53 (IE 601) PRCN

2012C
2013
(May)

PROCESS CONTROL

Paper : IE 601

Full Marks : 100

Pass Marks : 30

Time : Three hours

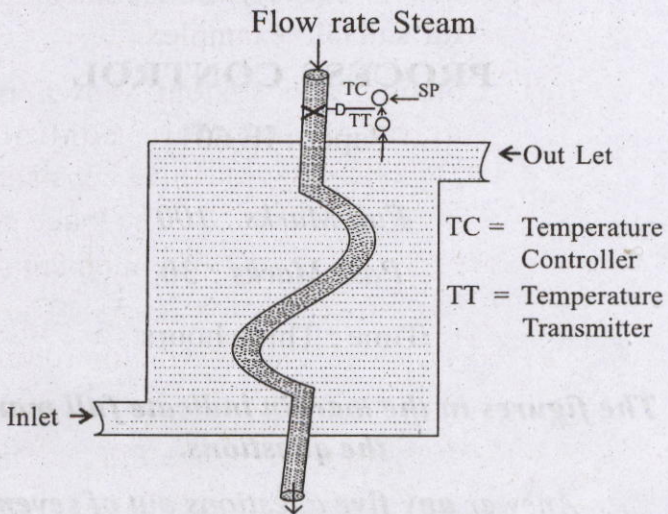*The figures in the margin indicate full marks for the questions.*

*Answer **any five** questions out of **seven**.*

1. (a) What are the advantages of automatic process control ?   4

   (b) A closed loop control system is used to accurately position components in a production operation. The amplifier-Valve positioner part of the system provides 10 *mm* of displacement per 1 *mv* change in input. The feedback element provides 0·01 *mv* per *mm* change in displacement. What will be the instantaneous error signal
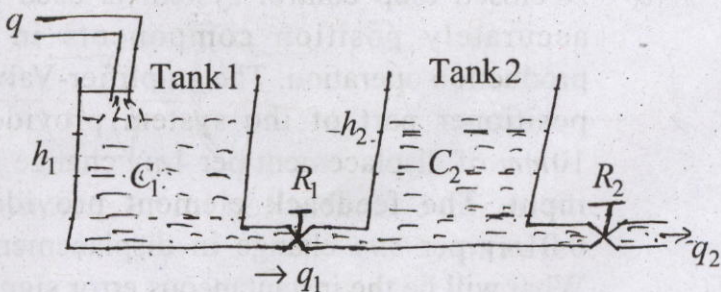
when reference signal is suddenly changed by 10 *mv* ?   4

(c) Find the process variables for the system given below?   4

Flow rate Steam

TC = Temperature Controller

TT = Temperature Transmitter

←Out Let

Inlet →

(d) For the level process shown in below Fig. derive the transfer function $H_2(S)/Q(S)$ 8

2. (a) What is the difference between continuous and batch process system ? 4

(b) Give the equation to find degree of freedom and chemical degree of freedom. 2

(c) What is two-position control ? Explain with suitable example. 4

(d) Consider the system shown in below figure. An armature controlled DC servomotor drives a load consisting of the moment of inertia J_L. The toque developed by the motor is T. The moment of inertia of the motor rotor is J_M. The angular displacement of the motor rotor and the load element are θm and θ respectively. The gear ratio is $n = \theta/\theta_M$. Obtain the transfer function $\theta(S)/E_i(S)$. 10
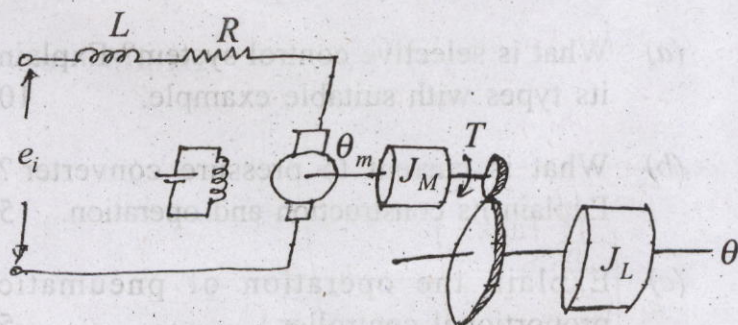
Armature-Controlled dc Servomotor system.

3. (a) Write short notes on the following :
   (i) PID Controller
   (ii) 1/4 Decay ratio
   (iii) Zieglar -Nichol's method of Tunning.

   $5 \times 3 = 15$

   (b) Find the work force resulting from 250N applied to a 1.25 *cm* radius forcing piston in a hydraulic actuator (i) If the working piston has a radius of 10 cm. Then (ii) Find the hydraulic pressure.　　　5

4. (a) Explain the purpose of cascade control for heat exchanger, with neat sketch.　　10

   (b) What is ratio control? Explain with an example.　　　10

5. (a) What is selective control system? Explain its types with suitable example.　　10

   (b) What is current to pressure converter ? Explain its construction and operation.　5

   (c) Explain the operation of pneumatic proportional controller.　　　5

6. (a) Give *two* examples of electrical actuators. 10

(b) What are the inherent characteristics of a control valve ? 6

(c) Find the proper valve size in inches and centimeter for pumping a liquid flow rate of 600 *gal/min* with a maximum pressure difference of 55 *psi*. The liquid specific gravity is 1·3. 4

7. Discuss about the following : 4×5

(a) Heat Exchanger

(b) Drying

(c) Evaporating

(d) Mixing.

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