

Abilene Approval Chart for Curriculum Changes

A = Approve I = Information Item R = Respond In Writing

Course Number: ECEN 315

or Degree Plan(s):

		De pt./ Sch ool	Coll ege	Dea n	TEC	AU AC/ Gra d	Pro vos t
	Campus-Level Academic Review¹						
	Change to a Course Include signatures from all chairs/program directors for cross-listed courses. ¹						
1.	Title (description unchanged)	A	A	A	I	I	I
2.	Description (not affecting content)	A	A	A	I	I	I
3.	Course term(s)	A	I	A	I	I	I
4.	Content (change of course outcomes)	A	A	A	I	I	A
5.	Number of credit hours	A	A	A	A	A	A
6.	Course number within the hundred	A	A	I	I	I	I
7.	Course number beyond the hundred	A	A	A	A	A	A
8.	Prerequisites	A	A	A	I	I	I
9.	Course restriction (e.g., majors only, junior standing)	A	A	A	A	A	A
10.	Level change (U to G or G to U)	A	A	A	A	A	A
11.	Cross list course	A	A	A	A	A	A
12.	Department of record	A	A	A	A	A	A
13.	Open or close a course	A	A	A	A	A	A
	Change to a Degree Plan						
14.	Educational Program — Revise	A	A	A	A	A	A
15.	Educational Program — Adopt/revise admission requirements	A	A	A	A	A	A
16.	GPA — Revise program-required GPA	A	A	A	A	A	A
17.	Minor — Revise	A	A	A	A	A	A

		De pt. /Sc hool	Col leg e	De an	TE C	AU AC /Gr ad	Pro vos t	Ca mp us Fac ult y	Se nior VP AA	Pre sid ent
	Full Review									
	Change to Catalog Information (for Campus)									
18.	General requirements for Bachelor's and Associate Degrees	-	-	-	-	A	A	A	A	I
19.	Policies governing academic probation and suspension	-	-	-	-	A	A	A	A	I
20.	Requirements for graduating with honors	-	-	-	-	A	A	A	A	I
	Change to a Degree Plan									
21.	Educational Program — Add or Discontinue ^{2,3}	A	A	A	A	A	A	A	A	I
22.	Educational Program — Discontinue (Provost-proposed)	R	-	R	A	A	A	A	A	I
23.	Minor — Add or Discontinue	A	A	A	A	A	A	-	A	I
24.	Minor — Discontinue (Provost-proposed)	R	-	R	A	A	A	-	A	I
25.	Degree — Add or Discontinue	A	A	A	A	A	A	A	A	I
26.	Degree — Discontinue (Provost-proposed)	R	-	R	A	A	A	A	A	I

		De pt. /Sch ool	Col leg e	Dea n	TEC	AU AC/ Gra d	Pro vos t	Ca mp us Fac ult y	Sen ior VP AA	Pre sid ent
	Change to General Education Requirements for Undergraduates (System)									
27.	Change course outcomes of an included course	A	A	A	A	A	A	-	A	I
28.	Add or drop a required course from the General Education Requirements	A	-	A	-	A	A	A	A	I
29.	Add or drop a course from a menu within the General Education Requirements	A	-	A	-	A	A	-	A	I
30.	Comprehensive revision of General Education Requirements	-	-	-	-	A	A	A	A	I

Notes

² Any change to a cross-listed course requires the signature of both department chairs or program directors overseeing the course to ensure that the courses stay in sync. This includes courses taught at other campuses (e.g. BIBL 101 and BIBO 101).

³ For undergraduate majors, a minimum of 30 hours is required. These programs must have a minimum of 6 elective hours, unless the requirements of external accrediting bodies make it impossible. Master's programs must include a minimum of 30 hours, and doctoral programs must include a minimum of 30 hours beyond the master's.

⁴ When a department/school or dean proposes closing a program, approval routing follows the typical process beginning with the department/school. An administrative proposal by the provost or senior vice president for academic affairs would follow the "provost-proposed" routing on the chart.

Department/School(s)



12/1/23

Chair Signature

Date

Chair/Program Director Signature

Date

College Academic Council(s)



3/22/24

Chair Signature

Date

Chair Signature

Date

Dean(s)



3/22/24

Signature

Date

Signature

Date

Teacher Education Council

Signature

Date

**Campus Academic Council:
Abilene Undergraduate or Abilene Graduate**

Signature

Date

Provost

Signature

Date

University General Education Council

Signature

Date

University Faculty

Abilene Faculty Senate Chair signature

Date

Dallas Faculty Council Chair signature

Date

Senior Vice President for Academic Affairs

Signature

Date

President

Signature

Date

Abilene New Course Application

You may delete the preceding instructional pages before submitting application.

