

# ELEN430 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

**Course :** ELEN430 **Title :** Embedded Systems Design

**Length of Course :** 16

**Prerequisites :** ENGR200, ELEN307 **Credit Hours :** 3

---

## Description

**Course Description:** The fundamentals of embedded system hardware and firmware design will be covered in this course. The main topics to be discussed are: embedded processor selection, hardware/firmware partitioning, glue logic, circuit design, circuit layout, circuit debugging, development tools, firmware architecture, firmware design, and firmware debugging. The Atmel AVR series microcontroller will be studied. The architecture and instruction set of the microcontroller will be discussed. A microcontroller development board will be utilized as a development and debugging platform. The course will culminate in a significant final project and will include interfacing real world peripherals to the microcontroller to perform some specific task. Depending on the interests of the students and professor, other relevant topics may be covered. 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: ELEN307 AND ENGR200)

### Course Scope:

This course covers the fundamentals of embedded systems. LabVIEW and C are both used for programming a softcore microprocessor. The content of the class also serves as a review of LabVIEW programming. The labs in the class coincide with course content and

---

## Objectives

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

CO-1. Distinguish between the hardware and software elements that constitute an embedded system.

CO-2. Design hardware needed for an embedded system.

CO-3. Design computer code to perform a task on a microprocessor.

CO-4. Integrate microprocessor peripheral devices into embedded systems.

CO-5. Apply feedback principals to design a microcontroller based digital controller.

CO-6. Design testing procedures to verify the performance of embedded systems.

CO-7. Prepare effective communication material using technical data.

---

## Outline

### **Week 1: Definitions and LabVIEW Basics**

---

Course Objective(s)

CO-1, CO-3

Readings

Chapter 1

Assignment(s)

Week 1 Forum - Introduction

Tutorial 1: Software Installation Tutorial

Week 1 Assignment

### **Week 2: Parallel Data Transfer and Virtual Instruments (VI)**

---

Course Objective(s)

CO-2, CO-3

Readings

Chapter 2

Assignment(s)

Week 2 Assignment

Tutorial 2: Ports

### **Week 3: Bidirectional data transfer and Debugging VIs**

---

Course Objective(s)

CO-2, CO-3, CO-7

Readings

Chapter 3

Assignment(s)

Week 3 Forum – Debugging in LabVIEW

Lab 1: Keypad

Week 3 Assignment

**Week 4: Logic in C and LabVIEW, and subVIs**

---

Course Objective(s)

CO-2, CO-3, CO-7

Readings

Chapter 4

Assignment(s)

Week 4 Assignment

Lab 2: LED Matrix

**Week 5: Advanced Input/Output (I/O) and subVIs**

---

Course Objective(s)

CO-2, CO-3, CO-4, CO-7

Readings

Chapter 4

Assignment(s)

Week 5 Forum – C and LabVIEW

Lab 3: UART

Week 5 Assignment

**Week 6: Advanced I/O and Loops**

---

Course Objective(s)

CO-2, CO-3, CO-4, CO-7

Readings

Chapter 5

Assignment(s)

Week 6 Assignment

Lab 4: SPI Interfaces

**Week 7: Advanced I/O and Array Clusters**

---

Course Objective(s)

CO-2, CO-3, CO-4, CO-7

Readings

Chapter 6

Assignment(s)

Week 7 Forum – I/O Standards

Lab 5: I2C

Week 7 Assignments

### **Week 8: First Half Review**

---

Course Objective(s)

CO-1, CO-2, CO-3, CO-4

Readings

None

Assignment(s)

Midterm Test

### **Week 9: Memory and Charts/Graphs in LabVIEW**

---

Course Objective(s)

CO-2, CO-3, CO-4, CO-7

Readings

Chapter 7

Assignment(s)

Week 9 Forum – Memory Types

Lab 6: Serial EEPROM

Week 9 Assignment

### **Week 10: Counters, Timers, and Charts/Graphs**

---

Course Objective(s)

CO-2, CO-3, CO-4, CO-7

Readings

Chapter 7

Assignment(s)

Week 10 Assignment

Lab 7: Timers and Event Counters

### **Week 11: Analog Interfaces and Data Acquisition**

---

Course Objective(s)

CO-2, CO-3, CO-4, CO-7

Readings

Chapter 8

Assignment(s)

Week 11 Forum – Analog to Digital Datasheets

Lab 8: Digital Potentiometer

### **Week 12: Control, Feedback, and File I/O**

---

Course Objective(s)

CO-2, CO-3, CO-4, CO-5, CO-7

Readings

Chapter 9

Assignment(s)

