Question Paper

Exam Date & Time: 06-Jan-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FIFTH SEMESTER B.TECH END SEMESTER MAKE-UP EXAMINATION, DEC 2022/JAN 2023

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) Describe the three characteristics of a DC motor [CO1, PO1, PO2, BL:2]. (3)

A)

B) A thyristor-based drive circuit is designed to control the speed of a DC motor by using a resistive and an inductive load. With a neat circuit diagram and waveforms, explain the working of the drive circuit [CO1, PO1, PO2, BL:2]. (3)

C) 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)

1. Rotor current at standstill with rheostat in the circuit.
2. Rotor current when slip rings are short-circuited and motor running with slip of 2.5%.
3. Torque under running conditions [CO1, PO1, PO6, BL:3]

2) Identify the type of control valve that is very safe to be used in the petrochemical industry. Explain its working with the help of a neat diagram [CO2, PO1, PO6, BL:2]. (4)

A)

B) Explain the development of flashing and cavitation in a control valve with the help of pressure profile diagrams [CO2, PO1, PO6, BL:2]. (4)

C) Explain the limitations of valve positioner [CO2, PO1, PO6, BL:1]. (2)

3) Illustrate with the help of an application block diagram, the working of a motion balance instrument [CO3, PO1, PO2, BL:2]. (4)

A)

B) Sketch the graphical symbols of the following linear actuators. (3)

a. Double acting cylinder- variable cushion on both sides

b. Double acting cylinder with a piston rod on both sides

c. Telescopic cylinder [CO3, PO1, PO6, BL:1].

C) Explain the concept of backlash in gears with a supporting diagram. State any one advantage and disadvantage of gear backlash [CO3, PO1, PO2, BL:1]. (3)

4)		With the help of a neat sketch, describe the features of knife edge follower and flat face follower. Also, explain any two important applications of cam and follower system [CO4, PO1, PO6, BL:3].	(4)
	A)		
	B)	Name the type of gear pump that needs a clear fluid as a medium and has a limitation of unbalanced side load on its bearing while operation. Also, explain the working principle of the same gear pump [CO4, PO1, PO6, BL:2].	(3)
	C)	Explain the operating principle of a tandem cylinder with an example [CO4, PO1, PO2, BL:1].	(3)
5)		With a neat diagram, describe the construction and working of the reluctance motor. Also, state any two advantages of this motor [CO5, PO1,PO2, BL:2].	(4)
	A)		
	B)	How is a hybrid stepper motor different from VR stepper motor? Describe the working principle of the hybrid stepper motor [CO5, PO1, PO2, BL:2].	(3)
	C)	Discuss the working of a gyroscope that operates on the principle of the Coriolis effect with a diagram [CO5, PO1, PO2, BL:1].	(3)

-----End-----