

University of Puerto Rico
 Mayagüez Campus
 College of Engineering
 Department of Electrical and Computer Engineering
 Bachelor of Science in Electrical Engineering

Course Syllabus

1. General Information:	
Alpha-numeric codification: ICOM 5217 Course Title: MICROPROCESSOR INTERFACING Number of credits: 3 Contact Period: 3 hours of lecture per week and 12 hours of laboratory in the semester Elective in INEL, Required in ICOM	
2. Course Description:	
English: Development of micro-controller based systems for embedded applications. Interfacing to peripherals such as liquid-crystal displays (LCD), keypads, digital-to-analog and analog-to-digital converters, etc. Emphasizes hardware and software design. Requires a final project that consists in the development of a working prototype in the laboratory. Spanish: Desarrollo de sistemas basados en micro-controladores para aplicaciones tipo embedded. Interconexión de periferales tales como pantallas de cristal líquido, teclados, sensores, convertidores análogo-digital, convertidores digital-análogo, etc. Énfasis en el diseño electrónico y programación. Requiere proyecto final que consiste en el desarrollo de un prototipo operacional en el laboratorio.	
3. Pre/Co-requisites and other requirements:	
INEL4206 Y INEL4207 or ICOM4055 and authorization of the Director of the Department. Pre-requisite by topics: Logic circuit design, microprocessor systems design, A/D and D/A converters.	
4. Course Objectives:	
At the end of the course the students are expected to know how to specify, design, and prototype a microprocessor-based embedded system. To achieve this objective the students have to develop a semester-long project consisting of specifying, designing, and prototyping an embedded system solution to a real life problem.	
5. Instructional Strategies:	
<input checked="" type="checkbox"/> conference <input type="checkbox"/> discussion <input checked="" type="checkbox"/> computation <input checked="" type="checkbox"/> laboratory <input type="checkbox"/> seminar with formal presentation <input type="checkbox"/> seminar without formal presentation <input type="checkbox"/> workshop <input type="checkbox"/> art workshop <input type="checkbox"/> practice <input type="checkbox"/> trip <input type="checkbox"/> thesis <input type="checkbox"/> special problems <input type="checkbox"/> tutoring <input type="checkbox"/> research <input type="checkbox"/> other, please specify:	
6. Minimum or Required Resources Available:	
Laboratory work is considered a major part of the class, and all students are expected to participate by developing a prototype of their designs in the laboratory. Radios, tape recorders, and other audio or video equipment are not permitted in the lab or classroom at any time. Smoking is not permitted in any area other than those areas designated for smoking. Laboratory Projects: <ul style="list-style-type: none"> • Familiarization with programmable controllers. Demonstrations on how to use the equipment and applications. Small project in the form of assignment required. • Familiarization with software development systems for embedded applications. Learning how to use debugging and measuring equipment. • A final design project is required. 	
7. Course time frame and thematic outline	
Outline	Contact Hours
1. Introduction to embedded systems design	3

2. Embedded microcontroller architecture	4
3. Bus Systems & Input/Output Interfaces	5
4. Displays and Keypads	3
5. Interrupts	4
6. Timers and Applications	4
7. Analog to digital converters	2
8. Serial communication	4
9. Memories and error correction	4
10. DMA Controllers	3
11. Design Technology in Embedded Systems	3
12. Student Presentations	2
13. Exams	4
Total hours: (equivalent to contact period)	45

8. Grading System

Quantifiable (letters) Not Quantifiable

9. Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

	Quantity	Percent
<input checked="" type="checkbox"/> Exams	1	20
<input checked="" type="checkbox"/> Final Exam	1	20
<input checked="" type="checkbox"/> Short Quizzes	0	0
<input checked="" type="checkbox"/> Oral Reports	1	10
<input checked="" type="checkbox"/> Laboratory Report	0	0
<input type="checkbox"/> Assignment	1	10
<input checked="" type="checkbox"/> Projects	1	40
<input type="checkbox"/> Journals		
<input type="checkbox"/> Other, specify:		
TOTAL:		100%

10. Bibliography:

- Vahid, F. Givargis, T.D. "Introduction to Embedded Systems" (2004) John Wiley.
- F. Vahid & T. Givargis: "EMBEDDED SYSTEM DESIGN: A Unified Hardware Software Introduction" John Wiley & Sons, Inc. 2002
- B. Brey, "The Intel Microprocessors", 5th Ed., Prentice Hall, 2000
- G. Miller, "Microcomputer Engineering", 2nd. Ed. Prentice Hall, 1999
- K. Ayala, "The 8051 Microcontroller", West Publishing, 1997
- Driscoll, Coughlin, and Villanucci, "Data Acquisition and Process Control with the M68HC11", Merrill 1994
- M. Slater, "Microprocessor-based Design", Prentice Hall, 1989
- MSP430x15x, MSP430x16x Mixed Signal Microcontroller Technical Data by Texas Instruments
- SiLabs C8051F336 25 MIPS, 16 kB Flash, 10-Bit ADC, 20-pin Mixed-Signal MCU Data Manual

- Microchip PIC18FXX2 High Performance, Enhanced FLASH Microcontrollers with 10-Bit A/D Data Sheet

11. According to Law 51

Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

12. Contribution of Course to meeting the requirements of Criterion 5:

Math	Basic Science	General	Engineering Topic
			√

13 Course Outcomes

Activity	Map to Program Outcome
1. Students conduct laboratory work to implement working prototype of project.	(b)
2. The students provide a final project of an original idea proposed by his or her group. Project implementation is a course requirement	(b)
3. Groups of two to four members work towards completion of the class project. Peer evaluation and an individual interview with the professor are required.	(d)
4. Each group must show originality in their work, the procedure to subdivide a complex problem in parts, and finally combining peer work into the final solution	(d)
5. Students will identify a problem where the skills in microprocessor interfacing could be applied	(e)
6. Their idea, along with a plausible procedure, is submitted by the working group in a proposal. The final report includes the explanation of the idea in the introduction part of the report	(e)
7. Project groups must offer an oral presentation and a written final report of their work	(g)
8. Oral presentation and working demonstration of the students work is open to the public, and therefore should be understandable for the interested parties. Mathematical derivation and technical content is allowed in oral presentations. Attendants to these sessions should at least understand why the derivation is needed although fully comprehension is not expected.	(g)
9. Proposals for projects should reflect awareness of societal needs	(h)
10. Students should comment the impact to society reflected by acceptance of their design into society, impact in low skills personnel being replaced by their solution, impact to the environment, or benefits to the intended group of person	(h)
11. Student must include enough references to prove their ability to search for information. This information could be reflected in the theory part of the report, or in the finding of a technical tool or part not easily found in hardware store (as for example, an inductive sensor, or pneumatic valve)	(i)
12. Student should comment on different alternatives to solve their problem. These alternatives should include emerging technologies and their associated cost, although they might not be implemented	(j)
13. Student must be able to program a microcontroller using a development environment that includes debuggers, editing tools, compilers, among others. The microcontrollers used in class are considered state of the art	(k)

Person (s) who prepared this description and date of preparation: Manuel Jiménez Submitted by: Manuel Jiménez, Isidoro Couvertier, Comité Timón, October 2007- Aproved by: Comité Timón October, 16 2007