

ELEN440 16

STUDENT WARNING: This course syllabus is from a previous semester archive and serves only as a preparatory reference. Please use this syllabus as a reference only until the professor opens the classroom and you have access to the updated course syllabus. Please do NOT purchase any books or start any work based on this syllabus; this syllabus may NOT be the one that your individual instructor uses for a course that has not yet started. If you need to verify course textbooks, please refer to the online course description through your student portal. This syllabus is proprietary material of APUS.

Course Summary

Description

Course Description: This course covers the foundational concepts in mechatronics. It introduces students to the required skills necessary to design a complete mechatronic system. Students will learn about the use and integration of sensors, actuators, microcontrollers, and various types of software required to interact with hardware. Students will gain a system-of-systems approach to designing a complete mechatronics system and how to structure and interface to electromechanical systems. They will also gain practical experience through laboratory exercises in design of graphical user interfaces and real-time operating systems needed to control mechatronic systems. Students will also design feedback control systems with time and task constraints. NOTE: This course requires the student to purchase additional materials that are not covered by the book grant. Please refer to the Course Materials section for additional details. Prerequisites: ELEN312 AND ELEN416

Course Scope:

The course is intended to give a broad based introduction of the art of merging multiple technologies to satisfy a common goal. The interrelationship of mechanical and electrical/electronic devices will be studied to provide an understanding how to design a complex system. The main focus will be hardware but microcontroller firmware will be written as well as an introduction to real-time systems.

Objectives

After completing the course, the student should be able to accomplish these Course Objectives (CO):

1. Analyze the basic building blocks of any Mechatronic system.
2. Compare and contrast the various power semiconductor devices.
3. Design algorithms on microcontrollers to control a mechanical task.
4. Use feedback sensors in a mechatronic system.

Outline

Week 1: Introduction to Mechatronics Analog Circuits and Components

Course Objective(s)

(CO-1)

Readings

Chapter 1

Chapter 2

Assignment(s)

Week 1 Forum - Introduction

Week 1 Assignment

Recommended Optional Reading

Recommended Media

Week 2: Semiconductor Electronic Devices and Digital Circuits.

Course Objective(s)

(CO-2)

Readings

Chapter 3

Assignment(s)

Week 2 Assignment

Lab 1 Assignment

Recommended Optional Reading

Recommended Media

Week 3: Microcontrollers

Course Objective(s)

(CO-3)

Readings

Chapter 4

Assignment(s)

Week 3 Forum

Week 3 Assignment

Lab 2

Recommended Optional Reading

Recommended Media

Week 4: Microcontrollers (cont.)

Course Objective(s)

(CO-3)

Readings

Chapter 4

Assignment(s)

Week 4 Assignment

Lab 3

Recommended Optional Reading

Recommended Media

Week 5: Data Acquisition and Microcontroller/PC Interfacing

Course Objective(s)

(CO-4)

Readings

Chapter 5

Assignment(s)

Week 5 Forum

Week 5 Assignment

Lab 4

Recommended Optional Reading

Recommended Media

Week 6: Data Acquisition

Course Objective(s)

(CO-4)

Readings

Chapter 5 (cont.)

Assignment(s)

Week 6 Assignment

Lab 5

Recommended Optional Reading

Recommended Media

Week 7: Control Software

Course Objective(s)

(CO-3)

Readings

Chapter 6

Assignment(s)

Week 7 Forum

Week 7 assignment

Lab 6

Recommended Optional Reading

Recommended Media

Week 8: Control Software (cont.)

Course Objective(s)

(CO-3)

Readings

Chapter 6 (cont.)

Assignment(s)

Week 8 Assignment

Lab 7 (Exam 1)

Recommended Optional Reading

Recommended Media

Week 9: Sensors

Course Objective(s)

(CO-4)

Readings

Chapter 7

Assignment(s)

Week 9 Forum

Week 9 Assignment

Lab 8

Recommended Optional Reading

Recommended Media

Week 10: Sensors (cont.)

Course Objective(s)

(CO-4)

Readings

Chapter 7 (cont.)

Assignment(s)

Week 10 Assignment

Lab 9

Recommended Optional Reading

Recommended Media

Week 11: Actuators

Course Objective(s)

(CO-1)

Readings

Chapter 8

Assignment(s)

Week 11 Forum

Week 11 Assignment

Lab 10

Recommended Optional Reading

Recommended Media

Week 12: Feedback Control

Course Objective(s)

(CO-3), (CO-4)

Readings

Chapter 9

Assignment(s)

Week 12 Assignment

Week 12 Lab

Recommended Optional Reading

Recommended Media

Week 13: Feedback Control (cont.)

Course Objective(s)

(CO-3), (CO-4)

Readings

Chapter 9 (cont.)

