Code No: NR220405 **NR**

II B.Tech II Semester Supplementary Examinations,
November/December 2005
CONTROL SYSTEMS
(Common to Electronics & Communication Engineering, Electronics & Instrumentation Engineering, Electronics & Control Engineering and Electronics & Telematics)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the concept of multivariable control systems.
   (b) Evaluate the output of the system given below(Figure1). [6+10]

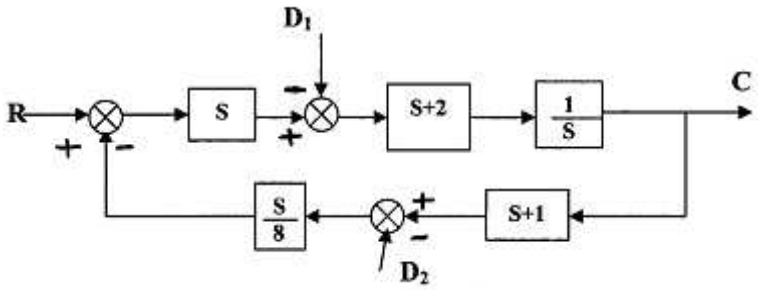

Figure 1:

2. (a) What is feedback? Explain the effects of feedback.
   (b) What is the sensitivity function and explain with respect to open loop and closed loop systems. [6+10]

3. (a) Determine the values of K and k of the closed-loop system shown below Figure2, so that the maximum overshoot for unit-step response is 25% and the peak time is 2sec. Assume that J=1kg-m^2.

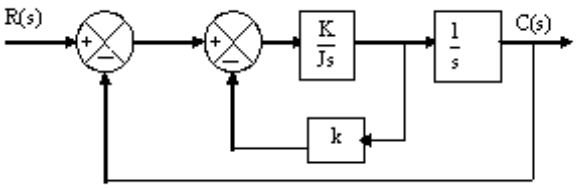

Figure 2:

   (b) Explain error constants K_p, K_v, K_a for type II system. [8+8]

4. A feedback system employing output-rate damping is shown in Figure 3:

(a) In the absence of derivative feedback (K_0=0), determine the damping factor and natural frequency of the system. What is the steady state error resulting from unit-ramp input?

(b) Determine the derivate feedback constant K_0, which will increase the damping factor of the system to 0.6. What is the steady-state error to unit-ramp input with this setting of the derivative feedback constant?

(c) Illustrate how the steady-state error of the system with derivative feedback to unit-ramp input can be reduced to same value as in part (a), while the damping factor is maintained at 0.6. [6+5+5]

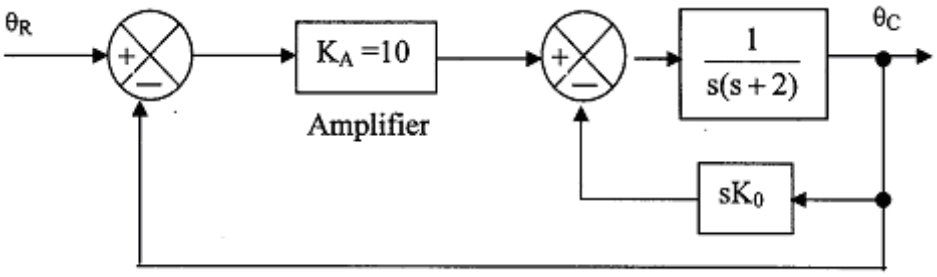

Figure 3:

5. A unity feedback system has an open loop transfer function
   G(s) H(s)= $\frac{K}{s(s+3)(s^2+2s+2)}$
   Sketch the root locus as 'K' varied from 0 to ∞ . [16]

6. The open loop transfer function of a system is G(s) = $\frac{K}{s(1+0.5s)(1+0.2s)}$ using Bode Plot. Find K so that

   (a) Gain margin is 6 dB,

   (b) Phase margin is 25^0. [16]

7. The open loop transfer function of unity feedback is
   $G(s) = \frac{1}{s(s+1)(0.5s+1)}$
   Design a compensator to meet the following specifications. Velocity error constant $K_v = 5$ sec^{-1}; phase margin = 40^0; Gain margin = 10 db. [16]

8. (a) For the given transfer function.
   $T(s) = \frac{(b_o\, s^3)}{s^3+a_2s^2+a_1s+a_0}$
   Obtain the state model of the system.

   (b) Obtain the state transition matrix ϕ(t) given the system matrix. [10+6]
   $A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$

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