EE 310.02E Digital Systems/Embedded Control
COURSE SYLLABUS – SPRING 2026

Instructor: Dr. Esam Obiedat
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Department of Engineering and Technology

Office Phone: 903-886-5474 (Engineering Main Office)

University Email Address: Esam.Obiedat@etamu.edu

Preferred Form of Communication: email

Office Hours: By appointment
Communication Response Time: 24 hours (weekdays) to email

COURSE INFORMATION

Materials - Textbooks, Readings, Supplementary Readings

Course Format: The class consists of lectures and Laboratory exercises.
Class Meeting Schedule: Meets 1/12/2026 through 5/8/2026
Class Meeting Dates: Tuesday & Thursday (9:00 AM– 11:00 AM)
Classroom: AG/ET 214

TEXTBOOK(S) REQUIRED:

AVR Microcontroller and Embedded Systems: Using Assembly and C, (2017 – 2nd Edition) Mazidi, Naimi & Naimi ISBN: 978-0997925968.

LAB MANUAL:

Lab Manual/Experiments provided by the instructor. Students will use the lab workstations and/or their personal laptops to support programming exercises using the Arduino.

The *syllabus/schedule are subject to change.*

SOFTWARE REQUIRED:

- Microsoft Office - MS Word, Excel, PowerPoint
- Arduino Integrated Design Environment (free) – Runs on your laptop, Windows PC or Apple Mac device
- Atmel Studio 7 IDE (free) – Runs on your Window PC. Apple MAC requires running the app with Virtual Machine
- Tinker CAD (free)
- Quartus Prime Lite (free)
- LABVIEW

COURSE DESCRIPTION:

This course introduces the hardware and software architecture of the AVR Microcontrollers and their applications. It also includes embedded system types, programming the microcontroller in assembly and C, serial and parallel data transfer, and interfacing I/O devices. Practical applications using Arduino and other devices will be developed through Lab exercises and course project design.

Prerequisites: EE 220 with a minimum grade of C, Math 315 or MATH 2320 with a minimum grade of C.

Student Learning Outcomes:

After successfully completing the course, students will be able to:

1. Recognize the major components of a microprocessor and microcontroller-based systems
2. Describe the difference between a microprocessor and a microcontroller
3. Analyze Assembly Language and C language programs for the AVR microcontroller, and debug errors in syntax and logic.
4. Illustrate program logic flow using flowcharts and develop assembly and C language programs from flowcharts.
5. Interface a variety of I/O devices to the microcontroller by incorporating ADCs and DACs.
6. Use appropriate Hardware and Software tools in the design, implementation, debugging, and testing of microcontroller-based systems
7. Develop and design interactive real-time applications with the AVR microcontroller
8. Perform experiments/course project independently as well as in a group.
9. Write a technical lab report.

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COURSE REQUIREMENTS:

Minimal Technical Skills Needed

- Working knowledge and basic skills in using Microsoft Office products Word, Excel, and PowerPoint.
- Working knowledge and basic skills at software programming in Assembly Language and/or C++ programming language or similar programming languages such as Python, MATLAB, and MS-Basic
- Working knowledge and basic skills using electrical engineering lab equipment including breadboards, power supplies, oscilloscopes, multi-meters, and signal generators.
- Working knowledge and basic skills in application of electrical engineering laws from Physics (Ohm's Law and Kirchoff's Voltage & Current Laws).
- Working knowledge and basic skills in the application of Boolean Algebra and related Boolean laws and rules. and LABVIEW.

Instructional Methods:

The instructional methods will include lectures (modules), class discussions, course projects, assignments, problem-solving exercises, Lab reports, simulations using software and experimental measurements. Instructions will be based on the course textbook and on the Lab manual. Course materials, announcements, and lecture notes will be posted on the course website (D2L).

Student Responsibilities or Tips for Success in the Course:

Students must attend classes, participate in classwork and discussions, and complete the required course assessments that support the anticipated learning objectives. Students are expected to regularly log into the course website (D2L) to download course material, submit their coursework as instructed, and follow up on new announcements. This course covers more advanced content that requires at least 6 hours of extensive study per week.

Attendance:

Attendance is a requirement for this course. The instructor will take attendance at the beginning of each class. Class Attendance Requirement (one lateness = 1/2 absence). Make-up for a missed In-class assignment may be given only if you contact the instructor before the end of the class and there is a valid reason for the absence. Because this course includes laboratory work, appropriate attire is required to reduce the risk of injury. Bluetooth earbuds or similar devices are not permitted while in the class/lab.

