Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 1724501 Date:17/05/2016

Subject Name: Solid State AC Drives

Time:10:30 am to 01:00 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)**	Why do large induction motors sometimes cause a dip in the supply system voltage when they are switched direct-on-line? Explain in detail from power system point of view.	**07**
	(b)	Sketch a typical torque–speed curve for an induction machine, covering the range of slips from 2 to -1. Identify the motoring, generating and braking regions. Which quadrants of the torque–speed plane are accessible when an induction machine is operating from a constant voltage and constant frequency supply?	**07**
Q.2	**(a)**	Why is the harmonic content of inverter-fed induction motor current waveform less than the harmonic content of the voltage waveforms?	**07**
	(b)	An induction motor designed for operation from 420 V is supplied at 360 V instead. What effect will the reduced voltage have on the following: (a) the synchronous speed (b) the magnitude of the air-gap flux (c) the induced current in the rotor when running at rated speed (d) the torque produced at rated speed.	**07**
		OR	
	(b)	Express torque expression with stator and rotor fluxes of direct torque control of induction motor?	**07**
Q.3	**(a)**	Load decreases the severity of sixth harmonic torque pulsation in CSI fed induction motor drive. Explain the reasons for this.	**07**
	(b)	Give applications of rotor resistance control of induction motors with justification.	**07**
		OR	
Q.3	**(a)**	List the different applications of CSI drive and justify that why VSI cannot be used for such type of applications?	**07**

	(b)	A three-phase , 11.2 kW, 1750 rpm, 460 V, 60 Hz, four pole, Y-connected induction motor has the following parameters : Rs = 0.1W, Rr' = 0.38W, Xs = 1.14W, Xr' = 1.71W, and Xm = 33.2W. If the breakdown torque requiretment is 35 Nm, Calculate : a) the frequency of supply voltage, b) speed of motor at the maximum torque	**07**
Q.4	**(a)**	Variable frequency control of Induction Motor is more efficient than stator voltage control, Why? Variable frequency control of Induction Motor yields high torque to current ratio during starting. Why?	**07**
	(b)	Explain why winding inductance of CSI induction motor drive should be low as compared to that of VSI feed drive.	**07**
		OR	
Q.4	**(a)**	Compare brush and brushless excitation wound field synchronous machine drives.	**07**
	(b)	What is the difference between self-controlled and true synchronous mode of variable frequency control of synchronous motor? Why is self-controlled motor free from hunting?	**07**
Q.5	**(a)**	Explain basic principle of Vector Control of the induction motor. Also, give the difference between direct and indirect vector control.	**07**
	(b)	Explain indirect vector control of induction motor with slip and flux estimation from machine parameters.	**07**
		OR	
Q.5	**(a)**	What are the limitations of rotor resistance control of an Induction motor how slip power recovery method helps in improving the performance of Induction motor .	**07**
	(b)	Draw the block diagram of open loop v/f speed control of multiple PM synchronous motors.	**07**

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