Code No: OR410851 **OR**

IV B.Tech I Semester Supplementary Examinations, April/May 2005
PROCESS DYNAMICS & CONTROL
(Chemical Engineering)

Time: 3 hours **Max Marks: 70**

Answer any FIVE Questions
All Questions carry equal marks

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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

$$\frac{dC_A}{dt} + \left(\frac{F}{V} + k\right) C_A = \frac{F}{V} C_{Ao}$$

   Assuming F, V, and k as constants, derive an expression for the solution of reactant concentration C_A for a step change in feed concentration C_{A0}.

2. The over transfer function of the control system is given by $G(s) = \frac{Y(s)}{X(s)} = \frac{16}{1.5s^2+2.4s+6}$ A step change of magnitude 6 is introduced in to the system. Calculate:
   (a) Overshoot
   (b) Period of oscillation.
   (c) Natural period of oscillation.
   (d) Rise time
   (e) Ultimate value of response

3. Define the following
   (a) Set - point
   (b) Load
   (c) Closed - loop system
   (d) Comparator

4. For the control system shown in figure1 given below determine:
   (a) C(s)/R(s)
   (b) C(∞)
   (c) Offset
   (d) C(0.5)
   (e) Whether the closed-loop response is oscillatory

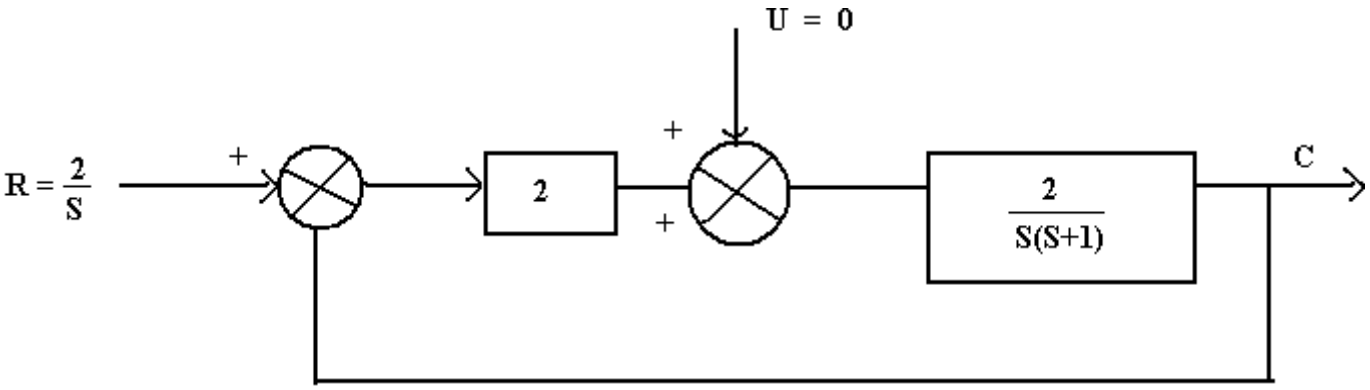

Figure 1:

5. (a) A system has the characteristic equation, $S^5 + 7S^4 + 18S^3 + 23S^2 + 17S + 6 = 0$ By using the Routh criterion determine whether or not the system is stable.

   (b) Explain servo and regulatory control problems with an example.

6. A control system representing a two-tank liquid level system having a PID controller and a first order-measuring lag. has the following open-loop transfer function

$$G = K_c \frac{1 + 2s/3 + 1/3s}{(20s + 1)(10s + 1)(0.5s + 1)}$$

   Construct the root locus diagram for the above system.

7. Construct the Bode diagram of a first-order system with dead time having a transfer function.

$$G(s) = \frac{K_p e^{-t_d s}}{\tau_p s + 1}$$

8. Explain linear, equal percentage and square root characteristics of control valves.

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