Week 12 Assignment

Lab 9: Data Logging

### **Week 13: Testing Embedded Systems and MathScript**

---

Course Objective(s)

CO-2, CO-3, CO-4, CO-6, CO-7

Readings

Chapter 10

Assignment(s)

Week 13 Forum – Testing

Lab 10: Microphone

Week 13 Assignment

### **Week 14: PCB Layout and LabVIEW Analysis**

---

Course Objective(s)

CO-2, CO-3, CO-6

Readings

Chapter 11

Assignment(s)

Week 14 Assignment

Lab 6: Project Proposal

### **Week 15: LabVIEW Certifications**

---

Course Objective(s)

CO-2, CO-3, CO-7

Readings

Chapter 12

Assignment(s)

Project

Week 15 Assignment

### **Week 16: Course Review**

---

Course Objective(s)

CO-1, CO-2, CO-3, CO-4, CO-5, CO-6, and CO-7

Readings

None

Assignment(s)

Week 16 Forum – Evaluation

Final Test

Project Presentations

---

## **Evaluation**

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 participation in the forums, assignments, tutorials, labs, quizzes, and test.

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

**Week 1 Self-introductions:** During Week 1 forum, each student must post a self-introduction (bio) to the class. This self-introduction is a requirement by the University, and is due by mid-night of Sunday of Week 1,

along with two reply posts to other students. Your response must be at least 100 words (a requirement) and include the following information:

- a. Your name
- b. Your major
- c. Where you are in the program of study - what percentage of the program have you completed?
- d. Your academic and career goals
- e. Your thoughts on what embedded systems are and some examples of embedded systems

**Forums:** There will be eight forums (1% each), counting 8% of the final grade. The forums will consist of specific questions to be answered, broad questions to be discussed, or polls for students to post their questions on the topics covered in that week. In each forum, a student is required to contribute an initial post in all weeks. Some weeks require two reply posts to other students in class. In weeks where reply posts are required, the initial post will be 60% of the grade and each reply post will be 20% of the grade.

**Assignments:** There will be fourteen assignments (1% each) during the course worth a total of 14% of the total grade. Each weekly assignment will cover one or more chapters in the book used in this course. For all problems requiring mathematical calculations, all work must be shown.

**Tests:** There will be two tests (15% for the midterm and 8% for the final exam), counting 22% of the final grade. Tests will be open book, and open note. Tests will be non-proctored and will be design based. Students must complete each test within its time limit.

**Tutorials:** There will be two tutorials (1% each), counting 2% of the final grade. Tutorials will introduce new software and hardware to the course and will require evidence of successful completion of the tutorial.

**Labs:** There will be ten labs (3.2% each), counting 32% of the final grade. Labs will require a written lab report as well as evidence of successful completion of the lab.

**Project:** There will be a final project that counts for 21% of the final grade. The project has a proposal (4.2% of the final grade) and a presentation (16.8% of the final grade). The project requires a live or recorded video presentation which is in week 16 of the course.

### Grading:

Name	Grade %
------	---------

---

## Materials

**Book Title:** Learning with LabVIEW - the VitalSource e-book is provided via the APUS Bookstore

**Author:** Bishop

**Publication Info:** Pearson

**ISBN:** 9780134022123

**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

**Book Title:** NI Student Software Suite - access instructions provided inside the classroom

**Author:** National Instruments

**Publication Info:** National Instruments

**ISBN:** 779252-3501

**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:** 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:** 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:** 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:** You must validate your cart to get access to your VitalSource e-book(s). If needed, instructions are available here - <http://apus.libguides.com/bookstore/undergraduate>

**Author:** N/A

**Publication Info:** N/A

**ISBN:** N/A

---

**Lab Materials:**

Manufacturer- National Instruments

Equipment/Software Name- ELVIS

Manufacturer- National Instruments

Equipment/Software Name- MultiSim and Eclipse Software

Manufacturer- National Instruments

Equipment/Software Name- myRIO

Manufacturer- National Instruments

Equipment/Software Name- NI myRIO Embedded 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](https://www.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 15% 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.

## Identity Verification & Live Proctoring

- Faculty may require students to provide proof of identity when submitting assignments or completing assessments in this course. Verification may be in the form of a photograph and/or video of the student's face together with a valid photo ID, depending on the assignment format.
- Faculty may require live proctoring when completing assessments in this course. Proctoring may include identity verification and continuous monitoring of the student by webcam and microphone during testing.

---

## University Policies

### [Student Handbook](#)

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

The mission of American Public University System is to provide high quality higher education with emphasis on educating the nation's military and public service communities by offering respected, relevant, accessible, affordable, and student-focused online programs that prepare students for service and leadership in a diverse, global society.

**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.