ECE 594, Microprocessor-Based System Design, Fall, 2023
ECE 594L, Microprocessor System Lab, Fall, 2023

- Instructor: Abu Asaduzzaman (DRZ)
- Department: Electrical and Computer Engineering (ECE)
- Office Location: 303 Wallace Hall (WH) building
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- Preferred Method of Contact: In person during office hours or e-mail
- Classroom, Day/Time: 1.3056 NetApp, Monday and Wednesday 12:30-1:45 PM
- Student/Office Hours: MW 8:00-9:30 AM (303-WH)
- Lab, Day/Time: 262JBC, Monday 3:45-6:15 PM
- Prerequisites: ECE 238, ECE 394
- Teaching Assistant (TA): Lab – Nowshin Nawal | Grading – DRZ
- TA Contacts: Lab – nxnawal@shockers.wichita.edu

How to use this syllabus

This syllabus provides you with information specific to this course, and it also provides information about important university policies. This document should be viewed as a course overview; it is not a contract and is subject to change as the semester evolves. Any changes should be shared via lecture and/or Blackboard.

University Policies and Procedures

The Wichita State University Policies and Procedures Manual can be found at: https://www.wichita.edu/about/policy/.

Academic Integrity

Students at Wichita State University are expected to uphold high academic standards. WSU will not tolerate a lack of academic integrity. Students are responsible for knowing and following the Student Code of Conduct http://webs.wichita.edu/inaudit/ch8_05.htm and the Student Academic Honesty policy http://webs.wichita.edu/inaudit/ch2_17.htm. When the faculty member determines sanctions are warranted for violations of academic integrity, regardless of severity, the faculty member must report the infraction to the Office of Student Conduct and Community Standards. If you need more information about the process or wish to appeal a decision, please visit https://www.wichita.edu/about/student_conduct/ai.php

If there are homework (HW) assignments in this course, each HW will be an individual assignment (unless otherwise stated). Students can discuss with others, but they should not write the solution together; one submission (wording/coding) should be reasonably different from other submissions. "Collaboration is good, cheating is not!" There will be severe consequences for academic dishonesty. Cheating (such as copying word-for-word from other sources) in any test will automatically result a 'Fail' grade in this course; this grading policy applies to all parties involved (including the ones who help/show).

Course Description

Presents knowledge required to understand the internal architecture and working principles of microprocessors and provides skills to design and program microprocessor-based systems. Introduces vendor-supplied special-purpose chips such as interrupt controllers, programmable input/output devices, and sensor modules. Laboratory and team-project activities give hands-on experience.

Measurable Student Learning Outcomes

Measurable Student Learning Outcomes: Undergraduate Level

After passing this course, undergraduate students will experience:

- (SO: EAC 1) an ability to identify and solve microprocessor-based embedded system problems by applying principles of engineering, science, and mathematics

- (SO: EAC 2) an ability to apply microprocessor-based embedded system design to produce solutions that meet specified needs with consideration of public safety and economic factors

Measurable Student Learning Outcomes: Graduate Level

After passing this course, graduate students will experience:

- (SO: EAC 6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use computer engineering judgment to draw conclusions

- (SO: EAC 7) an ability to acquire and apply new microprocessor-based embedded system knowledge as needed, using appropriate learning strategies

Required Texts/Readings Textbook

No textbook. | Please talk to the instructor before buying books for this course.

Reference Book: "Introduction to Microprocessor-Based Systems Design," Giuliano Donzellini, Andrea Mattia Garavagno, and Luca Oneto, Springer, 1st ed. 2022.

Reference Book: "Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C," Yifeng Zhu, E-Man Press LLC, any edition.

Reference Book: "Programming Embedded Systems: With C and GNU Development Tools," Michael Barr and Anthony Massa, O'Reilly Media, any edition.

Other Readings

Class notes and lab manual/assignments will be made available via WSU Blackboard.

Handouts on servicing interrupts and interfacing input/output devices (i) in Assembly Language using EASy68K and/or IDE68K editor/assembler and (ii) in C/C++ Language using CodeWarrior software package and DEMOEM hardware boards will be made available via WSU Blackboard.