Course ID (<i>Subject Code and Number</i>)	ECEN 315
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1. Systems and Catalog Information Complete each item.

A	Course Developer	Darby Hewitt
B	Course Instructor	Darby Hewitt
C	Course Title	Introduction to Embedded Systems
D	Course Abbreviation for Banner if title is more than 30 characters	Intro. to Embedded Systems
E		OSE - Onstead Science and Engineering
F		PHYS - Engineering & Physics
G		3
G1		3
G2		0
H	Is the course for a fixed or variable number of credit hours?	Fixed If variable, explain rationale:
I	Is the course repeatable for additional credit?	No
J	Maximum total number of credit hours a student can earn for this course	3
K		<u>Lecture (LEC)</u> See Schedule Type definitions in the Reference section.
L		3
M		<u>Standard</u>
N	Maximum Enrollment	20
O	Catalog Description (50 words or less)	Foundations of software and hardware development in the context of

		microcontroller-based systems. Topics include firmware development in C and assembly language, in-circuit debugging, GPIO, ADC, timer modules, hardware interrupts, and digital communication protocols (IIC, SPI, and UART).
P	List any prerequisites (course/s, test scores, class standing, major, etc.)	CS 120
Q	List any corequisites (these <i>must</i> be taken at the same time; note that a single requirement cannot be both a prerequisite <i>and</i> a corequisite)	ECEN 316
R	If the course is cross-listed, specify the subject code and course number of the other course	
S	Does this course require any additional student course fees?	<u>No</u> If yes, attach a completed course fee form .
T1	Will the course be offered in fall terms?	<u>Yes, every year</u>
T2	Will the course be offered in spring terms?	<u>No</u>
T3	Will the course be offered in summer terms?	<u>No</u>
U	First semester this course will be offered under new Course ID. <i>May not be earlier than the coming fall semester.</i>	Fall 2024
V	Is this course required for a program(s)?	<u>Yes</u> If yes, attach a completed curriculum proposal to change the program(s).
W	Should the addition of this course be retroactively applied to the degree plan it supports? <i>This is rare, and rationale should explain compelling extenuating circumstances.</i>	<u>No</u> If yes, provide rationale:

X	Has this course been offered as a Special Topics course? <i>New courses are not required to be taught as Special Topics courses prior to approval.</i>	<u>No</u> If yes, provide course ID, term, and enrollment:
Y	List any courses in which the content overlaps the proposed course. (Course ID and Name). <i>Attach a statement from the instructor/dept chair of the existing course justifying the new offering.</i>	The content of this course will be an expansion of the introductory content of the existing course ENGR 422 (Embedded Systems). Within the Electrical Engineering degree, more hours can be devoted to fundamental concepts of Embedded Systems. The design portions of ENGR 422 will be expanded similarly in another new course: ECEN 422. ENGR 422 will be removed from the catalog and its content will be expanded upon in ECEN 315 and ECEN 422.

2. Curriculum

This course is required in the new Electrical Engineering degree plan. It will provide a thorough foundation for advanced study and design work in the field of embedded systems.

3. Course Design

A. Audience and Course Goal

This course is designed to give Junior and Senior Electrical Engineering and Computer Science students foundational knowledge and skills in developing firmware for and integrating hardware in embedded systems.

B. Student Learning Outcomes and Measurements

	Student Learning Outcome	Measurement
1	Document the behavior of embedded systems, describing their behavior with flow diagrams and state machines	Quizzes and Exams
2	Demonstrate ability to write and interpret both C and assembly language code for microcontrollers	Quizzes and Exams
3	Interpret manufacturer datasheets to compare and contrast the capabilities of different microcontrollers	Quizzes and Exams

C. **Text and Resources**

1. *Introduction to the MSP432 Microcontroller* by Jonathan W. Valvano
2. ATtiny1627 Curiosity Nano board (provided)
3. Texas Instruments MSP432 LaunchPad and the EDUMKII BoosterPack (provided)
4. Various electronic components (provided)

