

**III B.Tech II Semester Supplementary Examinations,  
November/December 2005  
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 thermometer having a first order time constant of 0.2 min is placed in a temperature bath, and after the thermometer comes to equilibrium with the bath, the temperature of the bath is increased linearly with time at a rate of  $1^\circ/\text{min}$ .
  - (a) What is the difference between the indicated temperature and the bath temperature for 1.0 min after the change in temperature begins?
  - (b) What is the maximum deviation between the indicated temperature and the bath temperature and when does it occur?
  - (c) Plot the forcing function and the response. [6+6+4]
2. (a) Define and explain transportation lag.  
 (b) Develop transfer function for transportation lag. [8+8]
3. A first order process is controlled by a PD controller. The control valve is assumed to be a first order. Assuming the measuring element is having negligible time constant. Develop a block diagram for the feedback control system and obtain an overall transfer function. [16]
4. (a) Develop the block diagram of a generalized feed back control system with one disturbance, incorporating in each block the appropriate transfer function and on each stream the appropriate variable. [8]  
 (b) Develop the closed loop responses for set point and load changes. [4+4]
5. (a) Discuss how Routh test used for determining the stability of a control system for a general polynomial characteristic equation  
 (b) Write about the draw backs of Routh test and how are they overcome. [10+6]
6. Sketch the root loci of the following equation

$$1 + \frac{k(0.5s + 1)}{s(s + 1)(2s + 1)} = 0$$

also locate quantitative poles, zeros, breakaway point and asymptotes [16]

7. Estimate the Amplitude ratio and phase shift characteristics of a second order system whose transfer function is

$$G(s) = \frac{K_p}{\tau^2 s^2 + 2\zeta\tau s + 1}$$

also discuss the effect of damping coefficient  $\zeta$  on the Bode diagram. [16]

8. (a) Explain feedforward control using a neat schematic.  
(b) Present a comparative analysis of feedforward and feedback strategies [8+8]

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