Other reading materials (such as Internet of Things, research articles, etc.) will be made available via WSU Blackboard.

Other Equipment/Materials

"Microprocessor Tool-Boxes" (each box will have an embedded system development board and required peripherals) will be available for students to borrow so that they can complete the lab/project activities. Students will be provided information about hardware, software, and service supports so that they can develop systems that fulfill public safety requirements and help economic growth.

Class Protocol

There are points on class/lab performance. It is expected that students join the instructor and/or TA before classes/labs start. Students are always encouraged to ask questions, especially if they find ambiguity in assignments and materials covered.

Contact Policy

Although you may attempt to reach me by phone, email communication is always preferred. Feel free to email me any questions or concerns following these guidelines:
- **Always** email me from your WSU email address and/or through Blackboard.
- Always use the course name in the subject line of the email.
- Remember to sign your name.
- If you have a problem with accessing or uploading assignments, you should let me know as soon as possible before the assignment is due. You will also have to accompany this notification with the file in question, so I can verify that it is completed by the due date/time.
- I offer a Discussion Forum on Blackboard which allows common questions to be seen and responded to publicly.
- You **should NOT** contact me for tech support.
  - Any technical problems involving your computer, or issues regarding file uploading or sharing, should go through the OneStop. You can contact them at 316-978-3909. You can also fill out a request for help form at their website: https://wichita.edusupportcenter.com/sims/helpcenter/common/layout/SelfHelpHome.seam?inst_name=wichita

Response Time

To Email and Discussion Forum Questions:

As soon as possible within 24 hours. If you do not receive reply to your email within 24 hours, please re-send me the email, probably the email did not arrive to my Inbox.

Feedback on Assignments:

As soon as possible after the due date including the late submission date/time. Answer key will be discussed in lecture sessions and/or shared via Blackboard.

Grading Scale

WSU uses a +/- grading scale for final grades and to calculate grade point averages. In this class, grades are assigned according to the following chart. Other classes might assign grades differently: Be sure to understand the grading scales in all of your classes.

Points/Percentage	Letter Grade	Grade Points	Interpretation
93 and up	A	4.00	A range denotes excellent performance
90 – less than 93	A-	3.70	
87 – less than 90	B+	3.30	
83 – less than 87	B	3.00	B range denotes good performance
80 – less than 83	B-	2.70	
77 – less than 80	C+	2.30	
73 – less than 76	C	2.00	C range denotes satisfactory performance
70 – less than 73	C-	1.70	
67 – less than 70	D+	1.30	
63 – less than 67	D	1.00	D range denotes unsatisfactory performance
60 – less than 63	D-	0.70	
0 – less than 60	F	0.00	

Assignments (and Grading Scale)

List of grading assignments/components and values toward final grades are shown below. For exams and project, different grading scales will be used for undergraduate and graduate students. Graduate students will have additional activities in the project assignments that have higher weightage. The same grading scale will be used for all students on class performance, homework, and quiz. Homework assignments and their due dates will be announced in class and/or made available via Blackboard. Similarly, the due dates for Quiz, Exam, and Project will be announced in class and/or made available via Blackboard.

Grading Assignments/Components	Undergraduate	Graduate
Pop Quiz (five of six, random)	10%	10%
~~Homework~~		
Lab (ten, experiment and quiz)	10%	10%
Quiz (two of three, 30-minute, class-time)	20%	20%
Exam-1 (cumulative, 65-minute, class-time)	20%	15%
~~Exam~~		
Exam-2 (cumulative, 65-minute, class-time)	20%	15%
Project (Proposal, Presentation, and Report)	20% (2+8+10)	30% (4+10+16)

Late Assignments

For homework assignments, late submissions will not be accepted after five days from the original due date/time. Up to 50% points may be subtracted for any late submission. Exceptions include documented emergency situations and prior consents.

