Code No: NR311004 **NR**

III B.Tech I Semester Supplementary Examinations, April/May 2005
PROCESS CONTROL INSTRUMENTATION
(Electronics & Instrumentation Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) List out atleast four important process variables that are controlled in industries.
   (b) Select simple processes for all these variables and write the mass balance equations for these systems.
2. (a) Say whether heated tank and an immersed thermometer with negligible interaction is interacting or non-interacting. Justify your answer.
   (b) Write the differential equations and determine the transfer functions individually for heated tank and thermometer.
   (c) Determine the overall transfer function of this combination. How is this transfer function related with the individual transfer function?
3. (a) Explain with a neat sketch depicting the error vs controller output, the principle of a proportional controller action.
   (b) With an example, explain how offset error in proportional controller occurs. Suggest a way to overcome the offset error.
4. (a) What are the advantages of the force type pneumatic controllers? Describe with neat diagrams, the working of a force type pneumatic proportional controller.
   (b) Explain the working principle of a hydraulic proportional controller. How proportional gain can be adjusted in this controller?
5. (a) Explain the following terms as applicable to system evaluation with necessary graphs.
      i. Stability
      ii. measure of quality .
   (b) Discuss the quarter - amplitude criterion to evaluate the response.
6. (a) Explain the baffle - Nozzle system with the help of its characteristic curves.
   (b) Explain the pneumatic booster and what is its need.
   (c) Differentiate between direct and reverse action final control operation.
7. A heating furnace requires a control valve passing 10gpm preheated light fuel oil (SP.gr. = 0.8) at full load and only 2 gpm at the smallest heating load. The source pressure constant at 50psi gage, but there is 10psi drop in the oil pre heater and 20 psi drop at the furnace burner nozzles. Remaining pressure drop occurs only at control valve when it is fully opened.

(a) Find out control valve size required for the above application.

(b) Find out required rangeability of the valve

(c) Find out characteristic coefficient (α)

8. Under what conditions will the steady state feed forward control system yield the same performance as dynamic feed forward controller in rejecting the effect of disturbance?

⋆ ⋆ ⋆ ⋆ ⋆