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**Department of Computer Science and Information Technology**

**College of Science**

**University of Salahaddin - Hawler**

**Subject: Embedded Systems**

**Course Book – (3rd Year /2nd Semester)**

**Lecturer's name: Dr. Dler Salih Hasan**

**Academic Year: 2022/2023**

**Course Description**

Embedded Systems are everywhere. Every time you look at your watch, answer the phone, take a picture, or turn on the TV you are interacting with an embedded system. Embedded systems are also found in cars, airplanes, and robots. They far outnumber traditional computers (which also contain embedded processors) and it is estimated that there will be thousands of embedded devices per person by 2021. Learning to design and program embedded systems is a critical skill that is necessary for many industry and scientific jobs.

In this course you will learn the basics of designing, interfacing, configuring, and programming embedded systems. We will make use of the Arduino platform, which is an inexpensive, popular embedded system used by hobbyists, researchers, and in industry, to implement the techniques learned in class. By the end of the course you will have mastered the basics of embedded system design and programming. This course will help to prepare you for cutting edge careers in industry and research.

**Datasheets and other useful documents**

* [Nice picture of the Arduino Uno Pinout](http://arduino.cc/forum/index.php/topic%2C146315.0.html)

**Course Schedule**

Below is an approximate schedule of course topics. These are subject to change, assignments will be announced in class. Readings are recommended and will be added as the semester progresses, so make sure to check back often; however, the best resource for this course is attending class and taking good notes. The course is roughly broken into regular class lectures on Tuesdays and then lab-style lectures on Thursdays where a *Lab.* is specified. Typically during lab. there will be a short topic-specific lecture followed by a hands-on, small group, in class lab assignment.

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| **Week** | **Class Topics** | **Lab** |
| Week 1 | course intro, c programming | Arduino basics |
| Week 2,  | embedded system design, arduino intro, basic circuit diagrams | Arduino Math |
| Week 3,  | instruction sets, registers and mem access, digital I/O | LEDs and buttons |
| Week 4, | timers, debugging | timers and I/O |
| Week 5,  | debugging, pulse width modulation (PWM) | servos |
| Week 6,  | PWM, review | test 1(tentative) |
| Week 7,  | analog to digital converters (A2D) | analog sensors |
| Week 8,  | I2C, peripherals, sensors | analog sensors |
| Week 9,  | I2C, peripherals, sensors | Random No.  |
| Week 10,  | LCD | LCD |
| Week 11,  | I2C, peripherals, sensors | I2C |
| Week 12,  | Embedded Operating Systems | i2c |
| Week 13,  | embedded systems applications, review | test 2(tentative) |
| Week 14,  | power management, embedded algorithms, program optimization | Multiple sensors |
| Week 15,  | final project competition | Multiple sensors |