ELEC5260/6260/6266 - Embedded Computing Systems
Spring Term, 2019

Catalog Data: ELEC 5260. EMBEDDED COMPUTING SYSTEMS (3). Pr. ELEC 2220 or COMP 3350. The design of systems containing embedded computers. Microcontroller technology, assembly language and C programming, input/output interfacing, data acquisition hardware, interrupts, and timing. Real-time operating systems and application programming. Embedded system application examples.

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Textbook: *Computers as Components: Principles of Embedded Computing System Design. 4th Edition,* Marilyn Wolf, Morgan Kauffman, 2017, ISBN 978-0-12-805387-4 (Soft cover)
Professor Wolf's web site: http://www.marilynwolf.us/CaC4e/

References: Posted on Course Web Site: http://www.eng.auburn.edu/~nelson/courses/elec5260_6260/

Coordinator: Victor P. Nelson, Professor of Electrical & Computer Engineering

Goals:
1. Familiarity with and ability to analyze intelligent systems embedded into products such as automobiles, mobile phones, appliances, motors, Internet of Things, etc.
2. Ability to design computer hardware and software for real-time embedded systems, including input/output interfacing, timing and interrupts, application programming, real-time operating systems, and networks.

Prerequisites by topic:
1. Computer organization and system design
2. Assembly language & C programming

Class Meetings: Monday-Wednesday-Friday, 9:00 to 9:50 a.m.

Topic #	Topics:	Text Sections
1	Introduction to embedded systems & examples	1.1, 1.2
2	Embedded system design process & UML modeling	1.3, 1.4,Web doc's
3	Embedded CPUs, ARM instruction set	2.1, 2.2, 2.3,Web doc's
4	ARM microcontroller and Discovery Kit board	Web documents
5	DSP instruction sets (TI C55x)	2.5
6	Input/output programming	3.1, 3.2
7	Interrupts and real-time operation	3.2, 3.3
8	Memory systems	3.5, 4.4
9	System performance, power consumption, safety & security	3.6, 3.7, 3.8
10	Computing platforms – buses (ARM AHB/APB)	4.1, 4.2, 4.3, 4.4, 4.5, Web doc's
11	I/O devices	Web documents
12	Data acquisition (sensors, analog-to-digital, digital-to-analog)	Web documents
13	Embedded program design & modeling	5.1 – 5.6
14	Embedded operating systems, processes	6.1, 6.2, 6.3
15	Static and real-time scheduling	6.4, 6.5
16	Inter-process communication	6.6
17	Real-time operating system examples	6.9
18	Internet of Things (IoT) systems	8.1, 8.2, 8.3
19	Real-time IoT networks	8.4
20	Automotive and Aerospace systems	9.1, 9.2 ,9.3, 9.4
21	Embedded system design methodologies	7.1 - 7.4
22	Embedded system design case studies (throughout the course)	End of each chapter
	Final Exam: Monday, April 29, 8:00 a.m. - 10:30 a.m.	

Method for Evaluating Student Performance:

Category	*ELEC 5260*	*ELEC 6260/6266*
Mid-term Exams (2) @20%:	40%	40%
Final Exam:	20%	20%
Homework Assignments:	40%	40% **

Justification for Graduate Credit in ELEC 6260/6266

The material in this course is beyond the scope of what is typically presented in undergraduate electrical and computer engineering programs. ** Design projects for ELEC 6260/6266 will require additional research beyond what is presented in class.

Computer Usage/Laboratory Projects:

There will be a number of system design projects, utilizing an ARM microcontroller-based *Discovery* board (to be purchased by students), in addition to several "paper designs". ELEC 5260 and ELEC 6260/6266 students will do different projects after mid-semester. Design projects will be developed for the *Discovery* board in the C programming language, with some assembly language, using the Kiel MDK-ARM IDE tools (evaluation version is a free download at: https://www.keil.com/demo/eval/arm.htm.)

Policy on Unannounced Quizzes:

There will be no unannounced "pop" quizzes.

Policy on Attendance:

Attendance is strongly encouraged, but will not be recorded. All homework must be submitted at the designated times. Scores for late submissions will be reduced, unless prior arrangements have been made with the instructor.

Special 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.

Estimated ABET Category Content:

Engineering Science: 1 credit or 33%
Engineering Design: 2 credits or 67%

Primary ELEC/ECPE/WIRE undergraduate student outcomes related to ELEC 5260:

Graduates will have achieved and demonstrated

(a) an ability to apply knowledge of mathematics, science, and engineering
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Prepared by: Victor P. Nelson Date: January 9, 2019