Missed Tests and Labs/Projects

Makeup for missed tests (Quiz and Exam) and Labs/Projects) will be given only when there is a genuine reason, with clear proof. It is students' responsibility to provide the proof; if the reason for missing a test is illness, a doctor's note will be required. Students should contact the instructor before any makeup test.

Teaching Assistant(s)

Grading TA:

DRZ <DRZ>

Office Hours/Room: DRZ

Laboratory TA:

Nowshin Nawal <nxnawal@shockers.wichita.edu>

Office Hours/Room: Lab Hours, 262JBC

The Lab TA should be in the lab for the entire session to assist students and grade lab assignments. The Grading TA (if any) should grade test papers. However, the TAs are not allowed to solve student problems (any problem). If students have any questions regarding the course materials and/or laboratory assignments, they should immediately contact the course instructor.

Syllabus Policies and Student Resources

All students should familiarize themselves with the course-related policies and student resources that can be found at: **www.wichita.edu/syllabuspolicies**

These include, but may not be limited to:

- Academic Integrity
- CARE Team
- Concealed Carry Policy
- Counseling and Prevention Services
- COVID-19 Conditions
- Definition of a credit hour
- Disability Services
- First Generation Students
- Heskett Center and Campus Recreation
- Important Academic Dates
- Inclusive Excellence and Respect for Diversity
- Intellectual Property
- Names and Pronouns
- Shocker Alert System
- Student Health Services
- Title IX
- Video and Audio recording

Students with Disabilities

A disability is something that affects a major life activity. These life activities include, but are not limited to, learning, walking, breathing, hearing, and seeing, in addition to many other physical, sensory functions, and psychological disabilities.

If you are a student with a disability, or believe you might have a disability, which requires accommodations, please contact the Office of Disability Services (ODS) www.wichita.edu/ods to discuss reasonable and appropriate accommodations and eligibility requirements. It is the University's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability ODS will review your concerns and determine, with you, what academic accommodations are necessary and appropriate for you. For example,

adaptions of teaching methods, class materials or testing may be made on a case-by-case basis if warranted, as required by the Americans with Disabilities Act (ADA). All information and documentation of your disability is confidential and will not be released by ODS without your written permission.

Respect for Diversity

Wichita State University is committed to being an inclusive campus that reflects the evolving diversity of society. To further that goal, Wichita State University does not discriminate in its employment practices, educational programs or activities on the basis of age (40 years or older), ancestry, color, disability, gender, gender expression, gender identity, genetic information, marital status, national origin, political affiliation, pregnancy, race, religion, sex, sexual orientation, or status as a veteran. Retaliation against an individual filing or cooperating in a complaint process is also prohibited.

Students from all diverse backgrounds and perspectives are welcome in this Course and the diversity that students bring to this course should be viewed as a resource, strength and benefit. All materials and activities are presented with the intent to be respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangement for you.

Laboratory Information

The lab sessions will be held in 262 John Bardo Center. The main purpose of the lab sections is to provide students enough hardware, software, and service supports so that they can complete lab assignments and projects. Students will form groups (the number of students in a group will be determined after the regular enrolment period is over); each group will borrow one "Microprocessor Tool-Box" to perform the lab/project activities. A lab TA will assist students with the lab sessions. Students are welcome to use the Computer Architecture and Parallel Programming Laboratory (CAPPLab) for class projects. CAPPLab is physically located in room 312 Wallace Hall (you may visit online at https://www.wichita.edu/academics/engineering/CAPPLab/Lab.php). It must be noted that the "Microprocessor Tool-Boxes" belong to the ECE department. Students are required to get the tool-boxes from the lab TA and return all components in good working condition at the end of the semester.

Brief List of Topics to Cover

Introduction to Microprocessor-Based Systems
- Organization of Microprocessors: CPU, Memory, Registers, and Bus
- Programming Microprocessors in Assembly and C/C++ languages

Programming Microprocessor Systems using Assembly language
- Review Assembly Language using EASy68K/IDE68K software package
- Processing Interrupts; Interfacing Analog/Digital Serial/Parallel I/O

Programming Microprocessor Systems using C/C++ language

- Review C/C++ Language using CodeWarrior IDE and DEMOEM board
- Programming Timer, Sensor, liquid crystal display (LCD), etc.