4. Supporting Documentation

Required of all applications	
1	Approval Chart for Curriculum Changes
2	Syllabus — Attach the syllabus for the course based upon the anticipated first-semester offering.
4	Library — Submit new course application and syllabus to the Library dean's office. Attach the Library's memo.
Attach if applicable	
5	Content Overlap — Include one document for each course you listed in Section 1Y. Attach statement from instructor/dept chair of existing course justifying the new offering.
6	Departmental Resources — List the resources that support the course and are available only through the department, if applicable. Attach the list of the holdings and the location(s).
7	Resources — List resources (other than library or departmental resources) that are needed to support this course (computers, lab equipment, other technology, etc.). Attach a complete list of all items and indicate possible sources or estimated cost of each. List the sources of any needed funds.
8	Expenses — List additional expenses needed to implement this course (full-time or part-time faculty, graduate or lab assistants, student employees, travel, special student costs, room renovation, storage facility, etc.). Attach a complete list of all items, the estimated cost of each and the source of the funds.
9	Justification — Attach any documents to which you refer in Section 2B.

Syllabus for **Introduction to Embedded Systems** (ECEN 315); 3 credit hours

Fall 20XX, MWF 1-1:50 PM

BEN212

Course website: Canvas site on my.acu.edu

Instructor: Dr. Darby Hewitt, Associate Professor of Engineering and Physics

Email: darby.hewitt@acu.edu

Office: OSC 121B

Office hours: Monday 10-12, 2-4; Tuesday 8-11

Phone: (325) 674-6732 (Office), (217) 417-5859 (Cell)

Please limit cell phone calls/texts to emergencies if after 8 PM.

Text and supplies:

- ATtiny1627 Curiosity Nano board (provided)
- *Introduction to the MSP432 Microcontroller* by Jonathan W. Valvano
- Texas Instruments MSP432 LaunchPad and the EDUMKII BoosterPack (provided)
- Electronic components (provided)

ACU Catalog Course Description: Foundations of software and hardware development in the context of microcontroller-based systems. Topics include firmware development in C and assembly language, in-circuit debugging, GPIO, ADC, timer modules, hardware interrupts, and digital communication protocols (IIC, SPI, and UART). Prerequisite: CS120; corequisite: ECEN 316

Faith and Learning in the context of engineering courses: In any professional context, our faith should influence our work ethic. The author of Ecclesiastes encourages his readers to do whatever they do with all their might (paraphrase of Eccl. 9:10). You should be mindful of the faith tradition you represent with your actions when you go to work, and the classroom is a great place to start practicing that mindfulness.

Learning objectives (assessed through weekly quizzes, two mid-semester exams, and a final exam):

At the end of this course, students should be able to

- Document the behavior of embedded systems, describing their behavior with flow diagrams and state machines
- Demonstrate ability to write and interpret both C and assembly language code for microcontrollers
- Compare and contrast the capabilities of different microcontrollers

Course Outline:

Week 1 – What is an embedded system?

Week 2 – Programming in C with bits in mind

Week 3 – Event-driven programming and hardware interrupts

Week 4 – Digital communication protocols (SPI, I²C, and UART)

Week 5 – Programming in assembly language

Week 6 – Planning and organizing embedded code

Week 7 – Review/Test 1

Week 8 – Interfacing with analog devices

Week 9 – All about the ARM Cortex-M architecture

Week 10 – Comparing ADC in different platforms

Week 11 – Reflecting on development for different microcontroller platforms

Week 12 – Review for Test 2, Test 2 part 1 (take-home portion) assigned

Week 13 – Test 2 Part 1 due, Test 2 Part 2 (in-class)

Week 14 – Documentation of embedded system behavior

Week 15 – Final Exam review

Format of Class:

Each week, a new module will be opened in Canvas, and that module will have a homework assignment and a quiz. The quiz will be made available on the Friday of the corresponding week, and it will cover the material from the homework and lectures through the week. The homework assignment will be due on the following Monday.

Final Grade Composition:

Your final grade in this course will be calculated by performing a weighted average of your assignments according to the following table

Homework	10%
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Quizzes	22%
Lower-grade Test	13%
Higher-grade Test	25%
Final Exam	30%

Grade scale:

89.5% and above: A

79.5% to 89.4%: B

69.5% to 79.4%: C

59.5% to 69.4%: D

Below 59.5%: F

Homework: We'll have homework almost every week. I encourage you to work together on homework, but ***do not copy your classmates' work.*** No late homework will be accepted. If you cannot finish by the deadline, turn in what you have done on time.

