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 static performance characteristics of Instruments ? 10

   (b) Define the term Transducer and explain different types of transducers with suitable example. 10

2. *(a)* Explain the working principle of Thermocouple with neat sketch. 5

   (b) Convert the temperature $-60°C$ into other scales (ie, K, F & R). 3

(c) An electrical resistance both is made of platinum wire. Its resistance at $0°C$ is $100 ohms$. Determine its value of $-50°C$ and $+225°C$ (Assume the mean temperature coefficient $\alpha = 0 \cdot 385 \times 10^{-2} ohms/°C$) 4

(d) Distinguish between Head and Area type Flow Meter with suitable example. 8

3. (a) What are the different types of control actions and give its Transfer function, advantages and disadvantages ? 14

(b) If a force of $500N$ must be applied to open a valve, find the diaphragm area if a control gauge pressure $7500pa$ ($\simeq 10psi$) must provide this force. 2

(c) Find the expression for working force in terms of applied force in Hydraulic system and explain it. 4

4. Write short notes on the following : ***(any four)*** $4 \times 5 = 20$

(a) Heat Exchanger

(b) Dryers

(c) Distillation

(d) Evaporator

(e) Ionization guage

(f) Capacitive level sensor.

5. (a) What are the control valve characteristics ? 6

(b) Explain about I/P converter. 6

(c) Find the response of undamped second order system for unit step input. 8

6. (a) Using routh criterion determine the location of the roots of the given characteristic equations and comment on the stability of the system 10

$$S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$$

(b) Consider a unity Feedback System with a closed loop Transfer Function $C(S)/R(S) = KS + b/S^2 + aS + b$. Determine open loop transfer function *G (S)*. Show that steady state error with unit *ramp* input is given by $(a - K)/b$. 6

(c) Consider the unity feedback closed loop system where the forward transfer function is $G(S)=\dfrac{25}{S/(S+5)}$. Obtain the t_r, t_p, %MP and t_s, when the system is subjected to a unit-step input. 4

7. Obtain the closed loop transfer function $C(S)/R(S)$ of the system given below using Block diagram reduction technique and Signal Flow graph method (Mason's gain formula). 20