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|  |  | **ECTS Course Description Form** |
|  | **PART I ( Senate Approval)** |
|  | **Offering School**  | Engineering |
|  | **Offering Department** | Computer Engineering |
|  | **Program(s) Offered to** | Computer Engineering |  |
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|  | **Course Code**  | CS320 |
|  | **Course Name** | Embedded Systems Design |
|  | **Language of Instruction** | English |
|  | **Type of Course** | Lecture and lab work |
|  | **Level of Course** | Undergrad |
|  | **Hours per Week** | **Lecture: 3** | **Laboratory: 2** | **Recitation:**  | **Practical:**  | **Studio:** | **Other:** |
|  | **ECTS Credit** | **6** |
|  | **Grading Mode** | Letter grade |
|  | **Pre-requisites** | CS102 and CS222 |
|  | **Co-requisites** | **-** |
|  | **Registration Restriction** | - |
|  | **Educational Objective** | This course teaches the students the basic hardware and software of an embedded system and how they interact. Embedded systems are an important area of computer engineering and a large and growing market for computing technology. The trends to mobile computing, ubiquitous computing, and pervasive computing combined with ever increasing computational power and powerful new paradigms in hardware design are changing embedded systems design. In this course we consider the design of embedded hardware and software under pressures and constraints including performance, cost, size, time to market, power,   |
|  | **Course Description** | The objective of the course is to introduce the concept of Harvard + CISC architecture microcontrollers and design of embedded computing systems on typical applications including interrupts, timers, LCD and LED displays, keypads, A/D converters, rotary coders, stepper motors, serial and parallel communication interfacing. The design applications are introduced on a very widely used typical 8-bit embedded microcontroller unit, AT89C51. The scope of the course is the simple, distinct MCS-51 embedded system design with the applications in C and CISC assembly programming. The design/theory scale of the course is around 60/40. |
|  |  | **LO1:** Interconnect engineering concepts related to microprocessors, computer hardware and real-time software systems to design embedded systems for real-world applications.  |  |
|  | **Learning Outcomes**  | **LO2:** Learn to employ specialized knowledge of subsystems like processor cores and other hardware/software system components to design an embedded computer system. |  |
|  | **LO3**: Improve capabilities of using the technical knowledge of processor architecture, peripherals, programming, and CAD tools to design specific embedded computer systems. |
|  | **LO4:** Demonstrate knowledge and understanding of the microcontroller technology both for hardware and software |
|  | **LO5:** Analyze technical requirements and design simple embedded systems using switches, LED’s, timers, LCD modules, ADC and UART |
|  | **LO6**: Know the structure of a timer unit, and use it in simple C coded programs for various timing tasks. |
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|  | **PART II ( Faculty Board Approval)** |
|  | **Basic Outcomes (University-wide)** | **No.** | **Program Outcomes** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **LO6** |
|  | **PO1** | **Ability** to communicate effectively and write and present a report in Turkish and English.  | 0 | 2 | 0 | 0 | 0 | 0 |
|  | **PO2** | **Ability** to work individually, and in intra-disciplinary and multi-disciplinary teams. | 0 | 0 | 0 | 0 | 0 | 0 |
|  | **PO3** | **Recognition** of the need for life-long learning and **ability** to access information , follow developments in science and technology, and continually reinvent oneself. | 0 | 2 | 0 | 0 | 0 | 0 |
|  | **PO4** | **Knowledge** of project management, risk management, innovation and change management, entrepreneurship, and sustainable development. | 0 | 0 | 0 | 0 | 0 | 0 |
|  | **PO5** | **Awareness** of sectors and **ability** to prepare a business plan. | 0 | 0 | 0 | 0 | 0 | 0 |
|  | **PO6** | **Understanding** of professional and ethical responsibility and **demonstrating** ethical behavior. | 0 | 0 | 0 | 0 | 0 | 0 |
|  | **Faculty Specific Outcomes** | **PO7** | **Ability** to define complex engineeringproblems, develop models andimplement solutions for theseproblems | 2 | 0 | 2 | 2 | 0 | 2 |
|  | **PO8** | **Ability** to conduct lab experiments by usingcomputers and the ability of collecting, analyzing and interpreting data.  | 2 | 0 | 2 | 2 | 0 | 2 |
|  | **PO9** | **Ability** to apply the knowledge ofmathematics, science and engineeringprinciples to solve problems in computerengineering. | 2 | 0 | 2 | 2 | 1 | 2 |
|  | **PO10** | An **understanding** of current contemporaryissues and impact of engineering solutionsin legal and ethical levels | 0 | 0 | 0 | 0 | 0 | 0 |
|  | **PO11** | **Ability** to understand and apply discretemathematics concepts. | 0 | 0 | 0 | 0 | 0 | 0 |
|  | **PO12** | **Ability** to use modern engineeringtechniques, tools and informationtechnologies and develop softwareequipment and software. | 2 | 1 | 2 | 2 | 1 | 2 |
|  |  | **PO13** | **Ability** to analyze, design and manage thehardware/software computer systemrequirements with limited resources andconditions by modern engineeringprinciples. | 2 | 2 | 2 | 2 | 2 | 2 |
