

MASSACHUSETTS INSTITUTE OF TECHNOLOGY  
Department of Electrical Engineering and Computer Science

6.003: Signals and Systems—Spring 2005

Final Exam  
Tuesday, May 17, 2005

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**Directions:**

- **PLEASE WRITE YOUR NAME ON THIS COVER SHEET NOW!**
- Please also write your name on **all** remaining sheets.
- Unless indicated otherwise, answers must be derived or briefly explained. All sketches must be adequately labeled.
- There are a total of 6 problems in this booklet from pages 2 through 37.
- Enter all your work and answers directly in the spaces provided on the printed pages of this booklet. Additional work spaces are supplied from pages 38 through 40. These pages will NOT be graded unless you specify that you are continuing a particular problem on a particular continuation page.
- The bluebook is for your scratch work. We will NOT grade anything in your bluebook.
- This quiz is closed book, but students may bring and use three  $8\frac{1}{2} \times 11$  sheets of paper as reference.
- Tables of Fourier Series, Fourier transform, Laplace transform, and Z transform properties and basic transform pairs are supplied with this booklet.
- No calculators or cell phones are permitted.

**NAME:** \_\_\_\_\_

Check your section	Section	Time	Room	Rec. Instr.	TA
<input type="checkbox"/>	1	10-11	36-112	Prof. Freeman	Belal
<input type="checkbox"/>	2	11-12	36-112	Prof. Freeman	Belal
<input type="checkbox"/>	3	12- 1	36-112	Prof. Adalsteinsson	Karen & Ian
<input type="checkbox"/>	4	1- 2	36-112	Prof. Adalsteinsson	Karen & Ian
<input type="checkbox"/>	5	11-12	36-144	Prof. Baldo	James
<input type="checkbox"/>	6	12- 1	36-144	Prof. Baldo	James
<input type="checkbox"/>	7	11-12	34-304	Prof. Daniel	Ruby
<input type="checkbox"/>	8	12- 1	34-304	Prof. Daniel	Ruby

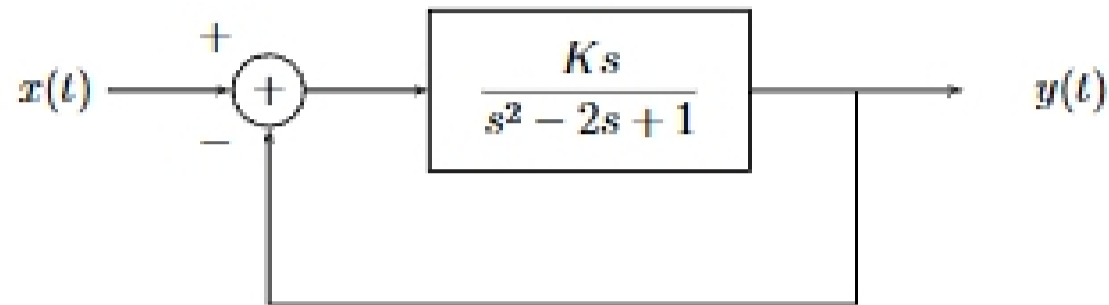
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Please leave the rest of this page blank for use by the graders:

Problem	No. of points	Score	Grader
1	35		
2	30		
3	35		
4	35		
5	30		
6	35		
Total	200		

**PROBLEM 1 (35 points)**

Consider the following causal CT feedback system.



**Part a.** Determine the range of  $K$  for which the closed-loop system is a stable LTI system.

range of  $K$  :

**Part b.** For a particular value of  $K$ , the closed-loop system has two real poles, one of which is at  $s = -1$ . Determine the other pole and the step response,  $s(t)$  of the closed-loop system corresponding to such value of  $K$ .

pole at ,  $s(t) =$