53 (IE 605) PRIC

2014

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 out of seven.*

1. *(a)* What are the blocks in the Instrumentation System ? 2

(b) Why process control is needed in Industries ? 3

(c) Define the terms — process variables and process elements. Explain it with suitable example. 5

(d) What is performance characteristics of Instruments ? Explain the dynamic performance characteristics. 10

2. *(a)* How the Electrical Instruments are classified and what are its types ? 8

(b) Find the working force resulting from $350N$ applied to a $2cm$ radius forcing piston, if the working piston has a radius of $9cm$ 4

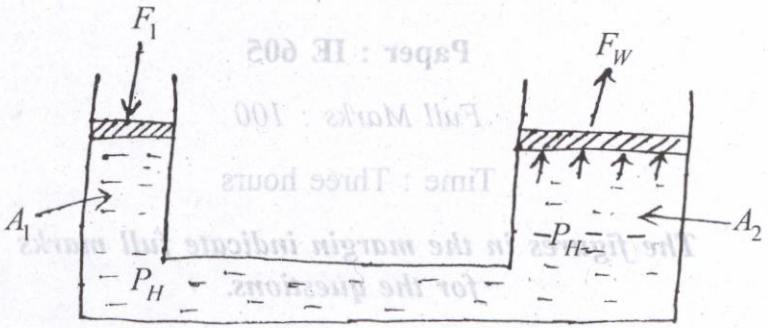

Fig : 1

(c) What are the Electrical Actuators and brief the construction and working principle of I/P convertor ? 8

3. *(a)* What are the different control actions ? Derive its Transfer Function and discuss its advantages and disadvantages ? 10

(b) Draw the model and derive the transfer function for proportional controller in Both Electronic and Pneumatic System. 10

4. Write short note on the following : 5×4=20

(a) Thermocouple

(b) Ionisation gauge

(c) Head Flow Meter

(d) Bubbler *(or)* Purge system level measurement system.

5. *(a)* What is heat Exchanger and Dryer ? Explain its type with neat sketch. 8

(b) An electrical resistance bulb is made of platinum wire, its resistance at $0°C$ is $100 Ohms$. Determine its value at $-150°C$ and $+350°C$ (Assume the Mean Temperature Coefficient $\alpha = 0 \cdot 385 \times 10^{-12} \, Ohm/°C$) 4

(c) Distinguish between interactive and non interactive system. 4

(d) Derive the Transfer Function $H(S)/Q(S)$ for the liquid level system shown in *Fig : 2* [H and Q are the deviation variables in 'h' and 'q' respectively] 4

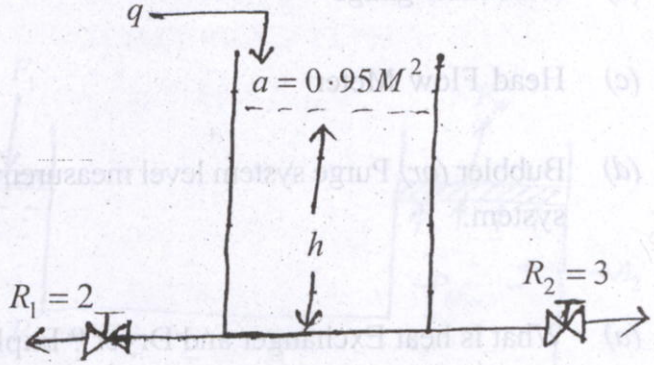

Fig : 2

6. The signal flow graph for a feedback control system is shown in *Fig : 3*. Determine the closed loop transfer function $C(S)/R(S)$ 20

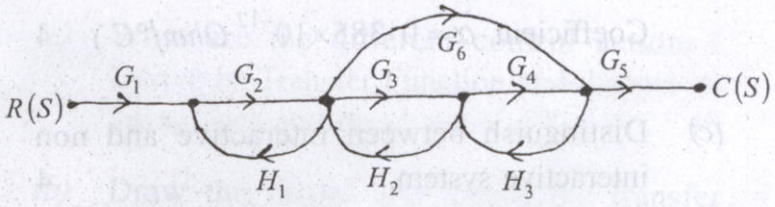

Fig : 3

7. *(a)* Derive the Transfer Function and draw the response of undamped second order system for unit step input. 5

(b) Using routh criterion determine the location of the roots of the given characteristic equations and comment on the stability of the system. 5

(c) Write short note on Zigler Nicholas Controller. 5

(d) For a unity Feedback Control System the open loop Transfer Function, $G(S)=\frac{5(S+1)}{S^2(S+2)}$.

Find *(i)* The position, velocity and acceleration error constant

(ii) The steady state error when the input is $R(S)$, where

$R(S)=2/S-1/S^2+1/2S^3$ 5