# of Absences	0 – 3	4	5	6	7	>7
Point Deduction	0	- 5	- 10	- 20	- 30	F

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Assessments:

Unless directed and/or approved by the instructor, only MS Office-compatible formats (.doc, .docx, .rtf, .xls, .xlsx, .ppt and .pptx) will be accepted for assignments and submissions. NO OTHER DOCUMENT OR FILE FORMATS WILL BE ACCEPTED.

Failure to comply with required document formats will result in late or rejected assignments (zero credit). Other specific formats may be dictated based on assignment and will be coordinated with/by the instructor prior to submission to assignment drop boxes.

Assessments (assignments, lab reports, quizzes, exams) must be submitted by the specified due date mentioned on the D2L platform. Each assessment requires a separate solution report. Some assessments may require the submission of simulation files created using software. Any file that is flagged as infected with malware or viruses will not receive a grade. Make-up assessments are generally not offered without valid, documented justification. When approved, make-up work should be completed within one week of the missed assessment (if possible). Early communication is essential, and approval is not guaranteed.

Exams and Quizzes:

The comprehensive exams (midterm and final) will be closed-book & closed-notes. Relevant scientific formulas will be provided in the supplementary sheet. The student will need to bring a scientific calculator for the exam. The use of a personal phone (or any other smart device) is strictly prohibited during exams. A makeup exam may be offered, but an official permit for absence that fulfills University procedures should be available on time.

Academic Integrity:

The first incident of academic misconduct will result in a zero for the assessment; further violations may lead to a failing grade in the course. All incidents will be reported to the department chair. If you are unsure whether something constitutes academic dishonesty, consult the instructor before submission. The AMUC Academic Integrity policy is included in the following sections.

GRADING:

The final course grade is based on 100 possible points (as described below in Assessments) and will be calculated based on the following grading scale:

Grading Scale:
A = 90-100 points
B = 80-89 points
C = 70-79 points
D = 60-69 points
F = < 60 points

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ASSESSMENTS:

The following assessments will be performed throughout this course to assess individual progress toward learning outcomes. The final course grade will be calculated based on the following assessments:

Assessment/ task	Weight	Tentative Date
Attendance	10%	Weekly
Assignments (5)	15%	Weeks: 3, 5, 7, 10, 13
Class Quizzes (3)	10%	Weeks: 3, 6, 12
Midterm Exam	15%	Week 8
Final Exam	20%	Week 16
Lab Work and Project	30%	Project presentation: Week 15.

Lab Safety Training

Students registered for this course must complete all required lab safety training prior to entering the lab and undertaking any activities. Once completed, Lab Safety Training is valid for the remainder of the same academic year (i.e., through the following August) and must be completed in subsequent years. There are no exceptions to this University policy. Failure to complete the required training will preclude participation in any lab activities, including those for which a grade is assigned.

Design Project

Students are required to complete a course design project and submit a comprehensive report at the end of the course. The project should demonstrate the student's ability to link the theoretical knowledge and practical skills acquired in the course to real-world applications. Students will work in a group up to three students. Students will submit their project proposal at week 8 to the instructor for approval.

Laboratory Exercises and Reports:

In support of the learning process, Laboratory Exercises provide the student with hands-on application of the concepts and knowledge gained in the lecture portion of the class. Through laboratory experiments, students apply 8-bit AVR microcontroller hardware and software, specifically ATmega328 via Arduino Uno, to solve technical problems. Students will develop practical skills through experiments using Arduino Microcontroller, I/O devices, Sensors, Motors, wireless communication devices, etc. This lab will also provide students with hands-on experience in implementing real world applications using AVR ATmega328 microcontroller, assembly and C language.

Pre-labs (reading, study, basic circuit/solution design, lab preparation) must be completed prior to coming to lab. Students will be turned away from the Lab if the Pre-lab is not complete. Lab circuits must be built during Lab on an empty breadboard. They may not have been built prior to

the Lab period. There are 8 laboratory experiments scheduled to be performed in the semester. Should need arise where less than 8 labs are performed during the semester, the omitted exercises will be given the average grade of all prior completed lab experiments, thereby maintaining the overall grade weighting for the Laboratory Exercises as defined above.

Lab Teams of 2 students (3 maximum) will be assigned by the instructor prior to the first laboratory experiment. Each Lab Team will submit one combined lab developed and created by the Lab Team within 1 week after completion of the lab experiment session. Laboratory Reports will be submitted to the appropriate D2L Lab Assignment folder or drop by the due date/time. All team members are expected to contribute to the lab report and will receive the same grade for their combined report. Late submissions will not be accepted. Each lab group will be provided with an Arduino Uno breadboard, wires and tools, and will be responsible for maintaining and returning the supplies at the end of the course. At the end of each lab, you will be asked to demonstrate your functioning circuit to the instructor using the Arduino hardware.

