COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Electrical and Control Engineering

Lecturer : Prof. Alaa El-din Ahmed Khalil

Course : Fundamentals of Control

Course Code: EE 311 **Time : 2 hours**

***Date* : 20 / 1 / 2015** **Marks: 40**

Final Exam

Answer the following Questions:

1 - For the system shown in Figure(1), determine the overall transfer function $\frac{C(s)}{R(s)}$ by ***using:*** **A.15**

(a) Block diagram reduction. **(5 marks)**

(b) Signal flow graph. **(5 marks)**

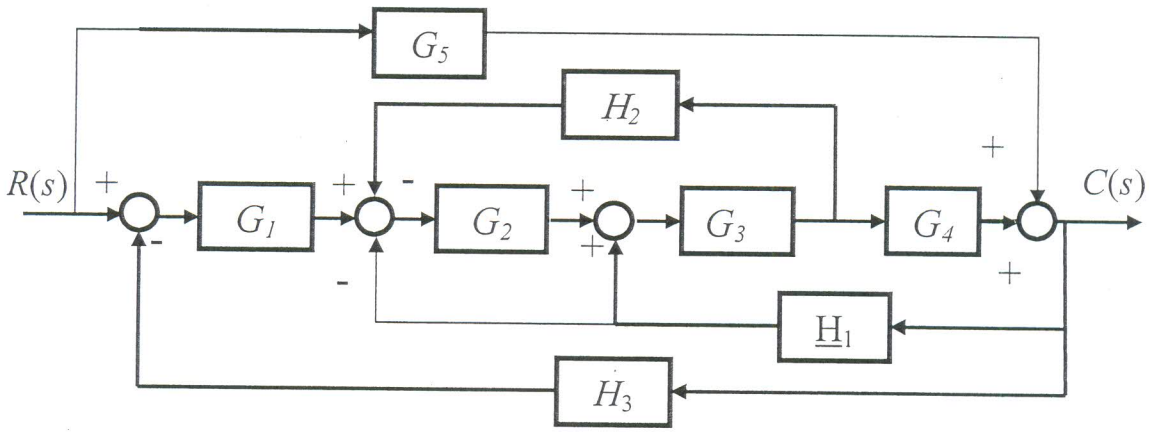
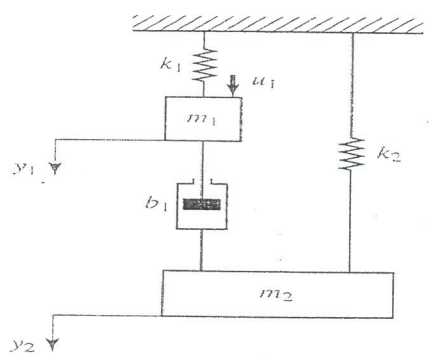


Figure (1)

2- Obtain the transfer functions $\mathbf{Y_1(s) / U_1(s)}$ of the mechanical system shown in Figure(2). **A.5**

(10 marks)



Figure(2)

Members of course Examination Committee:	Signature:	Date:
Lecturer: Prof. Alaa Eldin Ahmed Khalil	Alaa Eldin	5/1/2015
Course Coordinator : Dr. Ahmed Elshenawy		5/1/2015
Head of Department: Prof. Hamdy Ashour	Hamdy	5/1/2015

MPC 6/1-1

3- For the system shown in Figure(3), **A.27**

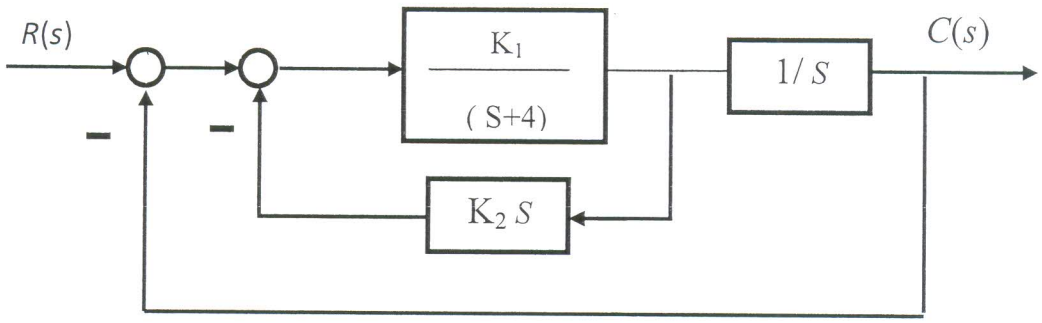


Figure (3)

Determine:

I) the values of K_1 and the damping ratio for an undamped natural frequency of 3 rad/sec, and K_2 =0. **(2 Marks)**

II) If K_1=15 , for the same value of undamped natural frequency find the value of K_2 and the new damping ratio. **(2 Marks)**

Then find:

(a) the rise time t_r . **(1.5 Marks)**

(b) the peak time t_p. **(1.5 Marks)**

(c) the maximum overshoot, M_p **(1.5Marks)**

(d) Steady – state error to a ramp input, i.e. $r(t) = 5t$ **(1.5 Marks)**

4- Consider the following closed-loop transfer function: **B.1**

$$\frac{C(s)}{R(s)} = \frac{K}{S(S^2 + 2S + 3)(S + 4) + K}$$

Using Routh's stability criterion, determine:

(a) the range of K for stability. **(5 Marks)**

(b) the critical gain value. **(2 Marks)**

(c) the roots for this value of critical gain and the other roots. **(3Marks)**

GOOD LUCK

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