بسم الله الرحمن الرحيم

El-Mansoura University
Faculty of Engineering
1st Year Students,
Computers & Systems Engineering Dept.

Subject: Control Engineering(2) CSE 3126
2nd Term Exam , 12/6/2013
Time Allowed: Three Hours

Attempt the Following Qustions: - **Maximum Marks :90 Marks**

1-(a) - Define the Following Terms:-
i- Break Away Point ii- Centriod
iii- Root Locus Angle of Departure iv- Marginally Stable System

(4 Marks)

(b) A control system has a forward transfer function $G_F(s) = \frac{k}{S(S+6)}$ & a negative feedback transfer function : $H(s) = \frac{k}{S(S+3)}$

Apply the phase angle condition to construct the root loci , then determine :
i- Break- away point , ii- the value of k such that the system becomes marginally stable , iii- if the system has a damping ratio : $\xi = 0.5$, find the closed loop poles at the points of intersection between the root locus branches & straight line having a slope :

$$\tan\theta = \frac{\pm\sqrt{1-\xi^2}}{\xi}$$

(25 Marks)

2-(a) – Define the Following Terms:
i- Corner frequency , ii- Gain cross –over frequency
iii- Gain margin , iii- Phase cross –over frequency

(4 Marks)

(b)- A negative unity feed-back control system has an open-loop transfer function:-

$$G(s)H(s) = \frac{k}{S(1+0.05\,S)(1+0.01\,S)}$$

- If k=10 , construct the Bode diagram & determine whether the systm is stabl or not ? & find both the gain and phase margins.
- Determine the value of k for marginal stability.

(25 Marks)

3-(a) – Complete the following expressions:
i- A segment of the real axis lies on the root locus if .....
ii- The root – locus is symmetrical around .....
iii- Th centriod of asymptotes is given by .....
iv- The Break-away point ..... . & can be determined by solving the equation .....

(5 marks)

(b)- A negative feed-back control system has a forward transfer function:-

$$G_F(s) = \frac{4\,(S+1)}{(S-3)}$$

& a feed-back transfer function: $H(s) = \frac{2.5}{S}$

Construct the root-locus of the system & determine:

P.T.O

i- The break- away point ii- The marginal value of the gain

if the system exposed to a step input : r(t)=2 , find the maximum over-shoot& the peak time by plotting the dynamic characteristics of the system , then find the steady- state error .

(20 Marks)

4-(a) – State Nyquist stability criterion

(4 Marks)

(b)- A negative feed-back control system has a forward transfer function:-

$$G_F(s) = \frac{K}{(s^2+6s+10)}$$

& a feed-back transfer function: $H(s) = \frac{1}{S}$

If k=5 , use Nyquist plot to determine both the gain and phase margins , then , determine the value of k for marginal stability .

N.B: use the range of ω from 0.1 rad/sec , 0.5 , 1 ,……,5,10, to 20 rad/sec

(20 Marks)

With my best wishes

Prof.Dr.,Fayez F.G.Areed,

9 a.m, wensday,12/6/2013