I will include reading as part of almost all homework assignments, and I will ask you to write two things you found interesting or ask two questions based on that reading.

Quizzes: I plan to have these every Friday, and they will cover the material we discussed on Monday and Wednesday of that week. Starting your homework on the day it is assigned is a good way to study for these. I will drop your two lowest quiz scores.

Mid-semester tests: Two tests will be given during the semester. You will have at least two weeks notice before tests. I will weigh your individual test grades according to how well you did on each of them. Your higher test score will account for 25% of your final grade, and your lower test score will account for 13% of your final grade.

Final Exam: The final exam will be given at the time scheduled by the university. It will be a cumulative survey of the material presented throughout the entire semester.

Attendance: Those who are in class every lecture are statistically more likely to get a good grade in the class.

Academic Integrity

I think that cheating is the worst thing someone could do in college, and that is saying a lot. Cheating is an act so counter to academic principles (not to mention Christian morality) that I will report any infraction without exception. See

<https://acu.edu/dean-of-students/student-handbook/academic-policies/> for the full university policy.

University ADA Compliance Statement

Abilene Christian University is dedicated to removing barriers and opening access for students with disabilities in compliance with ADA and Section 504 of the Rehabilitation Act. The Alpha Scholars Program facilitates disability accommodations in cooperation with instructors. In order to receive accommodations, you must be registered with Alpha Scholars Program, and you must complete a specific request for each class in which you need accommodations. If you have a documented disability and wish to discuss academic accommodations, please call our office directly at 325-674-2667.

Title IX Information and Policy

At ACU, we strive to comply with all applicable legal requirements prohibiting, preventing, and responding to sexual misconduct against any member of the ACU community. Moreover, as a Christian community, ACU has committed itself, unequivocally, to ensuring a working and learning environment in which the dignity of every individual is respected.

*Our Title IX – Sexual Misconduct Policy outlines specific definitions and procedures related to **sexual harassment, sexual exploitation, sexual assault, stalking, and relationship violence**. If you experience sexual misconduct in any of these forms, we encourage you to [report it](#) so that we can help maintain a work and academic environment free of unlawful behavior.*

The mission of ACU: to educate students for Christian service and leadership throughout the world.

The mission of the Onstead College of Science and Engineering is to explore and understand God's creation in the natural world and apply the acquired knowledge and principles to address its issues and challenges.

Department Mission:

The ACU engineering program strongly supports the university's mission of educating students for Christian service and leadership throughout the world. In support of this mission, ACU engineering graduates will attain:

- A deep and broad understanding of engineering principles and practices as evidenced by professional employment, continued professional development, and graduate study in engineering or other professional fields.
- An extensive knowledge of innovative design processes unique to engineering professionals as demonstrated by using critical thinking skills to contribute to scientific and technical literature, patents and intellectual property, professional societies, and creative designs.
- A thorough understanding of Christian service and leadership as shown in their commitments to professionalism, ethics, and service and leadership within the engineering profession, the church, and society.

February 2, 2024

Dr. Darby Hewitt
Associate Professor
Department of Engineering and Physics
Onstead Science Center (OSC) 121B
(325) 674-6732

Re: Review of Introduction to Embedded Systems Laboratory (ECEN 316)

Dear Dr. Hewitt,

Thank you for submitting Introduction to Embedded Systems Laboratory (ECEN 316) to us for a review. I have reviewed it based on the ACU Syllabus Guidelines. I found the syllabus to meet all aspects of the checklist.

Please note that this letter is intended as a reference, which will be read by the department chair and members of the council, who may also have questions or comments of their own. If you have any questions, please feel free to let me know.

Please also let me know if we can be of any help in the design and facilitation of this course.

Sincerely,

A handwritten signature in black ink, appearing to read "Scott E. Hamm", with a stylized flourish at the end.

Dr. Scott E. Hamm,
Assistant Director, Adams Center

ABILENE CHRISTIAN UNIVERSITY LIBRARY

M E M O R A N D U M

DATE: November 28, 2023

TO: Dr. Darby Hewitt

FROM: Mark McCallon, Associate Dean for Library Information Services **RE:** Course
Application for ECEN 315 – Introduction to Embedded Systems

After reviewing the course application and syllabus, the library does have adequate resources to support the proposed course. Please contact Mark McCallon, Librarian Liaison, if additional resources are needed for the course. Thank you for letting us review the course proposal and syllabus.