2012 C
2013
(May)

PROCESS INSTRUMENTATION AND CONTROL

Paper : IE 605

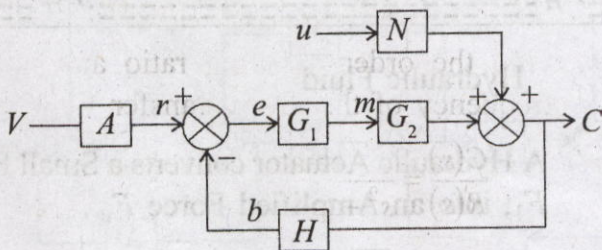*Full Marks : 100*
Pass Marks : 30

Time : Three hours

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

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

1. (a) Why process control is needed in Industry ?
        3

    (b) What are the process variables?   3

    (c) In the given block diagram list out the process variables and process elements.   4

(d) What is performance characteristics of Instruments ? 4

(e) Define the terms : 3×2=6

  (i) Accuracy

  (ii) Precision

  (iii) Sensitivity

2. (a) Discuss absolute instrument, secondary instrument, Transducer, inverse Transducer, Primary Transducer, Secondary Transducer, Active Transducer and Passive Transducer. 8

(b) Find the Working Force resulting from $200N$ applied to a $1cm$ radius forcing piston if the working piston has a radius of $6cm$. 4

Hydraulic Fluid
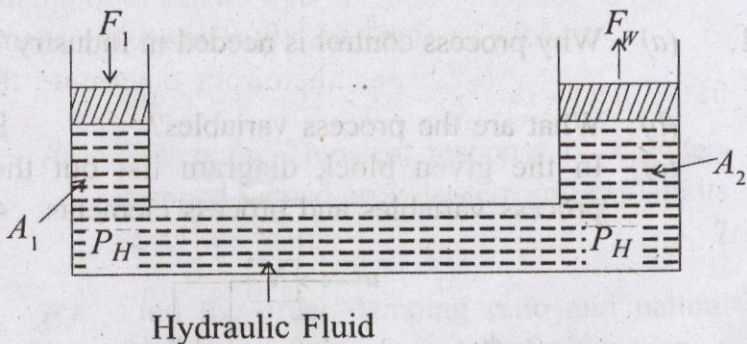
A Hydraulic Actuator converts a Small Force F_1, into an Amplified Force F_w.

(c) An Electrical resistance bulb is made of platinum wire, its resistance at $0°C$ is 100 ohms. Determine its value at $-100°C$ and $+250°C$ (Assume the mean temperature Coefficient $\alpha = 0.385 \times 10^{-2}\ ohms/°C$)   4

(d) What is a Electrical actuator ? Explain *any one* type with neat sketch.   4

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

    (a) Thermocouple
    (b) Ionisation guage
    (c) Head Flow Meter
    (d) Capacitive level measurement

4. *(a)* Derive the Mathematical Model for Mechanical Systems.   10

    (b) The block diagram of a closed loop control system is shown in Fig. Obtain the Signal Flow graph and therefrom determine the overall gain *C/R*   10
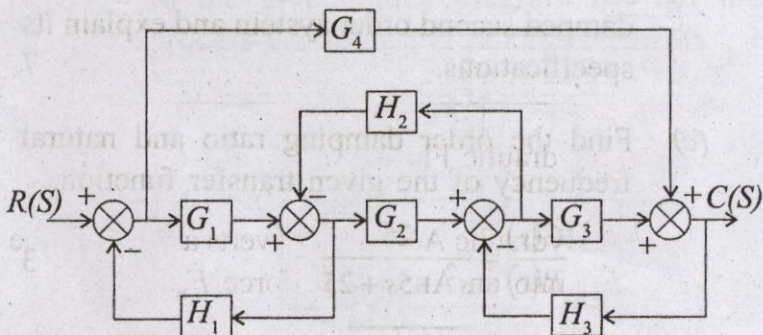
5. (a) For a First order system, find out the output of the system when the input applied to the system is unit ramp input. 10

(b) Explain two-position control with suitable example. 5

(c) Define and derive the Transfer Function for PID control. 5

6. Discuss the following : 5×4=20

(a) Dryer
(b) Evaporator
(c) Heat Exchanger
(d) Distillation

7. (a) Using Routh's Stability Criterion, ascertain stability for each of the following cases :

(i) $3s^4 + 10s^3 + 5s^2 + 5s + 2 = 0$

(ii) $s^6 + s^5 - 2s^4 - 3s^3 - 7s^2 - 4s - 4 = 0$ 10

(b) Sketch the Transient response of a under-damped second order system and explain its specifications. 7

(c) Find the order damping ratio and natural frequency of the given transfer function.

$$\frac{C(s)}{R(s)} = \frac{25}{s^2 + 5s + 25}$$ 3