53 (IE 605) PRIN

2017

PROCESS INSTRUMENTATION AND CONTROL

Paper : IE 605

Full Marks : 100

Time : Three hours

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

*Answer **any five** questions from **seven**.*

1. *(a)* Using block diagram reduction technique find closed loop transfer function of the system whose diagram is shown in *Figure* : 01.   10
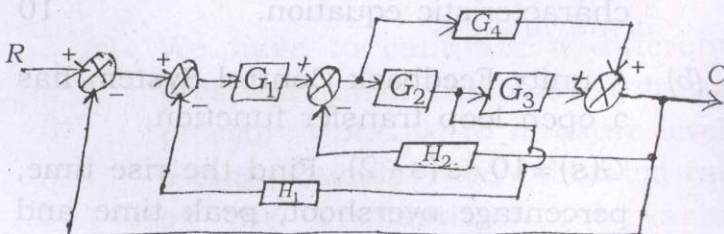

Figure : 01

(b) Derive the transfer function $H(s)/Q(s)$ for the liquid level system shown in *Figure* : 2 [H and Q are the deviation variables in 'h' and 'q' respectively].
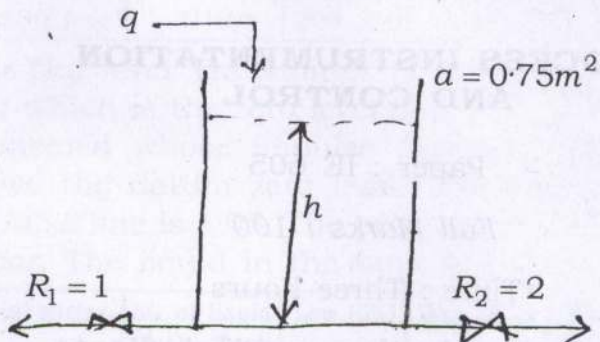
10

Figure : 2

2. (a) By Routh Stability Criterion determine the stability of the system represented by the characteristic equation,

$$9s^5 - 20s^4 + 10s^3 - s^2 - 9s - 10 = 0 \cdot$$

Comment on the location of roots of characteristic equation. 10

(b) A unity Feedback Control System has a open loop transfer function,

$G(s) = 10/s(s+2)$. Find the rise time, percentage overshoot, peak time and settling time. 10

3. *(a)* Explain the measurement of level using guided wave radar technology. **10**

    (b) Distinguish between RTD, Thermistor and Thermocouple. **10**

4. *(a)* Discuss in detail about the Density Measurement techniques used in Food industries. **10**

    (b) Write short notes on Pneumatic relay and Flapper nozzle system. **10**

5. *(a)* Write short notes on inherent characteristics of valve. **6**

    (b) An equal percentage valve has a maximum flow of $50 m^3/sec$ and a minimum of $1{\cdot}8 m^3/sec$. If the full travel is $6 cm$, find the flow at a $3 cm$ opening. **4**

    (c) We have to calibrate a differential pressure transmitter using hydrostatic pressure principle to measure level of a tank. Calculate the calibrated range of the Transmitter for various installation A_1 & B_1

$A_1 =$

Transmitter	SG of liquid in the Tank	Low (0%)	High (100%)	Calibration range
at 0 level	1·10	0 mm	1000 mm	
at−500 level	1·10	200 mm	1000 mm	

$B_1 =$ The level Transmitter is connected at one end which is the zero level and the other end is connected whose impulse tapping is 1300 mm above the datum zero lead. The liquid in this impulse line is 1·05. The pressure in the tank is 3 *bar*. The liquid in the tank has SG=1·10

Transmitter	SG of liquid in the Tank	Low (0%)	High (100%)	Calibration range
at 0 level	1·10	200 mm	1000 mm	
at 100 level	1·10	100 mm	1000 mm	

10

6. *(a)* Design and derive the gain of pneumatic PI controller.   10

   (b) Obtain the response of P, I & D controller for a step change in input and explain its advantages and disadvantages.   10

7. *(a)* What is pitot tube and explain how to calculate flow using it.   10

   (b) Draw P & ID diagram for closed loop temperature control in batch dryer and explain it.   10