

**ELEC 2220 - COMPUTER SYSTEMS
Summer 2010**

2010 Catalog Data: ELEC 2220. COMPUTER SYSTEMS (3) LEC, 3. Pr., ELEC 2210 or ELEC 2200. Computer hardware and software organization, processor programming models, data representation, assembly language programming, design of memory systems, input and output device interfacing and programming, multiprocessing.

Textbook: Frederick M. Cady, *Software and Hardware Engineering: Assembly and C Programming for the Freescale HCS12 Microcontroller, 2nd Ed.* 2008, Oxford University Press, ISBN-13: 978-0-19-530826-6

Class Web Site: <http://www.eng.auburn.edu/~nelsovp/courses/elec2220>
(Homework assignments, slides, supplementary documents, etc.)

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Course Objectives:

1. To understand the basic components, structure and operation of a digital computer system.
2. To be able to develop computer programs in assembly language.
3. To be able to design hardware and software for microcontroller-based systems containing various input/output devices and memory components.

Prerequisites by topic:

1. High-level language (C or Java) programming (COMP 1200, COMP 1210 or equivalent)
2. Digital logic circuits (ELEC 2200 or equivalent)

Primary program outcomes related to this course:

- Outcome 1. Ability to apply knowledge of math, science and engineering to solve problems.
- Outcome 2. Ability to apply in-depth knowledge of one or more disciplines within ECE
- Outcome 3. Ability to design an electrical component or system, containing hardware and software components, to meet desired needs
- Outcome 6. Proficiency in the use of computers and other modern tools and skills

Topics

1. Introduction to computer hardware and software components
2. Data representation, number systems, codes, code conversion
3. Processor programming model
4. Memory addressing modes
5. Assembly language programming with *Code Warrior*
6. Processor instruction set
 - Basics
 - Data movement operations
 - Arithmetic operations
 - Logical operations
 - Program control operations
7. Program debug with *Code Warrior*
8. Assembly language program design & structured programming
9. Parallel input/output ports & devices
10. CPU interrupts & interrupt-driven input/output
11. Interrupt service routines
12. Computer memory technologies (on-chip)
13. Expanded memory & input/output subsystems
14. Timing functions
15. Serial communication
16. Analog-to-digital and digital-to-analog conversion

Reading assignments in text:

- (Chap. 1, Chap. 2)
- (Review - ELEC 2200 text)
- (Chap. 4.1, 4.2, 4.5)
- (Chap. 4.6, 7.3)
- (Chap. 5.1-5.6, Chap. 8)
- (Chap. 7.1 – 7.4)
- (Chap. 7.5, 7.6, 7.7)
- (Chap. 7.8, 7.11)
- (Chap. 7.9, 7.10, 7.12, 7.13)
- (Chap. 7.14, 7.15, 7.16, 7.17)
- (Chap. 9)
- (Chap. 8.1, 8.2)
- (Chap. 11.1 – 11.8)
- (Chap. 12.1 – 12.9)
- (Chap. 12.10-12.11)
- (Chap. 13.1 – 13.4)
- (Chap. 13.5 - 13.6)
- (Chap. 14.1 – 14.9)
- (Chap. 15.1, 15.4)
- (Chap. 17.1 – 17.9)

FINAL EXAM: Wednesday, August 4, 4:00 – 6:30 p.m.

COURSE GRADING:

Homework (programming assignments, etc.):	15%
Term project (due at final class period)	15%
Mid-term exams (2 @ 20% each)	40%
Final exam:	30%

COURSE HOMEWORK AND PROJECTS:

Each student will write, debug, and demonstrate a number of short assembly language programs for the Freescale HCS12 microcontroller using Freescale's "Code Warrior" Integrated Development Environment and simulator. Several small computer subsystems ("paper designs") will also be done as homework exercises. These will make up the "homework grade" listed above.

During the last part of the semester, each student will do a microcontroller project, due at the last class period. This will make up the "term project" grade listed above.

Students are encouraged to use their own PCs for programming assignments. A copy of Freescale's *CodeWarrior* Development Studio is included in the textbook. Also, the "Special Edition" of *CodeWarrior* can be downloaded from the Freescale web site and used free of charge for limited-size programs. The ECE Department PC labs (Broun Hall 308 and 310) are available for ELEC 2220, except when scheduled for lab meetings in other ELEC courses. These are unlocked from 8 A.M. to 5 P.M. on weekdays. After-hours access is by coded entry only. See me if you require after-hours access. Code Warrior is installed on these PCs, and in other College of Engineering PC labs.

