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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 /1st Semester)**

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

**Academic Year: 2024/2025**

**Course Book**

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| **1. Course name** | Computer Organization and skills I |
| **2. Lecturer in charge** | Dr. Dler Salih Hasan |
| **3. Department/ College** | Computer Science and Information Technology / Science |
| **4. Contact** | e-mail:dler.hasan@su.edu.krd |
| **5. Time (in hours) per week** | Theory: 1Practical: 2 |
| **6. Office hours** | Sunday :8:30 am -9:30 pmMonday:10:30 am – 12:30 pm  |
| **8. Teacher's academic profile** |  |
| **9. Keywords** |  |
| 10. Course overview: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. |
| **11. Course objective**To design and develop reliable, efficient, and scalable embedded systems that integrate hardware and software components, ensuring optimized performance, minimal resource consumption, and seamless interfacing with other systems. |
| **12. Student's obligation**1- Attendance.1. Assignment
2. Homework
3. There examinations will be given, each 40%.
4. Final exam 50%.
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| **13. Forms of teaching**1- data show2- whiteboard |
| **14. Assessment scheme**1- Quiz 2%1. Assignment :5%
2. Homework :3%
3. There examinations will be given, each 30%.
4. Final exam 50%.

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| **15. Student learning outcome:**Using Arduino in the context of embedded systems, students will gain a comprehensive understanding of how to design and implement embedded solutions. They will learn about fundamental electronic components and their functions within circuits, and develop programming skills to control these components through the Arduino platform. This hands-on approach enhances problem-solving abilities as students troubleshoot and debug both hardware and software issues in their projects. Additionally, it fosters creativity and innovation, encouraging students to develop and implement unique solutions. Throughout the process, students will improve their technical communication skills by documenting and presenting their work, and acquire essential project management skills necessary for successfully completing embedded system projects from conception to deployment. |
| **16. Course Reading List and References‌:**David Russell,(2010) Introduction to Embedded Systems Using ANSI C and the Arduino Development Environment. ISBN: 9781608454983, Morgan & Claypool **Tianhong Pan , Yi Zhu, (2018) Designing Embedded Systems with Arduino, ISBN 978-981-10-4417-5, Springer** |
| **17. The Topics:** | **Lecturer's name** |
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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 |

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| **20. Question exams:****Q1/** What is the different between Arduino and Raspberry PI**Q2/** Count all operational attribute of embedded system **Q3/**Define GFlOAT , GflopsQ4/ Designed an Arduino code to read an analog input from a sensor (connected to pin A0) and control a series of LEDs based on the sensor reading. Turn on a number of the LEDSs depending on sensor Input. Use Array. |