Assignment(s)

Week 13 Forum

Week 13 Assignment

Lab 12

Recommended Optional Reading

Recommended Media

Week 14: Mechatronics Projects

Course Objective(s)

(CO-1), (CO-2), (CO-3), (CO-4)

Readings

Chapter 10

Assignment(s)

Week 14 Assignment

Lab 13

Recommended Optional Reading

Recommended Media

Week 15: Mechatronics Projects (cont.)

Course Objective(s)

(CO-1), (CO-2), (CO-3), (CO-4)

Readings

Chapter 10 (cont.)

Assignment(s)

Week 15 Forum

Week 15 Assignment

Lab 14

Recommended Optional Reading
Recommended Media

Week 16: Wrap-up, Final Lab Exam

Course Objective(s)

(CO-1), (CO-2), (CO-3), (CO-4)

Readings

None

Assignment(s)

Feedback Forum

Lab 15 (Final Exam)

Recommended Optional Reading
Recommended Media

Evaluation

Instructor announcements: Weekly announcements will appear on Monday of each week in the online classroom. This announcement will also be e-mailed to each student. The announcement will discuss the assignments for the week along with any other pertinent information for the week.

This is an upper level course; all students' work is to be presented as such in terms of quality and content. The grading system will be based on your introduction (2%), Forums (7%), Feedback Forum (1%), Lab assignments (30%), weekly assignments (30%), and exams (30%).

Reading Assignments: Please refer to the Course Outline section of this syllabus for the weekly reading assignments.

Week 1 Introductions: Each student must log into the classroom and introduce yourself to the class. This assignment is worth 20 points or 2 percent of your course grade. Your response is due by Sunday of Week 1. Your response must be greater than 250 words (a requirement) and include the following information.

- a. Your name
- b. Your university major or program
- c. Where you are in the program of study
- d. Your academic goals, to include why you are taking this class
- e. Information that you would like to share about yourself

Weekly Forums: The weekly discussion forum is for students to post their questions on course content for that week. This forum should not be used to discuss specific graded material questions prior to receiving feedback from the instructor (after the material is graded). If there is a question on a specific graded question, find a similar problem in the book and ask a question on that problem or concept. Asking specific questions on graded questions creates an unfair advantage and defeats the purpose of the assessment tool.

Lab Exercises: There are fifteen laboratory exercises that must be completed in order to pass the course. Despite having completed all other requirements for the course, you must complete all of the lab exercises in order to pass the course. You must demonstrate that you are competent in using the NI ELVIS or MyDaq unit to perform the laboratories.

Exams: There will be three exams, each worth 10% of your final grade. It is an open book, open note exam. It will be administered without a proctor. Students must complete the numbered exam by the end of the week indicated in the schedule.

Grading:

Name	Grade %
Assignments	30.00 %
Assignment 1: Mechatronics	2.00 %
Assignment 2: Analog	2.00 %
Assignment 3: Microcontroller	2.00 %
Assignment 4: Assembly Language	2.00 %
Assignment 5: Data Acquisition	2.00 %
Assignment 6: Integrated Circuit Interface	2.00 %
Assignment 7: Control Software	2.00 %
Assignment 8: RTOS	2.00 %
Assignment 9: Sensors	2.00 %
Assignment 10: Measurements	2.00 %
Assignment 11: Actuators	2.00 %
Assignment 12: Open/Closed Loop Ctrl	2.00 %
Assignment 13: Feedback Ctrl Systems	2.00 %
Assignment 14: Select Final Project	2.00 %
Assignment 15: Project Status	2.00 %
Labs	30.00 %
Lab #1: Review of LabView	2.31 %
Lab #2: DC Motor on/off Control	2.31 %
Lab #3: Ambient Sensor	2.31 %
Lab #4: Data Acquisition Card	2.31 %
Lab #5: Gyroscope	2.31 %
Lab #6: Open-Loop Step Response	2.31 %
Lab #8: Accelerometer	2.31 %
Lab #9: Sonic Range Finder	2.31 %
Lab #10: Servos	2.31 %
Lab #11: Stepper Motor	2.31 %
Lab #12: Increment Stepper Motor	2.31 %
Lab #13	2.31 %
Lab #14	2.31 %
Forums	10.00 %
Week 1 Forum	1.11 %
Week 3 Forum	1.11 %
Week 5 Forum	1.11 %
Week 7 Forum	1.11 %
Week 9 Forum	1.11 %
Week 11 Forum	1.11 %
Week 13 Forum	1.11 %
Week 15 Forum	1.11 %
Week 16 Forum	1.11 %
Exams	10.00 %
Exam 1: Lab #7	10.00 %

Final Exam	20.00 %
Final Exam1: Final Project	10.00 %
Final Exam2: Final Report	10.00 %

Materials

Book Title: NI Student Software Suite - this item is not covered by the APUS Book Grant