CLASS ATTENDANCE:

Regular, on-time class attendance is important because:

- your understanding of the material will be greater. You will receive a professionally prepared presentation on the subject, which frequently includes supplementary material not in the text.
- the course will be easier, and your grade will be higher.
- as an emerging professional, you incur professional and ethical responsibilities. Your primary mission at Auburn is to acquire a formal education. To that end, the single most important action you can take is to attend class.
- as a serious conscientious student, you owe a 3-credit course at least 9 hours of effort per week (**13.5 hours on the summer schedule**). The most efficient and constructive use of three hours of this time is to spend it in class.
- you are made aware of any administrative changes relating to the course.
- your absence creates problems for others. You don't pick up your work, you don't get copies of handouts, you are unaware of course administrative changes, etc. Late arrivals, or early departures are distractions to the class, and are rude and inconsiderate.

Therefore, your attendance record will be a factor in determining your course grade. Attendance will be recorded using a seating chart, with points assigned for absences and lateness, according to the following:

3 points: Unexcused absence

1 point: In attendance, but late or leaves early ("partial absence")

0 points: On time and in full attendance

A total of 6-8 points will result in the final course grade being reduced by one letter grade.
A total of 9-14 points will result in the final course grade being reduced by two letter grades.
A total of 15 or more points will result in a final course grade of "FA" (failure due to excessive absences)

Class convenes promptly at 1:15 p.m. If you arrive after class convenes, you're late! If you have an AU-approved written excuse for lateness, or absence, please submit that document, identifying the class involved, the particulars, your name, signature, and student number.

HOMEWORK:

The key to learning any engineering concept is to study it and understand how to apply it to solve problems. The role of the course instructor is to assist you in this endeavor by explaining concepts in class and providing meaningful homework to help you study and learn them. The purpose of homework is:

1. to apply relevant engineering principles to specific applications, to improve mathematical, scientific, and analytical skills, and to identify technical points that need further clarification;
2. to improve communication skills, to develop technical writing skills, to improve computer usage and graphical display skills, and to clarify concepts; and
3. to encourage class participation and to promote class involvement, responsibility, and professionalism.

Each student is urged to develop his/her own solution to all homework problems. Collaboration and answer checking are acceptable; however, **each student must submit only his/her own work**. Identical submissions will be considered “copies”. To submit the work of others is an academic honesty policy violation, which will be handled according to the procedures in the *Tiger Cub*. Late homework will be accepted only under extenuating circumstances and must be submitted using the procedure described above under class attendance. **Homework is late if it is submitted after class convenes (1:15 p.m.)!**

On all homework, please include the following header.

<p>Your Name ELEC 2220 Assignment Number Date submitted (22 May 2010)</p>

For programming assignments, submit a printout of your “source program” with the above information at the top of the program as “comments”, and a printout of the results, as indicated in the assignment. *Hand-written programs are not acceptable.*

Homework will be graded on both technical merit and format. Your presentation should be neat, easily legible, technically literate, technically correct, and well-organized.

OFFICE HOURS: You are encouraged to come by my office during posted hours to discuss problems or anything related to the course (or anything else that might be on your mind). This course builds on itself as it progresses, so it is important that you address and resolve problems as they arise, rather than waiting until the day before an exam.

ACCOMMODATIONS: Students who need accommodations are asked to arrange a meeting during office hours the first week of classes, or as soon as possible if accommodations are needed immediately. If you have a conflict with my office hours, an alternate time can be arranged. To set up this meeting, please contact me by E-mail. Bring a copy of your Accommodation Memo and an Instructor Verification Form to the meeting. If you do not have an Accommodation Memo but need accommodations, make an appointment with The Program for Students with Disabilities, 1244 Haley Center, 844-2096 (V/TT).

ACADEMIC HONESTY POLICY: All portions of the Auburn University student academic honesty code (Title XII) found in the *Tiger Cub* will apply to this class. All academic honesty violations or alleged violations of the SGA Code of Laws will be reported to the Office of the Provost, which will then refer the case to the Academic Honesty Committee.