

ME 176

Control Systems

Sem/AY:	2nd Sem 1617	Instructor:	Job Immanuel Encarnacion
Time:	W 830-1030 AM	Office:	ME Faculty Room
Room:	ME 3	Phone:	09479902457
Units:	3.0 u	E-mail:	jbencarnacion1@up.edu.ph

Consultation Hours: Wednesday and Friday, 1300-1500, Monday and Friday by appointment

Course Description: This course introduces the concept of control systems engineering applied to all the concepts learned so far in the field of mechanical engineering. This course incorporates what is already learned and brings in a new perspective on how to solve and design systems. This course aims to:

- Introduce students to the field of control systems engineering and its important in engineering design.
- Provide the mathematical fundamentals for modeling, analyzing and designing control systems.
- Further the student’s perspective in the field of mechanical design and establish the connection in everything
- Develop the student’s analytical and practical skills through assignments, quizzes, papers, and projects.

Student Outcomes: After this course, the students should be able to:

- Define and explain the fundamental concepts in control systems engineering
- Identify and describe control systems encountered in everyday life.
- Mathematically model dynamical systems and apply appropriate simplifying assumptions.
- Analyze and determine the characteristics of control systems to come up with the appropriate design.
- Systematically solve engineering problems involving control systems.
- Realize and explain the important of control systems in the field of engineering, and life.
- Love the field of mechanical engineering (and control systems).

References

- **CSE:** *Control Systems Engineering, 6th Edition*, Norman Nise (2011) [Available in Library]
- **MCE:** *Modern Control Engineering, 5th Edition*, Katsuhiko Ogata (2010) [Available in the Library]
- *Modeling Engineering Systems: PC-Based Techniques and Design Tools*, J.W. Lewis (1994)

Grade Equivalents

Final Grade	Equivalent Grade	Final Grade	Equivalent Grade
92 - 100	1.00	68 - below 72	2.50
88 - below 92	1.25	64 - below 68	2.75
84 - below 88	1.50	60 - below 64	3.00
80 - below 84	1.75	55 - below 60	4.00
76 - below 80	2.00	0 - below 55	5.00
72 - below 76	2.25		

Course Evaluation

- **Long Exams** **65%**
- **Assignments** **35%**

Course Outline

Lecture	Topic	Reference
0	Course Introduction	
Introduction to Control Systems Engineering		
1	Control Systems in Everyday Life	MCE 1.1-1.4
Mathematical Modeling of Systems		
2	Modeling of systems through Ordinary Differential Equations Laplace Transforms	CSE 2.1-2.3 , MCE 2.1-2.2, 2.7
3	Mechanical and Electrical Systems	MCE 3.1-3.3
4	Thermal and Fluid Systems	MCE 4.1-4.5
5	Transfer Functions and Operations	CSE 5.1-5.4
LTI Systems		
6	Poles, Zeros, and System Response First Order Systems	CSE 4.1-4.3 , MCE 5.1-5.2
7	Second Order Systems System Response with Additional Poles	CSE 4.4-4.9 , MCE 5.3-5.4
<i>Midterm Exams</i>		
Stability and Graphical Methods		
8	Routh-Hurwitz Criterion	CSE 6.1-6.4 , MCE 5.6
9	Bode and Nyquist Plots	MCE 7.1-7.7 , CSE 10.1-10.7
10	Root Locus Analysis	MCE 6.1-6.9 , CSE 8.1-8.5
11		
Steady State Errors and Sensitivity		
12	Steady State Errors and Pole Sensitivity	CSE 7.1-7.8
13		
PID Control		
14	PID Controllers	MCE 8.1-8.5
15		
<i>Finals</i>		