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| **PART III ( Department Board Approval)** |
| **Course Subjects, Contribution of Course Subjects to Learning Outcomes, and Methods for Assessing Learning of Course Subjects** | **Subjects** | **Week** |  | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **LO6** |
| **S1** | 1 | Introduction to embedded systems  | A1/3 |  |  |  |  |  |
| **S2** | 2 | Embedded Microcontroller Architecture, Instruction Set, and programming in Assembly  | A1/3 |  |  |  | A1/3 | A1/3 |
| **S3** | 3 | Configuration of ports and pins for input and output, LEDs and switches. | A1/3/8 |  |  |  |  |  |
| **S4** | 4 | Instruction counting for precise timing | A1/3 |  |  |  |  |  |
| **S5** | 5 | Configuration of Timer unit  |  | A1/3 | A1/3 | A1/3 |  |  |
| **S6** | 6 | Instruction sets: addressing modes and formats  |  | A1/3 | A1/3 | A1/3 |  |  |
| **S7** | 7,8 | Using interrupts with Timers and switches  |  | A1/3 | A1/3 | A1/3 |  |  |
| **S8** | 9 | Using timer in C coding  | A1/3 |  |  | A1/3 | A1/3 | A1/3 |
| **S9** | 10,11 | UART configuration and initialization  | A1/3 |  | A1/3 | A1/3 | A1/3 | A1/3 |
| **S10** | 12,13 | LCD Module interfacing with FSM application, and UART with interrupts  | A1/3 | A1/3 |  | A1/3 |  | A1/3 |
| **S11** | 14 | Student Design Project Organization and Discussions  | A1/3 | A1/3 |  | A1/3 |  | A1/3 |
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| **Assessment Methods, Weight in Course Grade, Implementation and Make-Up Rules**  | **No.** | **Type** | **Weight** | **Implementation Rule** | **Make-Up Rule** |
| **A1** | **Exam** | *60%* | *Midterm is 25% and final is 35% of the final mark.* | A make-up exam is provided in case of a legitimate reason with a proof. |
| **A2** | **Quiz** | *10%* | *At least three quizzes are taken* | No make-up |
| **A3** | **Homework** | *15%* | *At least four assignments are submitted.* | No make-up |
| **A4** | **Project** |  | - | - |
| **A5** | **Report** |  | - | - |
| **A6** | **Presentation** |  | - | - |
| **A7** | **Attendance/ Interaction** |  | - | - |
| **A8** | **Class/Lab./****Field Work** | 15% | There will be 8 laboratory sections - | No make-up |
| **A9** | **Other** |  | - | - |
| **TOTAL** | **100%**  |
| **Evidence of Achievement of Learning Outcomes** | Students will demonstrate learning outcomes through midterm exams, homework assignments, and the final exam. Every topic is tested with at least one exam or homework question. In order to pass, a student needs to accumulate at least 50 % of the total mark. |
| **Method for Determining Letter Grade** | The total mark is converted to a letter grade using the table below.

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| **Total points** | 100-95 | 94-90 | 89-85 | 84-80 | 79-75 | 74-70 | 69-65 | 64-60 | 59-55 | 54-50 |
| **Letter Grade** | A | A- | B+ | B | B- | C+ | C | C- | D+ | D |

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| **Teaching Methods, Student Work Load** | **No** | **Method** | **Explanation** | **Hours** |
| ***Time applied by instructor*** |
| **1** | **Lecture** | Lectures are given using the white board with the help of power point slides. Whenever necessary, numerical examples and sample questions are given to clarify theoretical concepts.  | 3X14 = 42 |
| **2** | **Interactive Lecture** |  |  |
| **3** | **Recitation** |  |  |
| **4** | **Laboratory** |  | 2X8=16 |
| **5** | **Practical** |  |  |
| **6** | **Field Work** |  |  |
| ***Time expected to be allocated by student*** |
| **7** | **Project** |  |  |
| **8** | **Homework** | The students get the solution to homework questions after submission. | 4\*4 = 16 |
| **9** | **Pre-class Learning of Course Material**  |  |  |
| **10** | **Review of Course Material** | Review is conducted at the end of every chapter or module. Students are asked to be ready for review sessions. | 4\*12 = 48 |
| **11** | **Studio** |  |  |
| **12** | **Office Hour** | two hour per week is allocated for students’ questions. In addition, students can arrange for a meeting at any time. | 2\*14 = 28 |
| **TOTAL** |  |
| **IV. PART** |
| **Instructor** | **Name** | Shahram Taheri |
| **E-mail** | shahram.taheri@antalya.edu.tr |
| **Phone Number** | *05519527217* |
| **Office Number** | *A1-19* |
| **Office Hours** | *TBA* |
| **Course Materials** | **Mandatory** | * The 8051 Microcontroller and Embedded Systems. M. Mazidi, J. Mazidi, R. McKinl..Pearson/Prentice Hall, 2006
 |
| **Recommended** |  |
| **Other** | **Scholastic Honesty** | Violations of scholastic honesty include, but are not limited to cheating, plagiarizing,fabricating information or citations, facilitating acts of dishonesty by others, havingunauthorized possession of examinations, submitting work of another person or workpreviously used without informing the instructor, or tampering with the academic work of other students. Any for of scholastic dishonesty is a serious academic violation and will result in a disciplinary action. |
| **Students with Disabilities** | Reasonable accommodations will be made for students with verifiable disabilities. |
| **Safety Issues**  | - |
| **Flexibility** | The level of detail can be made more in-depth or can be reduced depending on the students interests and time availability. |