



# COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Electrical & Control Engineering

Lecturer : Prof. Ezz El-Din Zakzouk

Course : Fundamentals of Control

Course Code : EE 311

Marks : 40

Date : 1/6/2015

Time : 2 hours

## Answer the following questions:

### Question 1:

Obtain the transfer function  $\frac{E_o}{E_i}$  for the system shown in Figure (1).

(C.1)  
(10 Marks)

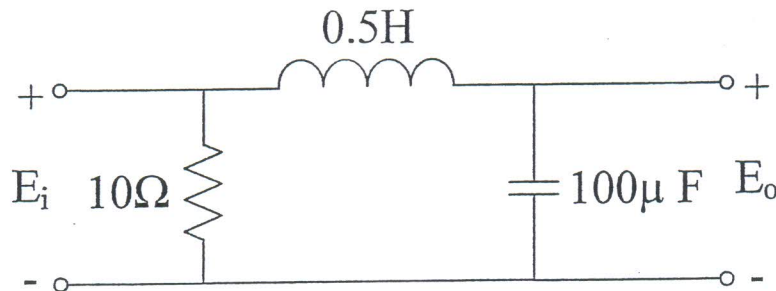


Figure (1)

### Question 2:

Using the **block diagram reduction technique**, find the closed-loop transfer function  $\frac{C(s)}{R(s)}$  of the system represented by the block diagram shown in Figure (2).

(B.1)  
(10 Marks)

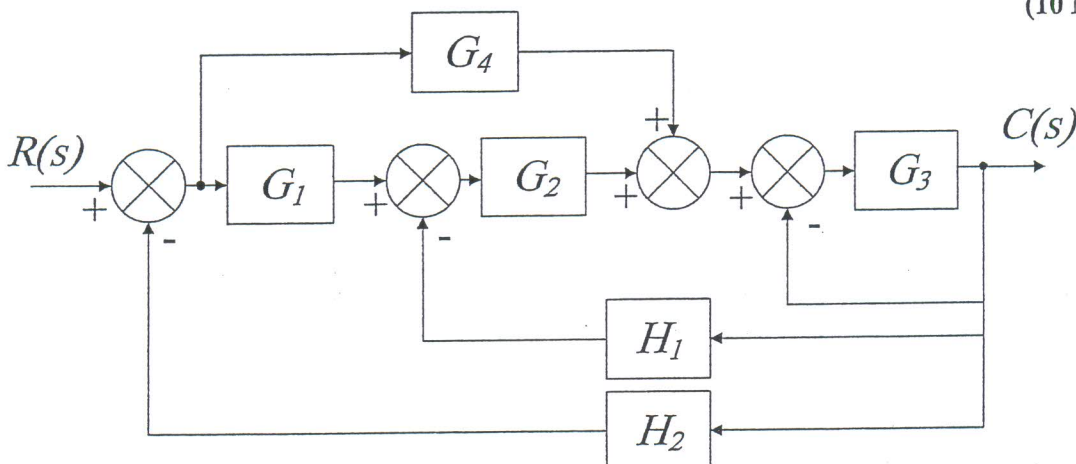


Figure (2)

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Lecturer: Prof. Dr. E. E. Zakzouk	<i>[Signature]</i>	12/5/2015
Course Coordinator: Dr. Ahmed Al-Shenawy	<i>[Signature]</i>	13/5/2015
Head of Department: Prof. Hamdy Ashour	<i>[Signature]</i>	13/5/2015

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**Question 3:**

For the system shown in Figure (3).

(A.5, A.31)  
(10 Marks)

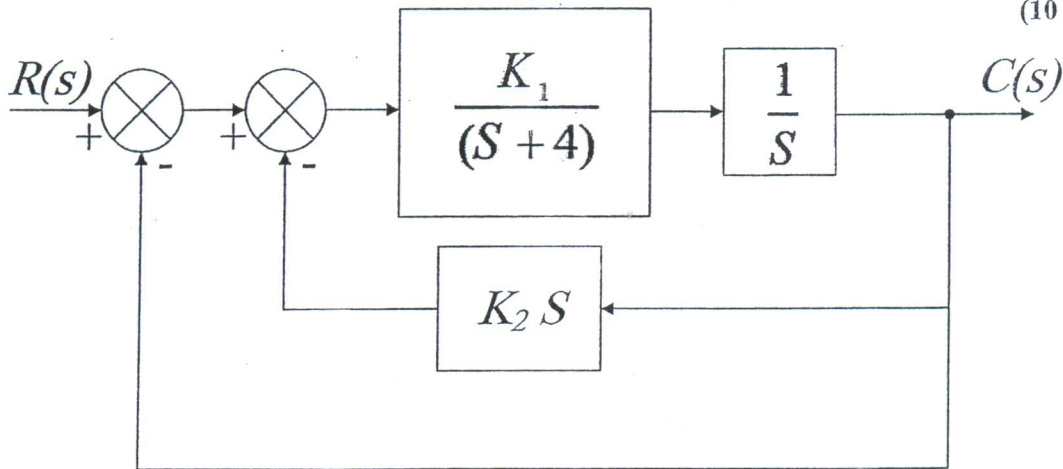


Figure (3)

Determine:

- The values of  $K_1$  and the damping ratio for an undamped natural frequency of 3 rad/sec, where  $K_2=0$ .
- For the same damping ratio in (a) and  $K_1 = 5$ , find the value of  $K_2$ , the rise time ( $t_r$ ), the peak time ( $t_p$ ), the maximum overshoot ( $\mu_p$ ) and the steady state error to a ramp input  $r(t) = t$ .

**Question 4:**

Using Routh's stability criterion for the following closed-loop transfer function,

$$\frac{C(s)}{R(s)} = \frac{K}{S(S^2 + S + 1)(S + 2) + K}$$

(A.27)  
(10 Marks)

To find:

- The range of  $K$  for stability.
- The critical gain value.
- The roots of the system for the critical gain value.

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Head of Department:	<i>[Signature]</i>	13/5/2015

2/2