



COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Electrical and Control Engineering

Lecturer : Prof. Alaa Eldin Ahmed Mohamed Khalil

Course : Fundamentals of Control

Course Code: EE 311

Date : 18 / 1 / 2016

Time : 2 hours

Marks: 40

Final Exam

Answer Four Questions Only:

1 - For the system shown in Figure(1), determine the overall transfer function $\frac{C(s)}{R(s)}$ by using: (10 marks)

(a) Block diagram reduction. (5 marks)

(b) Signal flow graph. (5 marks)

(B.1)

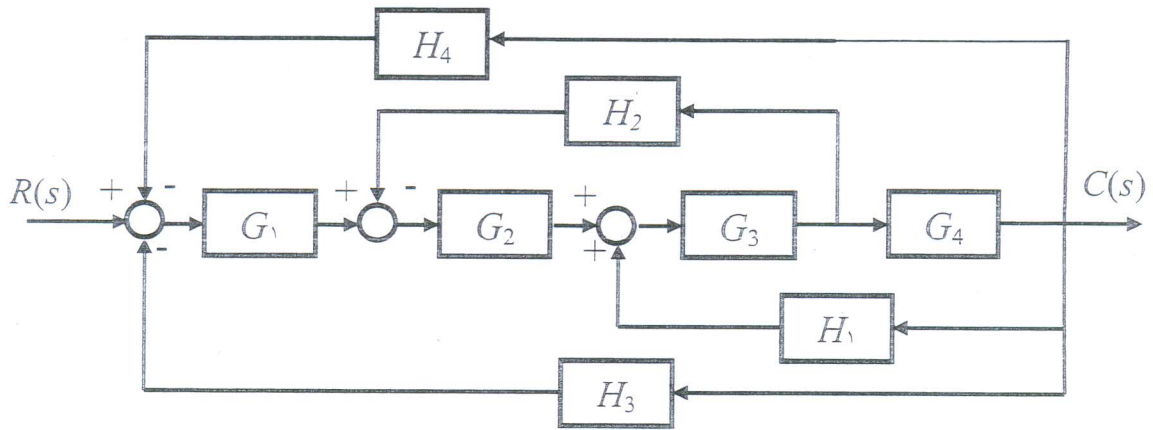
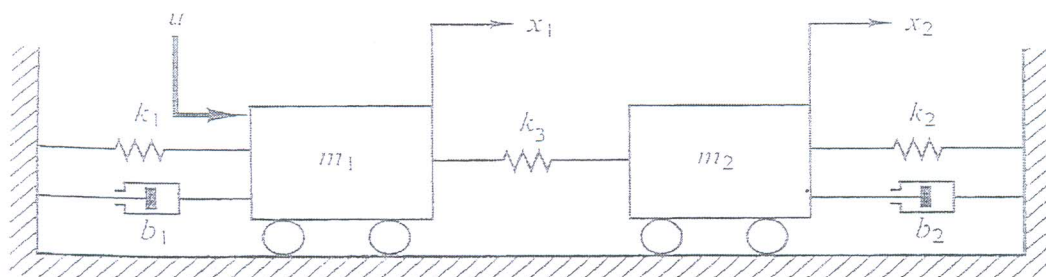


Figure (1)

2- Obtain the transfer functions $X_2(s) / U(s)$ of the mechanical system shown in Figure(2). (10 marks)

(C.1)



Figure(2)

Members of course Examination Committee:	Signature:	Date:
Lecturer: Prof. Alaa Eldin Ahmed Mohamed Khalil	<i>Alaa</i>	4/1/2016
Course Coordinator : Dr. Ahmed Khamis	<i>Ahmed</i>	4/1/2016
Head of Department: Prof. Hamdy Ashour	<i>Hamdy</i>	4/1/2016

3- For the second order system shown in figure (3) with the damping ratio of 16%

(10 marks)

(A.5,A.31)

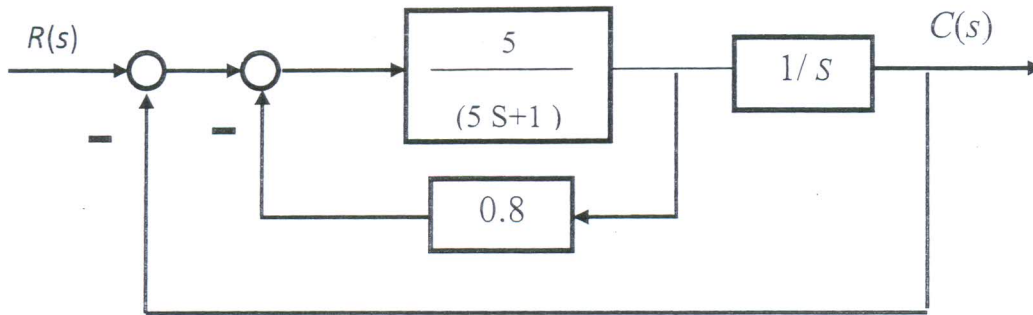


Figure (3)

Determine:

- (a) The rise time t_r . (2 Marks)
- (b) The peak time t_p . (2 Marks)
- (c) The settling time for 2% and 5% error (2 Marks)
- (d) The steady-state error coefficients (2 Marks)
- (e) Steady - state error to a ramp input, i.e. $r(t) = t$ (2 Marks)

4- A single loop negative feedback control system has an open loop transfer function as:

(10 marks)

(A.27)

$$G(s)H(s) = \frac{K(s + 1)}{s(s^2 + 4s + 5)}$$

- (a) Sketch the root locus for $0 \leq K \leq \infty$, showing all information on the graph. (4 marks)
- (b) Determine the range of gain K for which the system is stable. (2 marks)
- (c) For what value of K in the range $K \geq 0$ do purely imaginary roots exist? (2 marks)
- (d) Calculate the value of K that makes the damping ratio $\zeta = 0.5$ (2 marks)

GOOD LUCK

Members of course Examination Committee:	Signature:	Date:
Lecturer: Prof. Alaa Eldin Ahmed Mohamed Khalil		4/11/2016
Course Coordinator : Dr. Ahmed Khamis		4/11/2016
Head of Department: Prof. Hamdy Ashour		4/11/2016