Dordt College Engineering Department
EGR 304, Embedded Microcontroller Systems

Spring Semester, 2014

2013-14 Catalog Data	A course on the design of microcontroller-based systems and the associated software and hardware. Software issues such as modular design, interrupt driven I/O, and design for reliability are covered. Hardware issues such as serial and parallel interfacing, bus structures, grounding and shielding, and D/A and A/D conversions are also studied. Lab exercises provide design experience using a particular microcontroller or soft processor foundation in an FPGA. Prerequisites: Engineering 204, 220, Computer Science 110 or 111 or permission of instructor. (4 credit hours)
Textbooks:	Readings assigned from the Internet are used in place of a traditional textbook.
References	*Getting Started with Arduino*, available at http://arduino.cc/en. Sedra and Smith, *Microelectronic Circuits*, Oxford Circuit Cellar magazine and Circuit Cellar Online (http://www.circuitcellar.com) Nuts and Volts magazine http://www.nutsvolts.com
Instructor	Douglas F. De Boer, Professor of Engineering, http://homepages.dordt.edu/ddeboer Office Phone: 722-6245; Office location: SB237 (Office hours posted on homepage, or just call.) E-mail Douglas.DeBoer@dordt.edu, Home Phone: 722-1414, please call before 10 PM.
Goals	*Creational Structure*: Students will design a system that uses an embedded processor. The design will incorporate polled or interrupt driven input/output and a sensor to measure a physical quantity such as temperature, pressure, a radio signal, etc. This is a primary goal of this course. *Contemporary Response*: Students will consider the application of norms for the design of appropriate ergonomics for an I/O interface. *Creational Development*: Students will study the historical development of some standards, such as for serial interfacing, and reflect on how these past developments now influence modern trends in computer engineering.
Prerequisites by topic	Linear circuit analysis, elementary electronics, and digital logic circuits. Some experience with microprocessors is assumed but proficiency is not assumed.
Laboratory	One or two design projects will be completed, each with a formal written report. Design projects may be proposed by the students but must be approved in advance by the instructor. Some laboratory time may be used to present project management and presentation techniques. Grounds for lab project approval are based on the scope of the project and the relation of the project to the lecture material in class. Depending on the scope of the project work undertaken, there usually will also be a number of short lab exercises that may be ungraded or may require informal reports graded as homework.
Computer use	A development environment based on the C language will be used for most projects. A cross assembler or compiler may be used as well, as appropriate to the projects selected by the students. Students are encouraged (but not required) to use programs such as Mathcad or Matlab for homework solutions where appropriate.
courses@dordt	All assignments and most handouts are available via Dordt's course management system, "courses@dordt." The logon URL is http://courses.dordt.edu. Use your Dordt College network user ID and password. Then drill down to the EGR 304 course. Portions of this course's "courses@dordt" information are available to the world via a public web portal at http://homepages.dordt.edu/ddeboer/S14/304S14.HTM
Academic Integrity	Students must do their own work. More detail on this policy can be found on the web at http://homepages.dordt.edu/ddeboer/S14/HWSTDS14.HTM#DYOW. See the section headed "Do Your Own Work." This policy applies to the whole course, not just homework.
Accommodations	Students who require assistance or accommodations based on the impact of disability must contact the Coordinator of Services for Students with Disabilities, Marliss Van Der Zwaag, to access accommodations. Telephone 722-6490, e-mail Marliss.VanDerZwaag@dordt.edu
Means of Evaluation	Homework (10%), Two Tests (20% each) Laboratory Project(s) (26%), Final Exam (24%) For details, follow the "grading philosophy" link at http://homepages.dordt.edu/ddeboer

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Course Outline

Spring Semester, 2014

Class meets for two 75-minute periods per week, Tuesday and Thursday at 8:00 AM in room SB216.
The lab meets once a week for 180 minutes on Mondays at 2:00 PM in room SB233.

Class Dates (one row per week)		Class (Timing is approximate. Adjustments are usually needed to facilitate lab work, etc.)	Laboratory (Example Schedule)
1/14	1/16	Introduction: Review of assembly language programming	Initial Set-up of Arduino
1/21	1/23	Digital I/O drivers and gadfly parallel interfacing.	"Blinking LED's"
1/28	1/30	Serial Interfacing—RS-232 and similar schemes	RS-232
2/4	2/6	Serial Interfacing—Transmission lines	Transmission Lines
2/11	2/13	Serial Interfacing—Ethernet	Project I (4 weeks)
2/18	2/20	Serial Interfacing—USB, **Test #1, Thursday 2/20**	
2/25	2/27	Interrupt driven I/O	
3/4 (no class 3/11, 16, spring break)	3/6	Interrupt driven I/O	
3/18	3/20	Memory Interfacing	(no lab on 3/09 or 3/16, Spring Break)
3/25	3/27	Motor control	Project II (5 weeks)
4/1	4/3	Thyristors and AC load control	
4/8	4/10	Position encoders,	
4/15	4/17	**Test #2, Tuesday 4/15**	
4/22 (no class 4/24, assessment day		Review, project discussion, or selected topics	
4/29	5/1	Review, project discussion, or selected topics	(possible short lab)
Exam Week 5/5		**Final Exam,** **Monday 5/5, 3:30 – 5:30 PM**	

The class schedule may vary considerably to accommodate student interests and abilities. It is the nature of embedded systems that some of the software and hardware we use may be incompletely or poorly documented and may have more bugs than found in typical commercial software sold to the general public. Dealing with such variation and less than perfect software is part of the nature of this course. The lab is intended to be mostly open-ended and project oriented. This implies that content may also be added to or deleted from the course as needed to provide this necessary flexibility.