Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 710709N **Date:23/11/2016**

Subject Name: Electrical Drives (Power Electronics Group)

Time:10:30 am to 1:00 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)**	Draw and explain block diagram of an electric drive and significance of each block.	**07**
	(b)	Explain the various components of the load torque with suitable example and their effect on requirements of an electric drive.	**07**
Q.2	**(a)**	A separately excited DC machine is fed from a 1-phase half controlled rectifier bridge. Draw the waveforms representing the output voltage and current of the converter (inputs to machine) when the machine is operating in Motoring mode. Discuss these modes in brief.	**07**
	(b)	Draw and explain the speed-torque characteristics of a 3-phase fully-controlled rectifier drive. Also find the expression for no-load speed. List the assumptions if any.	**07**
		OR	
	(b)	Explain the non-simultaneous control mode operation of a dual converter. Hence, discuss the four quadrant closed-loop control of a DC separately excited motor employing the dual converter.	**07**
Q.3	**(a)**	Which harmonics are dominant in the output voltage of a six-step inverter? Discuss the effects of these harmonics on the performance of an induction machine fed from a six-step inverter.	**07**
	(b)	Explain Mode-V (conventional) and Mode-VII (with controlled fly wheeling) operation of 1-phase fully controlled rectifier-fed separately excited motor for regenerative braking action.	**07**
		OR	
Q.3	**(a)**	Explain AC-AC converter based three phase induction motor speed control.	**07**
	(b)	Explain semiconductor converter based controlled dynamic braking and composite braking of DC motor.	**07**
Q.4	**(a)**	For voltage source inverter variable frequency drives, explain open loop variable frequency PWM inverter drive with dynamic braking.	**07**
	(b)	Derive the expression of speed for time ratio control (TRC) using steady state analysis for chopper controlled DC separately excited motor. Explain its benefits and limitations.	**07**
		OR	
Q.4	**(a)**	Justify the following statement: "The voltage source fed induction motor can be operated with open-loop control while the current source fed induction motor is usually operated in closed-loop control." Also, draw the speed torque characteristics of an induction motor (i) when fed by voltage source and (ii) when fed by current source. For these two cases, comment on the location of the operating points on these characteristics to achieve optimum performance.	**07**
	(b)	Explain the use of induction motors in fan and pump drives applications and derive expression for ratio of maximum to rated motor current.	**07**

Q.5	**(a)**	Write a brief note on Static Scherbius drive.	**07**
	(b)	Write a brief note on braking methods for synchronous motor.	**07**

OR

Q.5	**(a)**	How can one get the motoring and regenerative braking with an Induction motor fed from a six-step voltage source inverter? Show the various schemes by which it can be achieved. Also, show the phase voltage and phase current waveforms under motoring and braking conditions.	**07**
	(b)	Derive the performance equations of a wound field cylindrical rotor synchronous motor operating from a source having constant voltage and constant frequency.	**07**

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