Embedded / IoT Systems

- Fundamental concepts and future of Embedded Systems
- Fundamental concepts and future of Internet of Things

Project/Research

- Sensing/Monitoring/Controlling Systems
- Low-Power Computing Systems

Tentative Schedule

Week Mon	Note	Important topics/readings, assignments, due dates, and reminders are listed here so that you can organize your time and academic work.
1 8/21		ECE 594/594L: Course syllabus; Labs and Projects; K-probe; Microprocessors: Internal Architecture: Hardware/Software;
2 8/28	Lab	IDE68K Assembly Language; Main Routine and Subroutines; Projects; Lab-01 discussion in 262-JBC; Quiz-1 discussion;
3 09/04	Quiz	9/04 (Labor Day) No Class/Lab; Quiz-1 (Wed, 30 points, 30 minutes); Programming Exceptions;
4 09/11	Lab	Lab-01 (Mon); Project: Groups, Topics, Grading, Proposal, etc.; Programming Interrupts; Lab-02 discussion;
5 09/18	Lab	Lab-02 (Mon); Programming Interrupts; Software Delay; Lab-03 discussion; Project: Groups (due), Labs (6-10) & Proposal;
6 09/25	Lab	Lab-03 (Mon); Interfacing Input / Output (I/O) Signals; Timers; Project Proposal on Week 10; Quiz-2/Lab-04 discussion;
7 10/02	Lab Quiz	Lab-04 (Mon); Embedded programming with C; Lab-05 discussion; Quiz-2 (Wed, 30 pts, 30-min); DEMOEM/CodeWarrior;
8 10/09	Lab EXAM	Lab-05 (Mon); Interfacing Concept; Exam-1 discussion; EXAM-1 (Wed, 65 pts, 65-min, Closed book);
9 10/16	Fal-Brk	10/14 (Sat) to 10/17 (Tue) (Fall Break) No Class; Mid-Term Point Updates; Project: Proposal; Lab-06 discussion;
10 10/23	Lab	Lab-06 (Mon); Analog/digital input/output; Project Proposal due (on Wed); Lab-07 discussion;
11 10/30	Lab Update	Lab-07 (Mon); Analog/digital input/output; ADC, DAC; Project Proposal Updates; Lab-08 discussion;

Week Mon	Note	Important topics/readings, assignments, due dates, and reminders are listed here so that you can organize your time and academic work.
12 11/06	Lab	Lab-08 (Mon); LCD Display; Project: Report and Presentation; Internet of Things (IoT) technology; Quiz-3/Lab-09 discussion;
13 11/13	Lab Quiz	Lab-09 (Mon); Serial/Parallel I/O; Programming sensors; Quiz-3 (Wed, 30 pts, 30-min); Lab-10 discussion;
14 11/20	Lab Thx-Brk	Lab-10 (Mon); Project: Presentation and Report; 11/22 (Wed) to 11/26 (Sun) (Thanksgiving Break) No Class;
15 11/27	Project	Project **Presentation**: Team-work, slides, in-person; Final **Report**: Team-work, via Blackboard on Friday;
16 12/04	Exam	Future of IoT Microprocessor-based systems; Review on Exam-2; EXAM-2 (Wed, 65 minutes, 65 points, Closed book);
Finals		None!
Note: A date in Column 1 indicates the Monday of that week. Here, 12/04 is Monday of Week 16.		

1) *August 5, 2023; prepared for fall 2023 term; DRZ*

2) *August 17, 2023; updated grading info and dates; DRZ*

Definition of a Credit Hour (https://www.wichita.edu/faculty/development/syllabuspolicies.php)

Example for 3 credit hour class: Success in this 3 credit-hour course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction and preparation/studying or course related activities for a total of 135 hours.

Go to 4.08 / Definition and Assignment of Credit Hours for the policy and examples for different types of courses and credit hour offerings.