Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem (Even) Examination May-2022

EE3CO25 / EX3CO25

Fundamentals of Industrial Electrical Drives

Programme: B.Tech. Branch/Specialisation: EE/EX

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. A four-quadrant operation requires- **1**

(a) Two full converters in series.
(b) Two full converters connected in parallel.
(c) Two full converters connected in back-to-back.
(d) Two semi converters connected in back-to-back.

ii. _____ drive is also called as Line shaft drive. **1**

(a) Individual drive (b) Multi-motor drive
(c) Group Drive (d) None of these

iii. High braking torque produced in- **1**

(a) Plugging (b) Dynamic braking
(c) Regenerative braking (d) None of these

iv. Type-A chopper is used for obtaining which type of mode? **1**

(a) Motoring mode (b) Regenerative braking mode
(c) Reverse motoring mode (d) Reverse regenerative braking mode

v. The speed and torque of induction motor can be varied by which of the following means? **1**

(a) Stator voltage control (b) Rotor voltage control
(c) Frequency control (d) All of these

vi. Variable speed drive using stator voltage control are normally- **1**

(a) Open loop system (b) Closed loop system
(c) Both (a) and (b) (d) None of these

vii. The maximum value of torque angle a in a synchronous motor is ..... degrees electrical. **1**

(a) 45 (b) 90
(c) Between 45 and 90 (d) Below 60

P.T.O.

viii. As the speed of an alternator increases, the frequency- **1**
(a) Remains constant
(b) Decreases
(c) Increases
(d) May increases or decreases depending on the power factor

ix. Programmable controllers are widely used in _____ control of industrial drive. **1**
(a) Positioning (b) Torque
(c) Motion (d) All of these

x. Which of the following statements is NOT correct? **1**
(a) If a problem in a PLC module occurs, the module can be changed in a matter of minutes without any changes in wiring.
(b) Outputs can be paralleled on the same rung.
(c) The physical wires between the input and output field devices and the PLC input and output modules are the only signal wires required in the PLC system.
(d) The size of PLCs has increased significantly in the last 10 years.

Q.2 i. Define electric drives What are the different factors for the selection of electrical drives? **3**
ii. Explain the concept of constant power and constant torque drives. **7**
OR iii. What does the steady state stability criterion mean? Explain in detail referred to motor dynamics. **7**

Q.3 i. Compare dynamic and regenerative braking for separately excited DC motor. (Any three). **3**
OR ii. Explain the operation of single phase fully controlled converter fed separately excited DC motor drive. **7**
iii. Describe the four-quadrant chopper fed DC separately excited motor with the help of diagrams. **7**

Q.4 i. What are the advantages and disadvantages (three each) of rotor resistance control? **3**
ii. Describe PWM Control comparison of VSI and CSI feed Induction motor drive operation. **7**
OR iii. Describe static Kramer drive control of IM from rotor side with closed loop schemes. **7**

Q.5 i. Draw the closed loop operation of synchronous motor drive. Give any two application of CSI fed synchronous motor. **3**
ii. Discuss the load commutated CSI fed synchronous motor operation with relevant waveform and speed torque characteristics. **7**
OR iii. Explain separate and self-controlled mode of operation of synchronous motor. **7**

Q.6 i. Write any three advantages of PLC based Industrial Drive Control. **3**
ii. Draw the architecture of Programmable logic controller and explain it in detail. **7**
OR iii. Explain the basic configuration of PLC system used in Industrial Drive Control. **7**

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Marking Scheme

EE3CO25 / EX3CO25 Fundamentals of Industrial Electrical Drives

Q.1	i.	A four-quadrant operation requires- (c) Two full converters connected in back-to-back.		**1**
	ii.	_____ drive is also called as Line shaft drive. (c) Group Drive		**1**
	iii.	High braking torque produced in- (a) Plugging		**1**
	iv.	Type-A chopper is used for obtaining which type of mode? (a) Motoring mode		**1**
	v.	The speed and torque of induction motor can be varied by which of the following means? (d) All of these		**1**
	vi.	Variable speed drive using stator voltage control are normally- (c) Both (a) and (b)		**1**
	vii.	The maximum value of torque angle a in a synchronous motor is ..... degrees electrical. (b) 90		**1**
	viii.	As the speed of an alternator increases, the frequency- (c) Increases		**1**
	ix.	Programmable controllers are widely used in _____ control of industrial drive. (d) All of these		**1**
	x.	Which of the following statements is NOT correct? (d) The size of PLCs has increased significantly in the last 10 years.		**1**
Q.2	i.	Definition of electric drives	1.5 marks	**3**
		Different factors for the selection	1.5 marks	
	ii.	Concept of constant power	3.5 marks	**7**
		Constant torque drives	3.5 marks	
OR	iii.	Steady state stability criterion means	2 marks	**7**
		Motor dynamics	5 marks	
Q.3	i.	Any three comparisons dynamic and regenerative braking		**3**
		1 mark for each	(1 mark * 3)	
OR	ii.	Operation of single phase fully controlled converter	3 marks	**7**
		Diagram	2 marks	
		Waveforms	2 marks	
	iii.	Four-quadrant chopper fed DC separately excited motor		**7**
			5 marks	
		Diagrams	2 marks	
Q.4	i.	Any three advantages of rotor resistance control	1.5 marks	**3**
		Any three disadvantages of rotor resistance control	1.5 marks	
	ii.	PWM Control comparison of		**7**
		VSI feed Induction motor drive operation	3.5 marks	
		CSI feed Induction motor drive operation	3.5 marks	
OR	iii.	Static Kramer drive control of IM from rotor side with closed loop schemes	5 marks	**7**
		Diagram	2 marks	
Q.5	i.	Closed loop operation of synchronous motor drive	2 marks	**3**
		Any two application of CSI fed synchronous motor	1 mark	
	ii.	Load commutated CSI fed synchronous motor	3 marks	**7**
		Operation with waveform	2 marks	
		Speed torque characteristics	2 marks	
OR	iii.	Separate mode of operation of synchronous motor	3.5 marks	**7**
		Self-controlled mode of operation of synchronous motor	3.5 marks	
Q.6	i.	Any three advantages of PLC based Industrial Drive Control		**3**
		1 mark for each	(1 mark * 3)	
	ii.	Architecture of Programmable logic controller	3 marks	**7**
		Explanation	4 marks	
OR	iii.	Configuration of PLC system	5 marks	**7**
		Diagram	2 marks	

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