

MASSACHUSETTS INSTITUTE OF TECHNOLOGY  
Department of Electrical Engineering and Computer Science

6.002 – Circuits and Electronics  
Fall 2005

Final Exam

December 20, 2005

YOUR NAME: SOLUTIONS

Recitation Instructor / TA: \_\_\_\_\_

General Instructions:

1. Please verify that there are 22 pages in your exam booklet.
2. Please do all of your work in the spaces provided in this examination booklet. In particular, try to do your work for each question within the boundaries of the question, or on the back side of the page preceding the question. Extra pages are also available at the end of the booklet. Place the answer to each question within the appropriate answer box.
3. You may use three double-sided pages of notes and a calculator while taking this exam.

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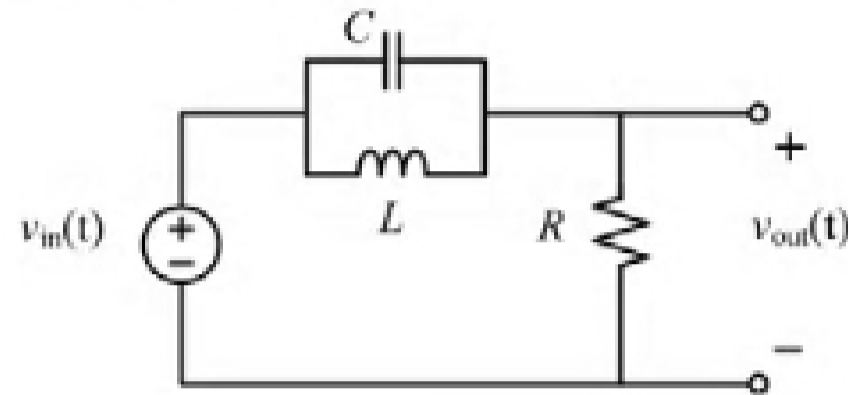
For examiner's use only:

Problem	Points	Score	Grader
1	8		
2	12		
3	20		
4	20		
5	20		
6	20		
Total	100		



**PROBLEM 2** (12 points)

This problem concerns the following circuit:



- (A) Assume that the network is operating in the sinusoidal steady state. Determine the response  $v_{out}(t)$  to the input voltage  $v_{in}(t) = V_{in} \cos(\omega t)$ . Note that  $v_{out}$  will take the form  $V_{out}(\omega) \cdot \cos(\omega t + \phi(\omega))$ .

$$\hat{V}_{out} = \frac{R}{R + \frac{Ls \cdot \frac{1}{Cs}}{Ls + \frac{1}{Cs}}} \cdot \hat{V}_{in}$$

$$= \frac{R}{R + \frac{Ls}{LCs^2 + 1}} \hat{V}_{in}$$

$$= \frac{R(LCs^2 + 1)}{R(LCs^2 + 1) + Ls} \hat{V}_{in}$$

$$s = j\omega$$

$$\hat{V}_{out} = \frac{R(1 - LC\omega^2)}{R(1 - LC\omega^2) + j\omega L} \hat{V}_{in}$$

(answer box located on the following page)