modeling & analysis of Electric Machines

Time: 2:30 pm – 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)**	What is field energy and co-energy for electromechanical system? Derive the expression of field energy and co-energy for an electromechanical system having one electrical and one mechanical input.	**07**
	(b)	Derive voltage equation of induction machine in machine variables with its constructional dimensions.	**07**
Q.2	**(a)**	For a doubly excited magnetic system, derive the relation for the magnetic stored energy in terms of reluctance.	**07**
	(b)	Transform the variables of stator reference frame into the synchronously rotating reference frame.	**07**
		OR	
	(b)	Develop equivalent circuit of a synchronous machine in the arbitrary reference frame.	**07**
Q.3	**(a)**	Write the voltage equations in the capacitive and resistive elements together. Determine the voltages in qd_o frame and hence obtain the impedance matrix into qd_o frame.	**07**
	(b)	A Resistor and inductor are connected in series, with R= 10 Ω and L= 100 mH. Determine energy stored in inductor Wes and energy dissipated by resistor Wel for t>0 , if I(0) = 100 A.	**07**
		OR	
Q.3	**(a)**	Explain the computer simulation of 3-phase, 2-pole, Y-connected salient pole synchronous machines.	**07**
	(b)	(i) Explain the reasons for transformation of machine variables in to different reference frames.	**04**
		(ii) Explain energy distribution in electromechanical system.	**03**
Q.4	**(a)**	Derive transformation matrix Ks for transforming a stationary circuit abc variable in to ds and qs axis variables.	**07**
	(b)	Explain generalized theory of rotating electrical machine and Kron's primitive machine	**07**
		OR	
Q.4	**(a)**	Explain angle of rotor and angle between rotors for synchronous machines.	**07**
	(b)	Explain the analysis of Switched Reluctance Motor.	**07**
Q.5	**(a)**	Explain the dynamic behavior of DC shunt machine when sudden change in load torque is applied.	**07**

	(b)	The input power to dc shunt motor during rated load is 100 W. the rotor speed is 2000 rpm and armature voltage 100 Volt. The armature resistance is 2 ohm and field resistance is 200 ohm. Calculate no load speed of motor.	**07**

OR

Q.5	**(a)**	Prepare time domain block diagram pertaining to DC series motor.	**07**
	(b)	Describe the dynamic performance of electromechanical system with necessary diagrams during step changes in supply voltage.	**07**

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