

Name: Roll No:   
e.g. 170001Dept.:   
e.g. CSE

Indian Institute of Technology Kanpur  
CS637 Embedded and Cyber-Physical Systems  
Homework Assignment 1  
*Deadline:* August 19, 2022

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*Total:* **40 marks**

**Problem 1.** (20 points) Problem 7 in the Exercises of Chapter 2 in [LS15].

[LS15] Edward A. Lee and Sanjit A. Seshia, Introduction to Embedded Systems, A Cyber-Physical Systems Approach, Second Edition, <http://LeeSeshia.org>, ISBN 978-1-312-42740-2, 2015.

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**Problem 2.** (10 points) Problem 2 in the Exercises of Chapter 3 in [LS15].

[LS15] Edward A. Lee and Sanjit A. Seshia, Introduction to Embedded Systems, A Cyber-Physical Systems Approach, Second Edition, <http://LeeSeshia.org>, ISBN 978-1-312-42740-2, 2015.

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**Problem 3.** (10 points) The states of the linearized model of a vehicle steering system represent the lateral deviation of the vehicle from the x-axis and the angle between the vehicle axis and the x-axis. The output of the linearized model is only the first state. Construct a Simulink model for the vehicle steering system with its controller that includes an observer. The dynamics are available in Example 6.4 and Example 7.3 in [AM09]. Apply a sinusoidal signal as the reference trajectory that specifies the desired deviation of the vehicle from the x-axis with time. Plot the output (lateral deviation of the vehicle from the x-axis) with time.

[AM09] K. J. Astrom and R. M. Murray. Feedback Systems: An Introduction for Scientists and Engineers. Princeton University Press, 2009.

[http://www.cds.caltech.edu/~murray/books/AM08/pdf/am08-complete\\_22Feb09.pdf](http://www.cds.caltech.edu/~murray/books/AM08/pdf/am08-complete_22Feb09.pdf) .

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