Registration no: | | | | | | | | | | |

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B.TECH
PCEC4303

Fifth Semester Examination – 2013
CONTROL SYSTEM ENGINEERING

Time: 3 Hours
Max marks: 70

Answer any SIX questions including Question No. 1 which is compulsory.
The figures on the right hand side indicate marks.

1. 2×10

a. What is the transfer function of a system whose response c(t) to an input r(t) is given by the differential equation

$$4\frac{d^3c(t)}{dt^3}+3\frac{d^2c(t)}{dt^2}+8\frac{d\,c(t)}{dt}+2\,c(t)=5r(t)$$

b. Discuss the merits and demerits of Block diagram representation of physical system compared to signal flow graph representation.

c. What is the overall transfer function of the system whose signal flow graph is shown in Fig.1?

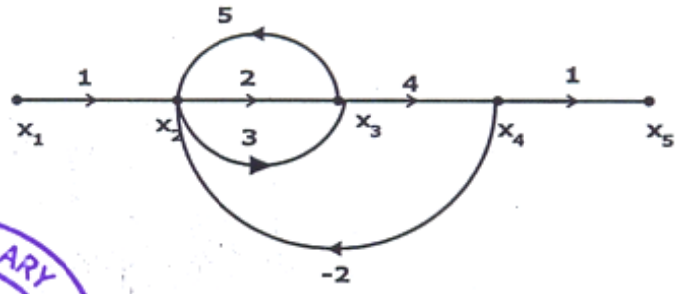

Fig.1

d. A unity feedback control system has an open loop transfer function

$$G(s)=\frac{20}{s(s+5)}$$

Find the rise time for a unit step input.

e. How do you categorize types and orders of a system?

f. For a unity feedback system having $G(s)=\frac{36}{s(s+5)}$, find the time at which second peak overshoot will occur.

g. What is the inference regarding system stability when the system characteristic equation has multiple poles on the $j\omega$-axis in s-plane?

h. What is principle of argument?

i. What are the advantages and disadvantages of frequency response analysis in comparison to time domain analysis?

j. Illustrate difference between root locus and root contours.

2.

a. Evaluate (C/R_2) by using block reduction techniques for a system whose block diagram representation is shown in Fig.2. 7

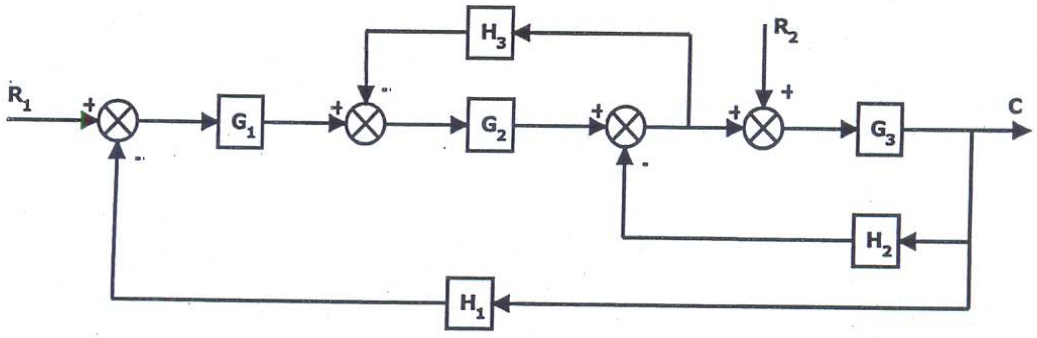

Fig. 2

b. Explain the effect of feedback on the sensitivity of a closed loop system? 3

3.

a. A unity feedback system has $G(s)=\frac{1}{s(1+2s)}$. Determine the dynamic error coefficients and express the steady state error as a function of time for the input described by $r(t)=2+4t+6t^2+2t^3$ 5

b. The characteristic equation of a feedback control system is

$S^4 + 20S^3 + 15S^2 + 2S + K = 0$

Determine the range of K for the system to be stable. Can the system be marginally stable? If so, find the required value of K and the frequency of sustained oscillation? 5

4.

a. The open loop transfer function of a control system is given by

$$G(s)H(s) = \frac{K}{S(S+6)(s^2+4S+13)}$$

Sketch the root locus and determine the stability criterion. 7

b. Explain the effects of adding poles and zeros to transfer function with suitable example. 3

5. Draw the Bode plot for the transfer function 10

$$G(s) = \frac{36(1+0.2s)}{s^2(1+0.05s)(1+0.01s)}$$

From the Bode plot determine

a. Phase crossover frequency
b. Gain crossover frequency
c. Gain margin
d. Phase margin

Comment on the stability of the system.

6.

a. The open-loop transfer function of a control system is given by

$$G(s)H(s) = \frac{10(s+1)}{s^2(s+2)(s+4)}$$

Draw the Nyquist plot and comment on the stability of the closed-loop system. 7

b. Distinguish between absolute stability, conditional stability and relative stability. 3

7.

a. Briefly explain the co-relation between time response and frequency response analysis. 5

b. Obtain the transfer function of an armature controlled DC servomotor. 5

8. Write short notes on any two 2×5

a. Constant M and N circle
b. Force-Voltage and Force-current analogy
c. PID Controller