NAME…… ROLL NO.....

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-2008

III B.TECH II SEMESTER SUPPLIMENTARY EXAMINATIONS
PROCESS DYNAMICS AND CONTROL
(CHEMICAL ENGINEERING)

AUG/SEP 2008

TIME-3 HOUR
MARK-80

ANSWER ANY FIVE QUESTIONS. ALL QUESTIONS CARRY EQUAL MARKS.

1. (a) What is a first order system ? What are its characteristic parameters ? Define the time constant and rise time for a first order system.

(b) An isothermal, constant hold up, constant through put CSTR with a first order irreversible reaction is described by

dCA
dt
+ F
V
+ k CA =
F
V
CAo

Assuming F, V, and k as constants, derive an expression for the solution of reactant concentration CA for a step change in feed concentration CAo.

2. Define and discuss the following terms:

(a) Quadratic lag
(b) Dead time
(c) Period of oscillation
(d) Natural period of oscillation.

3. Discuss the working principle & mechanism of pneumatic PID controller with the help of a neat schematic diagram

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.

(b) Develop the closed loop responses for set point and load changes.

5. For the control system whose characteristic equation is s4 + 4s3 + 6s2 + 4s + (1 + K) = 0
(a) Determine the value of K above which the system is unstable.
(b) Determine the value of K for which two of the roots are on the imaginary axis, and determine the value of these imaginary roots and the remaining two roots.

6. Determine the stability of the following two systems given their characteristic equations
S4 + 5S3 + 3S2 + 1 = 0
10S3 + 17S2 + 8S + 1 + Kc = 0
Using Root Locus method.

7. Plot the Bode diagram for the open loop transfer function of a control system given below which represents the PD control of three tanks in series; with transportation lag in the measuring element.
G(s) =
10(0.5s + 1)e-s/10
(s + 1)2 (0.1s + 1)

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