Question Paper

Exam Date & Time: 01-Dec-2022 (09:00 AM - 12:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FIFTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, NOV - DEC 2022

CONTROL SYSTEM COMPONENTS [ICE 3151]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1)		A 60 Hz, 3-pole induction motor with star connected rotor has an induced emf of 115 Volts between the slip rings at standstill, the impedance of 1.3 + 4.5j Ohms/phase and rheostat impedance of 2 + 1.4j ohms/phase. Compute:	(4)
	A)	1. Rotor current at standstill with rheostat in the circuit. 2. Rotor current when slip rings are short-circuited and the motor is running with a slip of 2.5%. 3. Torque under running conditions. [CO1, PO1, PO6, BL:3]	
	B)	A thyristor-based drive circuit is designed to control the speed of a DC motor by using the back emf. With a neat circuit diagram and waveforms, explain the working of the drive circuit. [CO1, PO1, PO2, BL:2]	(3)
	C)	How is a Tachogenerator different from a conventional generator? With a neat diagram, describe the working of tachogenerator. [CO1, PO1, PO2, BL:2]	(3)
2)		Describe the working of an electronic valve positioner with a block diagram. Also, state four advantages of using an electronic valve positioner. [CO2, PO1, PO6, BL:2]	(5)
	A)		
	B)	With the help of a pressure profile diagram, explain the development of flashing and cavitation in a control valve. [CO2, PO1, PO6, BL:3]	(3)
	C)	Maximum flow rate of an equal percentage control valve is $10m^3/h$. if the valve has a turndown of 50:1 and is subjected to constant differential pressure, calculate the quantity of flow passing through the valve with a lift of 50%.[CO2, PO1, PO6, BL:3]	(2)
3)		Illustrate with the help of an application block diagram, the working of a force balance instrument. [CO3, PO1, PO2, BL:2]	(4)
	A)		
	B)	Draw graphical symbols of the following linear actuators. a. Single acting cylinder with spring return b. Double acting cylinder with single piston rod c. Telescopic cylinder - double acting. [CO3, PO1, PO6, BL:1]	(3)
	C)	Describe the three types of gear trains with neat sketches. [CO3, PO1, PO2, BL:1]	(3)

4)		With the help of a neat sketch, describe the features of closed-cam follower systems. Also, explain two automobile applications of cams and followers. [CO4, PO1, PO6, BL:3]	(4)
	A)		
	B)	In the pulp and paper manufacturing industry, a pump is required to pump back liquor into the process. Identify the pump which can be used to perform this activity with reasons. Also, explain the working principle of the pump identified (note - the pump can run dry for a short period). [CO4, PO1, PO6, BL:3]	(4)
	C)	Draw the piping and instrumentation diagram of the following: a. Electrical Signal b. Hydraulic Signal c. Gate Valve d. Check Valve. [CO4, PO1, PO2, BL:1]	(2)
5)		Explain different modes of operation of a variable reluctance stepper motor. [CO5, PO1, PO2, BL:2]	(4)
	A)		
	B)	Discuss the working principle of a linear induction motor. State two advantages and two applications of a linear induction motor. [CO5, PO1, PO2, BL:1]	(3)
	C)	With the help of a neat diagram, explain the working of ring laser gyroscope. [CO5, PO1, PO2, BL:1]	(3)

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