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RN-7427

B. E. - IV (Sem. VIII) (Instrumentation & Control) Examination

May / June – 2010

Process Instrumentation

Time : Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. - 4 (Sem. 8) (I & C)**

Name of the Subject :

☛ **Process Instrumentation**

☛Subject Code No. : **7 4 2 7** ☛Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Answer the two sections separate answer books.
(3) Use of non programmable calculators is allowed.
(4) Assume suitable data if required.
(5) Black figures to the right indicate full marks.
(6) Draw neat diagrams and use mathmatical expressions whenever required.

SECTION I

Q-1 10

a. State the laplace transformation for PID controller. Express your views.
b. If a derivative action is applied to the output instead of error signal, what will be the equation for the output of PID controller?
c. State the stability criteria for MIMO systems.
d. Find *F(t)* if $F(s) = \dfrac{1}{(s+2)s}$
e. Give the generalized state space representation in the matrix form for the system having n inputs and m outputs. The state vector $x \in \Re^p$

Q-2 (a) Prove that for the stability requirements the poles of the s transform transfer function of the system must lie on the left in the complex s plane. 15

(b) Consider the system defined by, 10

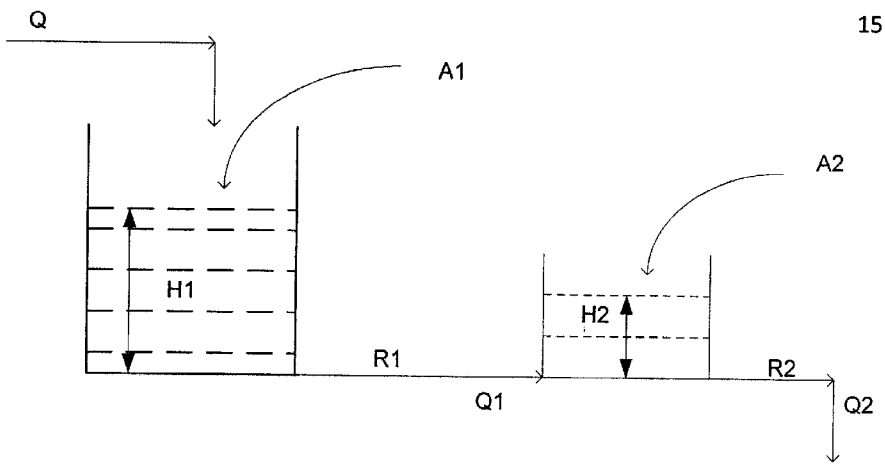
$\dddot{y} + 6\ddot{y} + 11\dot{y} + 6y = 6u$

Give the state space representation for this system. Also draw the block diagram.

5

OR

Q-2 (a)



15

Prove that the transfer function of the above system is given by,

$$\frac{H_2(s)}{Q(s)} = \frac{R2}{\tau_1\tau_2 s^2 + (\tau_1 + \tau_2 + A_1R_2)s + 1}$$

Where, $\tau_1 = A_1R_1$, $\tau_2 = A_2R_2$

(b) With suitable example discuss the feed forward control. Also compare feedback and feed forward control. 10

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Q-3 (a) What is cascade control? Derive expression of the transfer function 8

(b) What is state transition matrix (STM)? Derive expression for STM. 7

SECTION II

Q-4 (a)

a. What is the phase shift in the output of PI controller if the input is a pure sine wave? 10
b. Is the derivative action alone sensitive to high frequency noise? Why?
c. What is the reason of offset in proportional controller?
d. How the offset in proportional controller can be eliminated?
e. What is capacity of the process?

Q-5 (a) How the PI controller can be implemented using op-amps? Derive equation for output of PI controller. 15

(b) Obtain the time response of the following system 10

$$\begin{pmatrix}\dot{x}_1\\ \dot{x}_2\end{pmatrix} = \begin{pmatrix}0 & 1\\ -2 & -3\end{pmatrix}\begin{pmatrix}x_1\\ x_2\end{pmatrix} + \begin{pmatrix}0\\ 1\end{pmatrix}u$$

Where u is a unit step function. Also derive the transfer function if x_1 is the output.

OR

Q-5 (a) Explain the adaptive control in detail. Also discuss tuning and adaption mechanism. 15

(b) What is decoupling and interaction in MIMO system? Comment on Relative Gain Array with mathematical arguments. 10

Q-6 Write notes on 15

1. Gain Scheduling
2. Cascade Control