A Formal Lab Report should enable someone else to duplicate your work and obtain the same results without reference to any other documents. This does not mean that you should append data sheets to your report but that the schematics and parts layout should be clear and accurate.

Formal Lab Reports should follow the same approach used in the lab, which is a Hypothesis/Test sequence. In Prelab, you will be asked to design a circuit to perform a specific function. During the lab time, lab groups will build circuits, demonstrate their working circuit and collect test data to show how the circuit performed. Test data and photos of the circuits will be used in the group Lab Report.

The Lab Report must be constructed using the Laboratory Report Template provided on D2L, strictly following the formatting requirements as presented in the Lab Report Template. Lab groups will submit their Lab Report to the designated D2L folder by the due date/time designated on D2L.

Lab Report Must include the following:

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1. **Cover page**: Your lab report cover page should include the following information:
    - Course name and title
    - Experiment number and title
    - Names of group members and their IDs
    - Instructor's name.
    - Date
2. **Objectives**: State clearly the objectives of the experiment
3. **Equipment required**: List all the equipment and components used in the experiments
4. **Introduction:** Provide the necessary background to the problem that you are trying to solve in the lab and the approach to solve it.
5. **Procedure:** Each part of the lab experiment should explain the following**:**
    - Basic measurements and calculation
    - Explanation of the derived solution
    - Schematics developed that demonstrate the solution
6. **Results and Analysis**: Each part of lab experiment should have the following:

- Include tests used to prove the solution worked.
- Include drawing of the solution you built in lab.
- State the observations made while performing the lab and an explanation of your results.

7. **Conclusions:** In this section of the lab:
    - Describe what you did and learned from the lab.
    - Explain at what degree the objectives of the lab were achieved.
    - Describe possible real time applications from the work done in the lab

Submit the files containing the circuit simulation, a schematic, and data which explain the lab results you obtained. Graphics must be created using a graphics program. Graphics in your lab reports may not be hand-drawn.

Lab Reports are due as hardcopy and by submission to the drop-box before lab time one week after the lab was performed. 10% per day will be deducted from the final lab grade for each 24 hours or portion thereof that a lab is late. Hardcopy of Lab Reports are to be submitted to the instructor.

FINAL DESIGN PROJECT:

Students will be divided into Final Design Project Groups that are required to complete a course design project highlighting the knowledge gained through this course. The project should demonstrate the student's ability to link the theoretical knowledge and practical skills acquired in the course to real world applications. Students will work in a group of up to four students as assigned by the instructor.

The Final Design Project consists of multiple deliverables:

1) **Final Design Project Proposal (Group Submission)** Students will submit their project proposal at week 10 to the instructor for approval in the drop box on D2L. The project proposal is worth 1% of the final grade for the course.
2) **Final Design Project Demo/Presentation/Report (Group Submission)** This is worth 10% of the final grade for the course. Group PowerPoint presentations and report submissions are to be provided on D2L by due date/time.

   The Final Design Project Demo/Presentation consists of:

   a) **Final Design Project Demonstration** – Project Groups will present a WORKING demonstration of their final design projects. This will be a live demonstration before the class (no D2L submission)

   b) **Final Design Project Presentation** – Project Groups will present a PowerPoint presentation before class highlighting the design, construction, and testing process for their final design project. This will be a PowerPoint presentation using the template found on D2L.

   c) **Final Design Project Report** – Project Groups will deliver a comprehensive report that captures group experiences in words and pictures concerning the design, construction, and testing of their project.
3) **Final Design Peer Review (Individual Submission)** This is worth 1% of the final grade for the course. All students are required to evaluate the performance of all group members including

themselves. Everyone is required to submit the Peer Review form (provided on D2L) to the designated Peer Reviews folder on D2L by the due date/time.

STUDENT OUTCOMES (ABET):

The program must have documented student outcomes that support the program's educational objectives. Attainment of these outcomes prepares graduates to enter the professional practice of engineering. Student outcomes are outcomes (1) through (7), plus any additional outcomes that may be articulated by the program.

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

COURSE OUTLINE / CALENDAR

The instructor reserves the right to adjust the schedule in order to serve the needs of the class and any changes will be communicated in a timely manner.

