COLLEGE OF ENGINEERING & TECHNOLOGY

Department: Electrical & Control Engineering
Lecturer: Prof. Ezz El Dein Zakzouk
Course: Control System I **Marks: 40**
Course No. : EE411
Date : 11/1/2015 **Time : 2 hours**

Final Exam

Answer the following questions:-

Question no.1: **(A.5., B.2., B.5., C.1.)**

- **Consider the system shown in figure 1** **(12 marks)**

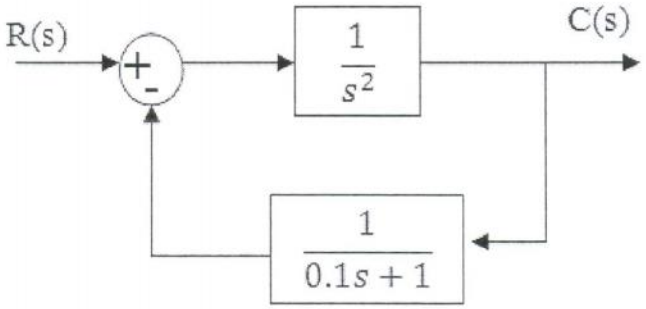

Figure (1)

a. Discuss the stability of this system using:
   - Nyquist plot
   - Root locus

b. Design a lead compensator using root locus such that :
   Settling time $\leq 1sec$
   Maximum Overshoot $\leq 16\%$

c. Find the steady state error for a unit ramp input before and after compensation.

Question no.2: **(A.15., B.2., B.5., C.1.)**

For the lag circuit shown in figure 2: **(8 marks)**

a. Find the transfer function ($\frac{V_o}{V_i}$)

b. This circuit is used to improve a system with

$$G_p(s) = \frac{10}{s(s+4)}, H(s) = 1$$

and negative feedback.

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Head of Department: Prof. Hamdy Ashour	Hamdy	6/1/2015

Design the lag compensator in the frequency domain such that the velocity error constant is 5 sec^{-1} keeping the transient behavior of the old system unchanged.

Hint: Find the ζ from the system before compensation then find the phase margin required.

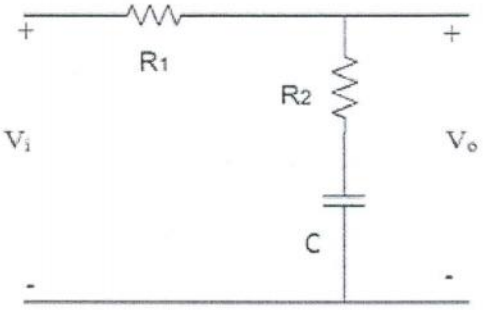

Figure (2)

Question no.3: (A.27., B.3., C.1.)

(10 marks)

Consider a unity feedback control system whose feedforward transfer function is given by:

$$G_p(s) = \frac{10}{s(s+2)(s+8)}$$

It is desired that the closed loop poles are located at $s = -2 \pm j2\sqrt{3}$ and the velocity error constant is equal to 10 sec^{-1}

Design the proper compensator and then find its circuit parameters

Question no.4: (A.5., B.2., B.5., C.1.)

Consider the system shown in figure 3: **(10 marks)**

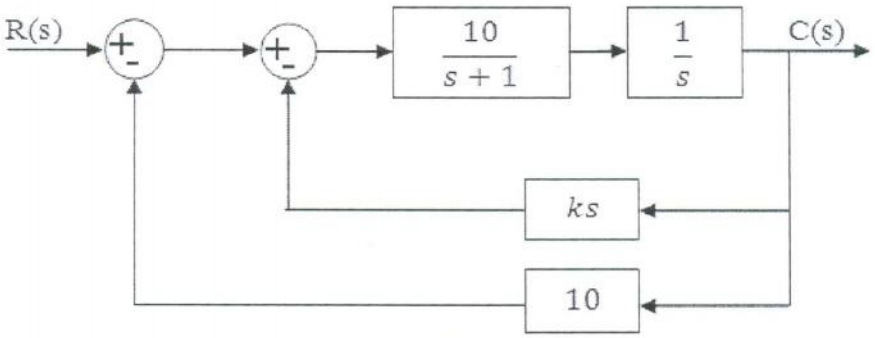

Figure (3)

Sketch the root loci of the system as the velocity feedback gain k varies from zero to infinity. Determine the value of K such that the closed loop poles have the damping ratio ξ of 0.7.

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