

**III B.Tech II Semester Supplementary Examinations, Apr/May 2006**  
**PROCESS DYNAMICS AND CONTROL**  
**(Chemical Engineering)**

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions  
 All Questions carry equal marks

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1. (a) What is a transfer function ? How is it useful in solving problems of process dynamics ? How do you represent the transfer function by a block diagram ?  
 (b) A temperature sensing device can be modeled as a first order system with a time constant of 6 sec. It is suddenly subjected to a step input change of  $25^{\circ}\text{C}$  to  $150^{\circ}\text{C}$ . What temperature will be indicated after 10 sec. [8+8]
2. Explain in detail the terms used to describe an under damped II order response. [16]
3. Explain in detail with a block diagram, working mechanism of a proportional pneumatic controller. [16]
4. For the control system shown in figure1 given below determine an expression for  $C(t)$  if a unit-step change occurs in  $R$ . Sketch the response  $C(t)$  and compute  $C(2)$ . [8+8]

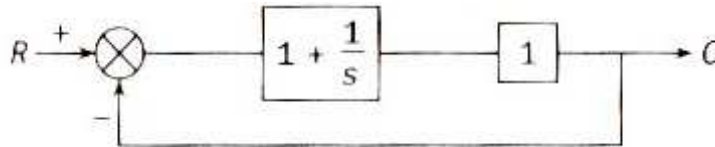


Figure 1:

5. (a) Using  $T_1 = 1, T_2 = T_3 = 1/3$ , determine the values of  $K_c$  for which the control system shown in figure2 is stable.  
 (b) For the values of  $K_c$  for which the system is on the threshold of instability, determine the roots of the characteristic equation. [8+8]
6. (a) Discuss the various rules that are to be following for plotting Root-locus diagram.  
 (b) Applying these rules sketch the root locus diagram for the open-loop transfer function of  $G = \frac{K}{(s+1)(s+2)(s+3)}$  [8+8]
7. (a) Derive expression for amplitude ratio and phase angle as functions of  $\omega$  for the transfer function  $G(s) = 1/(s^2-1)$

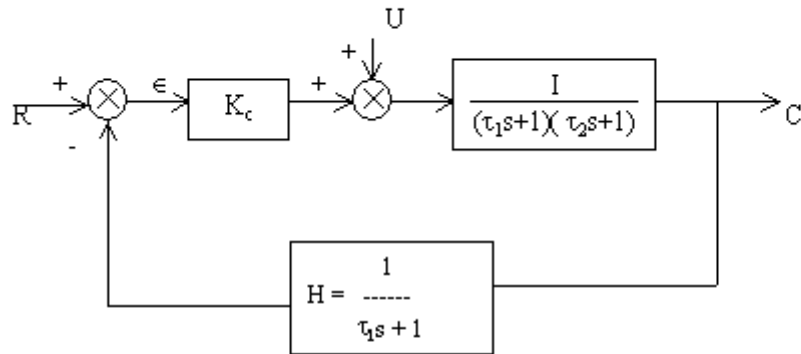


Figure 2:

- (b) What is Bode stability criterion? Discuss its application in analyzing stability of a general control system. [8+8]
8. (a) Write in detail about the Zeigler-Nichols controller settings.
- (b) Write about the precautions to be taken in applying Z-N method. [8+8]

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