Course schedule:

1. **Topics Covered (Tentative Schedule)**

Week	**TOPICS**	Chapter/Notes	**Assignment/Exams**
1	Introduction to Computing; Microprocessors and Microcontrollers fundamentals;	Chapter 0	
2 & 3	Introduction to AVR Microcontrollers; AVR Microcontroller Architecture	Chapter 1 & 2	HW1
4 & 5	AVR Instruction Set; Assembly language programming	Chapter 3	QUIZ1

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6	AVR IO Port programming	Chapter 4	
7 & 9	Advanced Assembly language programming; AVR Addressing Modes	Chapter 5 & 6	HW2
8	**Midterm Exam**		
10 & 11	AVR Programming in C	Chapter 7	Project Proposal
12& 13	AVR Timers and Counters	Chapter 9	HW3/QUIZ 2
14	AVR Interrupt programming	Chapter 10	
15	Project Demo and Presentations		Project Demonstration/Presentations

Laboratory schedule:

Experiment	Week
EX00: Introduction to the Microprocessor Lab Introduction to the Arduino Microcontroller platform + Essential C Language Programming	2
EX01: Interfacing LEDs/Switches with Arduino Uno + Traffic Lights simulation	3
EX02: Interfacing Digital and Analog IO Devices to the Arduino board (LDR, Potentiometer, DC motor, Servo motor)	4
EX03: DC Motor Speed control using PWM	5
EX04: Temperature Sensing and LCD display **EX05**: Assembly Programming using AVR Studio	6
EX07: Robotic Car Remote Control using Bluetooth module	7
EX08: Robotic Car movement with Obstacle Avoidance ability	8
EX09: Robotic Car Line Following using IR sensors	9
EX10: Integration of Bluetooth control, Obstacle Avoidance, and Line Following functions in the Car	10
EX11: Advanced Programming Exercises in AVR Studio	11
EX12: Timers and Interrupt Programming in AVR	12
Robotic Car Event (**Bonus** for event winners)	13
Project Demo	14/15

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TECHNOLOGY REQUIREMENTS

LMS

All course sections offered by East Texas A&M University have a corresponding course shell in the myLeo Online Learning Management System (LMS). Below are technical requirements

LMS Requirements:
https://community.brightspace.com/s/article/Brightspace-Platform-Requirements

LMS Browser Support:
https://documentation.brightspace.com/EN/brightspace/requirements/all/browser_support.htm

Zoom Video Conferencing Tool
https://inside.tamuc.edu/campuslife/CampusServices/CITESupportCenter/Zoom_Account.aspx?source=universalmenu

ACCESS AND NAVIGATION

You will need your campus-wide ID (CWID) and password to log into the course. If you do not know your CWID or have forgotten your password, contact the Center for IT Excellence (CITE) at 903.468.6000 or helpdesk@etamu.edu.

Note: Personal computer and internet connection problems do not excuse the requirement to complete all course work in a timely and satisfactory manner. Each student needs to have a backup method to deal with these inevitable problems. These methods might include the availability of a backup PC at home or work, the temporary use of a computer at a friend's home, the local library, office service companies, Starbucks, a TAMUC campus open computer lab, etc.

COMMUNICATION AND SUPPORT

If you have any questions or are having difficulties with the course material, please contact your Instructor.

Technical Support

If you are having technical difficulty with any part of Brightspace, please contact Brightspace Technical Support at 1-877-325-7778. Other support options can be found here:

https://community.brightspace.com/support/s/contactsupport

STUDENT RESPONSIBILITIES FOR COURSE

CWID and Password

You will need your campus-wide ID (CWID) and password to log into the course. If you do not know your CWID or have forgotten your password, contact the Center for IT Excellence (CITE) at 903.468.6000 or helpdesk@etamu.edu.

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Technology-Related Issues

Personal computer and internet connection problems do not excuse the requirement to complete all course work in a timely and satisfactory manner. Each student needs to have a backup method to deal with these inevitable problems. These methods might include the availability of a backup PC at home or work, the temporary use of a computer at a friend's home, the local library, office service companies, Starbucks, a ETAMU campus open computer lab, etc.

TECHNOLOGY REQUIREMENTS AND SUPPORT

Minimal Technical Skills Needed

Students will need reliable computer and internet access for this course. Students must be able to effectively use myLeo email, myLeo Online D2L, and Microsoft Office.

Learning Management System (LMS) – D2L

All course sections offered by East Texas A&M University have a corresponding course shell in the myLeo Online Learning Management System (LMS). Below are the technical requirements:

- View the Learning Management System Requirements Webpage.
- Learn more on the LMS Browser Support Webpage.

Technical Support

If you are having technical difficulty with any part of Brightspace, please contact Brightspace Technical Support at 1-877-325-7778. Other support options can be found on the Brightspace Support Webpage.

