Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VI (NEW SYLLABUS) EXAMINATION- SUMMER 2017

Subject Code: 2160913 **Date: 08/05/2017**

Subject Name: Control of Electric Drive

Time:10:30AM to1:00PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 Short Questions **14**

1 An equilibrium point will be _____ when an increase in speed causes load torque to exceed the motor torque. (stable/unstable)

2 Problem of fluctuating loads are overcome by mounting a flywheel on the motor shaft in reversible drives. (True/False)

3 The phase controlled rectifiers used in speed control of dc motors to convert fixed ac supply voltage into

(a) Variable dc output voltage
(b) Variable ac output voltage
(c) Variable frequency ac output voltage
(d) Full rectified ac output voltage

4 A dc motor drive supplied by fully controlled rectifier can operate in

(a) Forward motoring and forward braking mode
(b) Forward motoring and reverse braking mode
(c) Reverse motoring and reverse braking mode
(d) Reverse motoring and forward braking mode

5 A single phase , bridge type , full converter can be used for regenerative braking of a dc motor drive

(a) With change over switch (b) Without any additional device
(c) By open circuiting the field (d) By making firing angle = $\pi/2$

6 For a single phase ac to dc controlled rectifier to operate in regenerative mode, the condition satisfied should be

(a) Half controlled bridge, $\alpha < 90$, source of emf in load
(b) Half controlled bridge, $\alpha > 90$, source of emf in load
(c) Full controlled bridge, $\alpha > 90$, source of emf in load
(d) Full controlled bridge, $\alpha < 90$, source of emf in load

7 In a chopper fed dc drive variable voltage output can be obtained by

(a) Varying the 'on' and 'off' time ratio
(b) Adjusting the wave shape
(c) Using a saturable core reactor in series with motor
(d) None of above

8 _____quadrant chopper is used for both forward motoring and regenerative braking.

9 In a chopper fed dc drive, the chopping frequency is approximately equal to

(a) 50 Hz (b) 300 Hz
(c) 1000 Hz (d) 5000 Hz

10 In ac motor control, the ratio of voltage to frequency is maintained constant

(a) To maximize magnetizing current
(b) To minimize magnetizing current
(c) To maximize the current drawn from the supply to provide torque
(d) To provide maximum pull out torque

11 The operation of an inverter fed induction motor can be shifted from motoring to regenerative braking by

(a) Reversing phase sequence
(b) Increasing inverter voltage
(c) Decreasing inverter frequency
(d) Increasing inverter frequency

12 In a 3-ϕ voltage source inverter operating in square wave mode, the output line voltage is free from

(a) 3rd harmonics (b) 7th harmonics
(c) 11th harmonics (d) 13th harmonics

13 In stationary reference frame, the frame speed ω=_____

14 Rotor flux oriented vector control gives natural decoupling effect. (True/False)

Q.2	**(a)**	State the classification of load torques.	**03**
	(b)	Draw and explain block diagram of electric drives.	**04**
	(c)	Explain the four quadrant operation of electrical drive for hoist load.	**07**
		OR	
	(c)	Explain basic structure of solar and battery operated drives.	**07**
Q.3	**(a)**	A 200V, 875 rpm 150A separately excited dc motor has an armature resistance of 0.06 Ω. It is fed from a single phase fully controlled rectifier with an ac source voltage of 220 V, 50 Hz. Assuming continuous conduction, calculate motor speed for firing angle α = 160° and rated torque.	**03**
	(b)	Explain chopper controlled DC motor drive operation for motoring mode.	**04**
	(c)	Derive basic modeling of DC motor with necessary assumptions. Draw block diagram from the derived functions.	**07**
		OR	
Q.3	**(a)**	A 200V, 875 rpm 150A separately excited dc motor has an armature resistance of 0.06 Ω. It is fed from a single phase fully controlled rectifier with an ac source voltage of 220 V, 50 Hz. Assuming continuous conduction, calculate firing angle for rated motor torque and 750 rpm.	**03**
	(b)	Explain operation of doubly fed induction machine in super synchronous mode.	**04**
	(c)	Discuss operation of dual converter in simultaneous and non-simultaneous controlling mode.	**07**
Q.4	**(a)**	State application of synchronous motor drive.	**03**
	(b)	Write advantages of traction drives.	**04**
	(c)	Discuss significance of v/f control of induction motor. Discuss motor characteristics in constant torque and constant power region.	**07**
		OR	
Q.4	**(a)**	Write advantages of BLDC motor over conventional dc motor.	**03**
	(b)	Describe difference between scalar and vector control method of electrical drive.	**04**
	(c)	Explain Constant airgap flux control scheme for induction motor drives.	**07**
Q.5	**(a)**	Explain the vector control principle for AC motor drive.	**03**
	(b)	Compare direct torque control method and field oriented control method.	**04**
	(c)	Develop the d-q model of Induction Motor in arbitrary reference frame.	**07**
		OR	
Q.5	**(a)**	Explain drive parameter loads with rotational motion.	**03**
	(b)	Discuss the voltage flux estimator employed in direct vector control.	**04**
	(c)	Explain the direct vector control of an induction motor with necessary diagram.	**07**

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