



SE-7427

**B. E. IV (Sem. VII) (Instrumentation & Control)
Examination**

May / June – 2011

Process Instrumentation

Time : Hours]

[Total Marks :

Instructions :

(1)

नीचे दशांशिक निशानीवाणी विगतो उत्तरवही पर अवश्य लक्षणी. Fillup strictly the details of signs on your answer book.		Seat No. :	
Name of the Examination :		<input type="text"/>	
B. E. - IV (Sem. VII) (Instrumentation & Control)		<input type="text"/>	
Name of the Subject :		<input type="text"/>	
Process Instrumentation		<input type="text"/>	
Subject Code No. : 7 4 2 7		Section No. (1, 2,.....) : 1, 2	
		Student's Signature	

- (2) Use of non programmable calculators is allowed.
- (3) Assume suitable data if required.
- (4) Black figures to the right indicate full marks.
- (5) Draw neat diagrams and used mathematical expressions whenever required.

SECTION - I

- 1 (a) State the laplace transformation for PI controller. **10**
- (b) State final value theorem for s domain.
- (c) State the condition for marginal stability in s domain.
- (d) Find F(t) if $F(s) = \frac{1}{(s+3)s}$
- (e) Give the generalized state space representation in the matrix form for the system having n inputs and m outputs. The state vector $x \in \mathbb{R}^p$

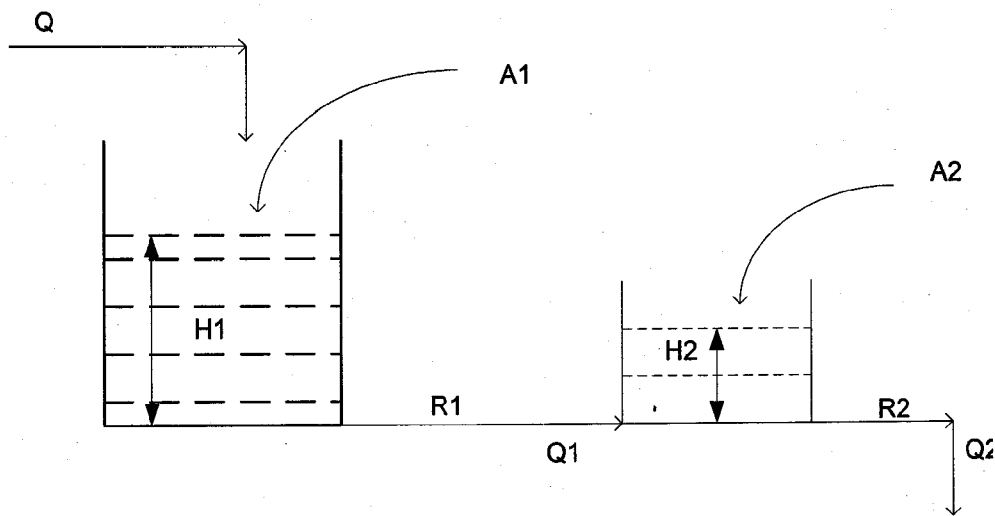
- 2 (a) Prove that for the stability requirements the poles of the s transform transfer function of the system must lie on the left in the complex s plane. 15

- (b) Fine relative gain array for 10

$$K_p = \begin{pmatrix} 12.8 & -18.9 \\ 6.6 & -19.4 \end{pmatrix}$$

OR

- 2 (a) 15



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

$$\frac{H_2(s)}{Q(s)} = \frac{R_2}{\tau_1 \tau_2 s^2 + (\tau_1 + \tau_2 + A_1 R_2) s + 1}$$

Where $\tau_1 = A_1 R_1$, $\tau_2 = A_1 R_2$

- (b) With suitable example discuss the cascade control. Also discuss the tuning rules for the same. 10
- 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

- 4 (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 FOPTD model ?
- 5 (a) How the PI controller can be implemented using op-amps ? Derive equation for output of PI controller. 15
- (b) A proportional derivative controller has a 0.4–2.0 volt input range and 0 to 5 volts output. Proportional gain is 5%/ % and derivative gain is 0.08% per (%min). The period of the fastest expected signal change is 1.5 seconds. Design using op-amp. 10

OR

- 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
- 6 Write notes on. 15
- (1) Auto tuning rules
- (2) Multivariable nyquist plots