

CPE 301: Embedded System Design

CATALOG DATA

Study of the microcontrollers and its application to a broad range of engineering problems. Study of architecture, instruction set, interfaces, etc. Study of Assembly and C programming for microcontrollers. Use of simulation and emulation. Study of microcontroller interface with sensors, actuators, motors, peripheral devices and communication.

COREQUISITES AND PREREQUISITES

Prerequisites CpE 200 or CS 218. All prerequisites must be completed with a grade of C or better. Advanced Standing required.

RELEVANT TEXTBOOKS

Please refer to the website for information on the components/boards to buy for this course. There is no required textbook for this course.

COURSE TOPICS

- Introduction to AVR architecture
- Introduction to AVR ISA
- Introduction to AVR ATMEGA 328
- Interfacing with AVR ATMEGA 328
- RTOS on AVR ATMEGA 328
- Projects on AVR ATMEGA 328

Self-Labs: (Assembly and C)

1. Introduction to the Microcontroller Development System
2. AVR Program and Debug
3. Timing and Timer Interrupts
4. PWM
5. A2D
6. UART
7. LED Display; Synchronous Serial Port; Keypad Scanning
8. Motor Control
9. SPI, I2C interface

LEARNING OUTCOMES (Student outcomes) [UULO course outcomes]

Upon completion of this course, students will be able to:

1. Understand the architecture, ISA, programming, and interface requirements of a commercially used microprocessor (AVR). (1.2,1.3,1.4,1.6,1.7,1.8,1.10,1.11) [1,2]
2. Analyze and design to interface a microprocessor to Displays, EEPROM memory, parallel ports, serial ports (USART, SPI, I2C), etc. (1.2,1.3,1.4,1.6,1.7,1.8,1.10,1.11) [1,2]

3. Apply microprocessor systems to solve real-time problems like timers, counters, A2D, Motors, etc. (1.2,1.3,1.4,1.6,1.7,1.8,1.10,1.11,2.2,3.2,3.3,3.4) [1,2,4]
4. Learn to use assemblers, Compilers, simulators and emulators to help with design and verification. (1.2,1.3,1.4,1.6,1.7,1.8,1.10,1.11,2.2,3.2,3.3,3.4) [1,2]
5. Design, develop, report and present real-world projects based on microcontrollers (1.2,1.3,1.4,1.6,1.7,1.8,1.10,1.11,2.2,3.2,3.3,3.4) [1,2,3,4,5]

STUDENT OUTCOMES

1. The appropriate technical knowledge and skills:
 2. an ability to apply advanced mathematics such as differential equations and discrete mathematics,
 3. an ability to apply knowledge of basic sciences,
 4. an ability to apply knowledge of computer science
 6. an ability to apply knowledge of engineering
 7. an ability to design a system, component, or process to meet desired needs within realistic constraints
 8. an ability to identify, formulate, and solve engineering problems,
 10. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice,
 11. an ability to design and conduct experiments, as well as to analyze and interpret data.
2. The appropriate interpersonal skills:
 2. an ability to communicate effectively.
3. The knowledge and skills to be responsible citizens:
 2. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context,
 3. a recognition of the need for, and an ability to engage in life-long learning,
 4. a knowledge of contemporary issues,

UULO COURSE OUTCOMES

1. Intellectual Breadth and Lifelong Learning
2. Inquiry and Critical Thinking
3. Communication
4. Global/Multicultural Knowledge and Awareness
5. Citizenship and Ethics

COMPUTER USAGE

Microcontroller IDE, Compilers, Simulators, Emulation, and Debuggers.

GRADING

Midterm:30%, Assignments: 40%, Project: 30%

COURSE SYLLABUS PREPARER AND DATE

Venkatesan Muthukumar, DEC 2014

Academic Misconduct—Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility and professionalism. By choosing to join the UNLV community, students accept the expectations of the Student Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical

path. Students enrolling in UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution.

An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another, from the Internet or any source, without proper citation of the sources. See the *Student Academic Misconduct Policy* (approved December 9, 2005) located at: <https://www.unlv.edu/studentconduct/student-conduct>.

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Disability Resource Center (DRC)—The UNLV Disability Resource Center (SSC-A 143, <http://drc.unlv.edu/>, 702-895-0866) provides resources for students with disabilities. If you feel that you have a disability, please make an appointment with a Disabilities Specialist at the DRC to discuss what options may be available to you. If you are registered with the UNLV Disability Resource Center, bring your Academic Accommodation Plan from the DRC to the instructor during office hours so that you may work together to develop strategies for implementing the accommodations to meet both your needs and the requirements of the course. Any information you provide is private and will be treated as such. To maintain the confidentiality of your request, please do not approach the instructor in front of others to discuss your accommodation needs.

Religious Holidays Policy—Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor **within the first 14 calendar days of the course for fall and spring courses (excepting modular courses), or within the first 7 calendar days of the course for summer and modular courses**, of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. For additional information, please visit: <http://catalog.unlv.edu/content.php?catoid=6&navoid=531>.

Transparency in Learning and Teaching

The University encourages application of the transparency method of constructing assignments for student success. Please see these two links for further information:

<https://www.unlv.edu/provost/teachingandlearning> or <https://www.unlv.edu/provost/transparency>

Library Resources

Students may consult with a librarian on research needs. For this class, the subject librarian is Sue Wainscott. (https://www.library.unlv.edu/contact/librarians_by_subject). UNLV Libraries provides resources to support students' access to information. Discovery, access, and use of information are vital skills for academic work and for successful post-college life. Access library resources and ask questions at <https://www.library.unlv.edu>.

Incomplete Grades—The grade of I—Incomplete—can be granted when a student has satisfactorily completed three-fourths of course work for that semester/session but for reason(s) beyond the student's control, and acceptable to the instructor, cannot complete the last part of the course, and the instructor believes that the student can finish the course without repeating it. The incomplete work must be made up before the end of the following regular semester for undergraduate courses. Graduate students receiving "I" grades in 500-, 600-, or 700-level courses have up to one calendar year to complete the work, at the discretion of the instructor. If course requirements are not completed within the time indicated, a grade of F will be recorded and the GPA will be adjusted accordingly. Students who are fulfilling an Incomplete do not register for the course but make individual arrangements with the instructor who assigned the I grade.

Tutoring and Coaching

The Academic Success Center (ASC) provides tutoring, academic success coaching and other academic assistance for all UNLV undergraduate students. For information regarding tutoring subjects, tutoring times, and other ASC programs and services, visit <http://www.unlv.edu/asc> or call 702-895-3177. The ASC building is located across from the Student Services Complex (SSC). Academic success coaching is located on the second floor of the SSC (ASC Coaching Spot). Drop-in tutoring is located on the second floor of the Lied Library and College of Engineering TEB second floor.

UNLV Writing Center

One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance. Appointments may be made in person or by calling 702-895-3908. The student's Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at: <http://writingcenter.unlv.edu/>.

Rebelmail—By policy, faculty and staff should e-mail students' Rebelmail accounts only. Rebelmail is UNLV's official e-mail system for students. It is one of the primary ways students receive official university communication such as information about deadlines, major campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the university. Students' e-mail prefixes are listed on class rosters. The suffix is always @unlv.nevada.edu. **Emailing within WebCampus is acceptable.**

Final Examinations—The University requires that final exams given at the end of a course occur at the time and on the day specified in the final exam schedule. See the schedule at: <http://www.unlv.edu/registrar/calendars>.