COMMUNICATION AND SUPPORT

Interaction with Instructor Statement

If you have any questions or are having difficulties with the course material, please contact your instructor. Correspondence will always be through university email (your "myLeo" mail) and announcements in myLeo online (D2L). You will not RECEIVE email through D2L, so be sure to check your ETAMU email for communication. Students are encouraged to check university email daily.

Include the Following in Emails with Instructor:

- Course name and subject in the subject line
- Salutation (Good afternoon, Dr. Jackson)
- Proper email etiquette (no "text" emails – use proper grammar and punctuation)
- Student name and CWID after the body of the email (possibly add to student signature on email)

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COURSE AND UNIVERSITY PROCEDURES/POLICIES

Syllabus Change Policy

The syllabus is a guide. Circumstances and events, such as student progress, may make it necessary for the instructor to modify the syllabus during the semester. Any changes made to the syllabus will be announced in advance.

Student Conduct

All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment. The Code of Student Conduct is described in detail online in the Student Guidebook.

Students should also consult the Rules of Netiquette Webpage for more information regarding how to interact with students in an online forum.

ETAMU Attendance

For more information about the attendance policy, please view the Attendance Webpage and the Class Attendance Policy

Academic Integrity

Students at East Texas A&M University are expected to maintain high standards of integrity and honesty in all their scholastic work. For more details and the definition of academic dishonesty see the following procedures:

Undergraduate Academic Dishonesty University Procedure 13.99.99.R0.03

Undergraduate Student Academic Dishonesty Form

Graduate Student Academic Dishonesty University Procedure 13.99.99.R0.10

Graduate Student Academic Dishonesty Form

Use of Artificial Intelligence

East Texas A&M University acknowledges that there are legitimate uses of Artificial Intelligence, ChatBots, or other software that has the capacity to generate text, or suggest replacements for text beyond individual words, as determined by the instructor of the course.

Any use of such software must be documented. Any undocumented use of such software constitutes an instance of academic dishonesty (plagiarism).

Individual instructors may disallow entirely the use of such software for individual assignments or for the entire course. Students should be aware of such requirements and follow their instructors' guidelines. If no instructions are provided the student should assume that the use of such software is disallowed.

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In any case, students are fully responsible for the content of any assignment they submit, regardless of whether they used an AI, in any way. This specifically includes cases in which the AI plagiarized another text or misrepresented sources

Students with Disabilities-- ADA Statement

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring an accommodation, please contact:

Office of Student Disability Resources and Services

East Texas A&M University
Velma K. Waters Library Rm 162
Phone (903) 886-5150 or (903) 886-5835
Fax (903) 468-8148
Email: studentdisabilityservices@etamu.edu
Website: Office of Student Disability Services

Nondiscrimination Notice

East Texas A&M University will comply in the classroom, and in online courses, with all federal and state laws prohibiting discrimination and related retaliation on the basis of race, color, religion, sex, national origin, disability, age, genetic information, or veteran status. Further, an environment free from discrimination on the basis of sexual orientation, gender identity, or gender expression will be maintained.

Campus Concealed Carry Statement

Texas Senate Bill - 11 (Government Code 411.2031, et al.) authorizes the carrying of a concealed handgun in East Texas A&M University buildings only by persons who have been issued and are in possession of a Texas License to Carry a Handgun. Qualified law enforcement officers or those who are otherwise authorized to carry a concealed handgun in the State of Texas are also permitted to do so. Pursuant to Penal Code (PC) 46.035 and ETAMU Rule 34.06.02.R1, license holders may not carry a concealed handgun in restricted locations.

For a list of locations, please refer to the Carrying Concealed Handguns On Campus document and/or consult your event organizer.

Pursuant to PC 46.035, the open carrying of handguns is prohibited on all East Texas A&M University campuses. Report violations to the University Police Department at 903-886-5868 or 9-1-1.

East Texas A&M Supports Students' Mental Health – Counseling Services

The Counseling Center at East Texas A&M University, located in the Halladay Building, Room 203, offers counseling services, educational programming, and connection to community resources for students. Students have 24/7 access to the Counseling Center's crisis assessment services by calling 903-886-5145. For more information regarding Counseling Center events and confidential services, please visit https://www.etamu.edu/counseling-center/

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Mental Health and Well-Being

The university aims to provide students with essential knowledge and tools to understand and support mental health. As part of our commitment to your well-being, we offer access to Telus Health, a service available 24/7/365 via chat, phone, or webinar. Scan the QR code to download the app and explore the resources available to you for guidance and support whenever you need it.

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