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(Following Paper ID and Roll No. to be filled in your Answer Book)

Paper ID : 132501 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. V) THEORY EXAMINATION, 2015-16

CONTROL SYSTEM-I

[Time : 3 hours] [Maximum Marks : 100]

SECTION-A

1. Attempt **all** parts. All parts carry **equal** marks. Write answer of each part in **short**. (2×10=20)

   (a) Compare between an open-loop and closed loop control system.

   (b) What is a Techo-generator ?

   (c) Explain Controllability of the system.

   (d) Explain Eigen vector.

   (e) What is a dominant pole pair ?

   (f) Mention the nature of transient response of second order control system for different types of damping

   (g) Define damping ratio.

(h) Draw the polar plot for $G(s)H(s) = \frac{K}{jw}$

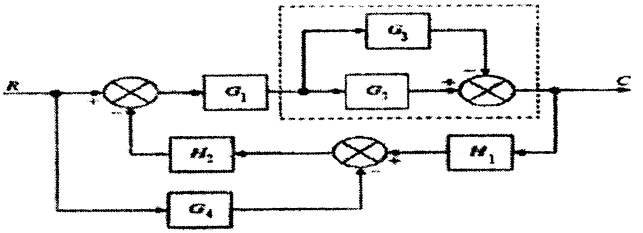
(i) What is the general effect of adding a pole to the forward path transfer function ?

(j) Explain phase margin.

SECTION-B

Note: Attempt any **five** questions from this section.(10×5=50)

2. Discuss the effect of feedback on stability of the system. Determine the overall transfer function of the given system below using block diagram reduction technique.



3. Define the following SFG terminology-

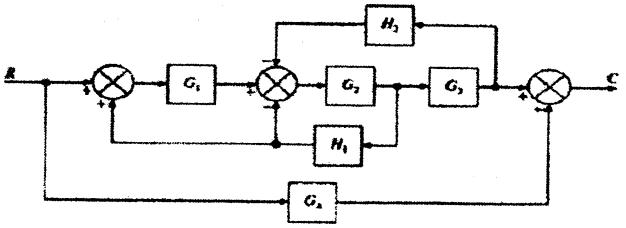
(a) Forward Path

(b) Loop

(c) Self loop

(d) Non-touching loops

Find the closed loop transfer function of the system given using mason's gain formula.



4. What are the advantages of state space techniques ? For the given transfer function obtain the dynamic equations.

$$G(s) = \frac{y(s)}{u(s)} = \frac{K}{s^3 + a_3 s^2 + a_2 s + a_1}$$

5. For the following state equation, determine the transferfunction Y(s)/U(s).

$$x(t) = \begin{bmatrix} 0 & 3 \\ -2 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 3 \end{bmatrix} u(t)$$

$$y(t) = [1 \;\; 0] x(t) + u(t)$$

6. Discuss the time response of a first order control system subjected to unit ramp input. A certain unity feedback system is described by the following transfer function

$$G(s) = \frac{K}{s^2(s+30)(s+50)}$$

Determine the state error coefficients and also determine the value of K to limit the steady state error to 20 units due to input $r(t)=1+10t+20t^2$.

7. Derive the time response of a second order system subjected to unit step input?

8. Determine the ranges of K such that the characteristics equation.

$s^3 + 3(K+1)s^2 + (7K+5)s + 4K + 7 = 0$ has roots more negative than $s=-1$.

9. Give frequency domain specifications. Determine the expression for resonant peak and resonant frequency for a second order system.

SECTION-C

Note: Attempt any **two** parts from this section : $(15\times2=30)$

10. What is meant by the term magnitude criterion with reference to root locus technique? Sketch the root locus for system with

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

11. Discuss Nyquist Stability criterion in detail. Also sketch the Nyquist plot for the system with

$$G(s)H(s) = \frac{(1+0.5s)}{s^2(1+0.1s)(1+0.02s)}.$$

Comment on stability and find the value of gain margin.

12. Explain what is bode plot. Draw the bode plot of the unity feedback control system having open loop transfer function.

$$G(s) = \frac{10}{s(1+0.02s)(1+0.2s)}$$

Also determing GM and discuss the stability of closed loop system.

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