

# CBCS SCHEME

USN

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18MT731

## Seventh Semester B.E. Degree Examination, Jan./Feb. 2023 Automation in Process Control

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions, choosing ONE full question from each module.**

### Module-1

- 1 a. Explain in detail about Final control operation with the help of block diagram. (10 Marks)  
 b. What is control system? Draw the block diagram of a physical control system shown in Fig Q1(b).

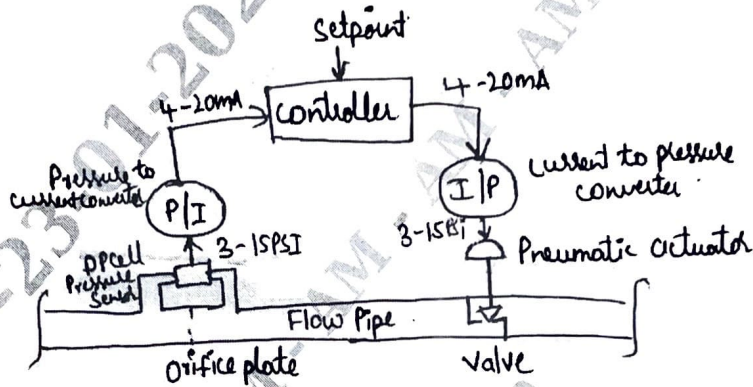


Fig Q1(b)

(10 Marks)

OR

- 2 a. With a neat block diagram, explain process control system. (06 Marks)  
 b. i) Find the working force resulting from 200N, that is applied to a 1-cm radius forcing piston, if the working piston has a radius of 6cm  
 ii) Also find hydraulic pressure. (07 Marks)  
 c. A pressure difference of 1.1Psi occurs across a constriction in a 5cm diameter pipe. The constriction constant is  $0.009 \text{ m}^3/\text{s per K pa}^{1/2}$ . Find :  
 i) The flow rate in  $\text{m}^3/\text{s}$  ii) The flow velocity in  $\text{m/s}$ . (07 Marks)

### Module-2

- 3 a. Explain in detail about control system parameters. (10 Marks)  
 b. A liquid – level control system linearly converts a displacement of 2 to 3m into a 4 to 20mA control signal. A relay serves as the two position controller to open or close an inlet valve. The relay closes at 12mA and opens at 10mA. Find  
 i) The relation between displacement level and current  
 ii) The neutral zone or displacement gap in meters. (10 Marks)

OR

- 4 Draw the output in the three mode controller, when the error is changing as shown in Fig Q4. When  $K_p = 5$ ,  $K_I = 0.7/\text{s}$ ,  $K_d = 0.5\text{s}$ ,  $P_o = 20\%$

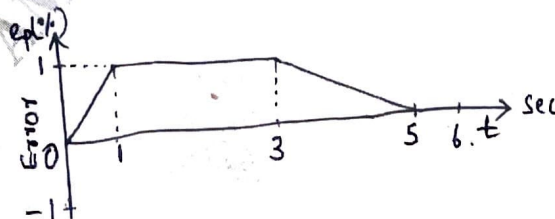


Fig Q4

(20 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8 = 50, will be treated as malpractice.

Module-3

- 5 a. With a neat diagram, explain discrete state process control. (08 Marks)  
 b. Explain how a discrete state process can be described in terms of the objectives and hardware of the process with example. (12 Marks)

OR

- 6 a. In an application of the Ziegler-Nichols method a process begins oscillation with a 30% proportional band in an 11.5 – min period. Find the nominal three mode controller setting. (08 Marks)  
 b. A process requires adjustments of setpoint to increase production. A particular sequence must be followed to provide the increase. SP1, SP2, SP3 are the set points, P and PCR are the pressure and a critical pressure respectively and T and TCR are the temperatures and critical temperature respectively. Develop a flowchart that increase the setpoint as follows :
1. Increase SP1 by 1%.
  2. Wait 10s, test for pressure compared to critical.
  3. If the pressure is less than critical then
    - a. Decrease SP2 by  $\frac{1}{2}\%$
    - b. Increase SP3 by  $\frac{1}{4}\%$
    - c. Wait for  $T < TCR$ .
    - d. Increase SP2 by 1%
    - e. Go to step 2
  4. If the pressure is above critical
    - a. Decrease SP1 by  $\frac{1}{2}\%$
    - b. Decrease SP2 by  $\frac{1}{4}\%$
    - c. Go to step 2.
- (12 Marks)

Module-4

- 7 a. Explain two position controller with neutral zone made from OPAMP's and a comparator and also draw the characteristic in terms of voltage. (10 Marks)  
 b. A controller is shown in Fig Q7(b) with scaling so that 0-10V corresponds to a 0-100% output. If  $R_2 = 10K\Omega$  and full scale error rang is 10V, find the values of  $V_0$  and  $R_1$  to support of 20% proportional band about a 50% zero error controller output.

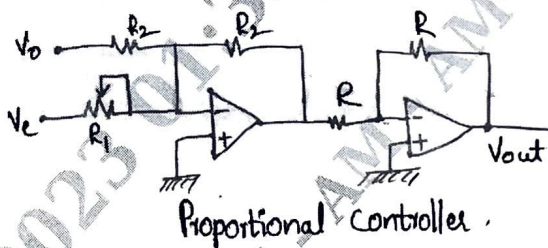


Fig Q7(b)

(10 Marks)

OR

- 8 a. Explain Derivative mode Electronic control also draw a practical derivative mode OPAMP controller. (10 Marks)  
 b. Suppose a proportional pneumatic controller has  $A_1 = A_2 = 5cm^2$ ,  $x_1 = 8cm$  and  $x_2 = 5cm$ . The input and output pressure ranges are 3 to 15 Psi. Find the input pressure that will drive the output from 3 to 15 Psi. The setpoint pressure is 8Psi and  $P_o = 10Psi$ . Find proportional band. (10 Marks)

Module-5

- 9 a. What is meant by V-F converter? Explain charge Balancing VFC with neat diagram. (10 Marks)  
 b. Explain Dual slope ADC with neat circuit and waveforms. (10 Marks)
- OR
- 10 a. Explain 4-bit R-2R Resistive Ladder DAC, with circuit diagram and equations. (10 Marks)  
 b. With a neat circuit diagram, explain Flash Converter ADC. (10 Marks)

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