Author: National Instruments

Publication Info: National Instruments

ISBN: 779252-3501

Book Title: NI Elvis Kit - this item is not covered by the APUS Book Grant

Author: National Instruments

Publication Info: National Instruments

ISBN: 780381-02

Book Title: NI myRIO Embedded Student Design Device - this item is not covered by the APUS Book Grant

Author: National Instruments

Publication Info: National Instruments

ISBN: 782692-01

Book Title: NI myRIO Starter Accessory Kit - this item is not covered by the APUS Book Grant

Author: National Instruments

Publication Info: National Instruments

ISBN: 783068-01

Book Title: NI myRIO Embedded Systems Accessory Kit - this item is not covered by the APUS Book Grant

Author: National Instruments

Publication Info: National Instruments

ISBN: 783070-01

Book Title: myParts Kit from Texas Instruments - this item is not covered by the APUS Book Grant

Author: National Instruments

Publication Info: National Instruments

ISBN: 783752-01

Book Title: Fundamentals of Mechatronics, 1st ed.- the VitalSource e-book is provided via the APUS Bookstore

Author: Jouaneh

Publication Info: Cengage

ISBN: 9781111569013

Book Title: Additional required items are available to order from the APUS Bookstore. If you buy these items from other vendors, you may not receive all the parts you need for your course. These items (as noted) are not covered by the APUS Book Grant.

Author: N/A

Publication Info: N/A

ISBN: N/A

Websites

Site Name- Book Website

Website URL/Address- [Fundamentals of Mechatronics website](#)

Lab Materials

Manufacturer- National Instruments

Equipment/Software Name- NI myRIO Mechatronics Kit

Manufacturer- National Instruments

Equipment/Software Name- myRIO

Manufacturer- National Instruments

Equipment/Software Name- NI myRIO Starter Kit

Course Guidelines

Citation and Reference Style

- Attention Please: Students will follow the APA Format as the sole citation and reference style used in written work submitted as part of coursework to the University. Assignments completed in a narrative essay or composition format must follow the citation style cited in the APA Format.

Tutoring

- [Tutor.com](#) offers online homework help and learning resources by connecting students to certified tutors for one-on-one help. AMU and APU students are eligible for 10 free hours* of tutoring provided by APUS. Tutors are available 24/7 unless otherwise noted. Tutor.com also has a SkillCenter Resource Library offering educational resources, worksheets, videos, websites and career help. Accessing these resources does not count against tutoring hours and is also available 24/7. Please visit the APUS Library and search for 'Tutor' to create an account.

Late Assignments

- Students are expected to submit classroom assignments by the posted due date and to complete the course according to the published class schedule. The due date for each assignment is listed under each Assignment.
- Generally speaking, late work may result in a deduction up to 20% of the grade for each day late, not to exceed 5 days.
- As a working adult I know your time is limited and often out of your control. Faculty may be more flexible if they know ahead of time of any potential late assignments.

Turn It In

- Faculty may require assignments be submitted to Turnitin.com. Turnitin.com will analyze a paper and report instances of potential plagiarism for the student to edit before submitting it for a grade. In some cases professors may require students to use Turnitin.com. This is automatically processed through the Assignments area of the course.

Academic Dishonesty

- Academic Dishonesty incorporates more than plagiarism, which is using the work of others without citation. Academic dishonesty includes any use of content purchased or retrieved from web services such as CourseHero.com. Additionally, allowing your work to be placed on such web services is academic dishonesty, as it is enabling the dishonesty of others. The copy and pasting of content from any web page, without citation as a direct quote, is academic dishonesty. When in doubt, do not copy/paste, and always cite.

Submission Guidelines

- Some assignments may have very specific requirements for formatting (such as font, margins, etc) and submission file type (such as .docx, .pdf, etc) See the assignment instructions for details. In general, standard file types such as those associated with Microsoft Office are preferred, unless otherwise specified.

Disclaimer Statement

- Course content may vary from the outline to meet the needs of this particular group.

Communicating on the Forum

- Forums are the heart of the interaction in this course. The more engaged and lively the exchanges, the more interesting and fun the course will be. Only substantive comments will receive credit. Although there is a final posting time after which the instructor will grade comments, it is not sufficient to wait until the last day to contribute your comments/questions on the forum. The purpose of the forums is to actively participate in an on-going discussion about the assigned content.
- “Substantive” means comments that contribute something new and hopefully important to the discussion. Thus a message that simply says “I agree” is not substantive. A substantive comment contributes a new idea or perspective, a good follow-up question to a point made, offers a response to a question, provides an example or illustration of a key point, points out an inconsistency in an argument, etc.
- As a class, if we run into conflicting view points, we must respect each individual's own opinion. Hateful and hurtful comments towards other individuals, students, groups, peoples, and/or societies will not be tolerated.

University Policies

[Student Handbook](#)

- [Drop/Withdrawal policy](#)
- [Extension Requests](#)
- [Academic Probation](#)
- [Appeals](#)

- [Disability Accommodations](#)

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