

## **Faculty of Engineering & Technology**

### **Design of Real-Time Embedded Systems**

#### Information:

Course Code: CMP 456 Level: Undergraduate Course Hours: 2.00- Hours

**Department:** Specialization of Mechatronics Engineering

Instructor Information :					
Title	Name	Office hours			
Professor	Medhat Hussein Ahmed Awadalla	1			
Teaching Assistant	Mohamed Samir Ahmed Mohamed	2			

### Area Of Study:

The overall aims of this course are:

"Enrich students' knowledge of the disciplinary foundation of embedded systems as well as insight into current research and development work.

Train the students' to identify, formulate and deal with issues of embedded systems independently and creatively. "Reinforce students' ability to model, simulate, and integrate technological solutions to design an embedded system. "Train students' to develop skills in laboratory and project assignments which require gathering of information and critical evaluation.

## **Description:**

Introduction to bus architectures and programming; Device and system firmware; Arduino and I/O architectures; Memory architectures; Interrupt service routines; Real-time clocks/timers; Real-time debugging techniques and tools; Development and testing techniques; Students will be introduced to the full embedded system design process including: analysis, design (using extended finite state machine specification), interfacing, programming, hardware assembly, integration and system testing.

# Course outcomes :

### a. Knowledge and Understanding: :

- 1 Describe the architecture of the embedded systems used in Mechatronics applications.
- 2 Demonstrate the principles of the design of embedded systems for various fields of mechanical engineering and, in particular, mechatronics engineering discipline.
- 3 Identify at least one programming language can be used for a microcontrollers.

### b.Intellectual Skills::

- 1 Develop computer programs for engineering applications including programming of microprocessor based units.
- 2 Analyze electrical and electronics circuits including logic circuits, and microprocessor based mechatronics systems .
- 3 Solve microcontroller design problems related to mechanical engineering.
- 4 Evaluate designs, processes, and performance and propose improvements.



c.Profession	onal and Practical Skills: :		
1 -	Use measuring instruments and laboratory equipment to design experiments of embedded systems, collect, analyze and interpret results.		
2 -	Apply gained hardware and software skills to create and design embedded applications in mechatronics and its applications.		
3 -	Use the basic organizational and project management skills.		
d.General	and Transferable Skills: :		
1 -	Collaborate effectively within multidisciplinary team		
2 -	Search for information and engage in life-long self-learning discipline through self-learning assignments.		
3 -	Refer to relevant literatures in project report.		

Course Topic And Contents :					
Topic	No. of hours	Lecture	Tutorial / Practical		
Introduction to embedded processors and C programming.	4	2	2		
Arduino embedded system design platform, Arduino basic circuit diagrams	6	4	2		
Timers, debugging, and pulse width modulation (PWM), analog input	6	4	2		
Communication protocols (UART, SPI, I2C), interrupts, and power management.	6	4	2		
Embedded algorithms and feedback control	6	4	2		
Peripherals and sensors	6	4	2		
Embedded systems applications.	6	4	2		
Final design project.	5	4	1		
Total hours	45	30	15		

aching And Learning Methodologies :	
teractive Lecturing	
roblem solving	
iscussion	
xperiential Learning	
roject	
esearch	

Course Assessment :						
Methods of assessment	Relative weight %	Week No	Assess What			
Final Exam	40.00					
First Midterm	15.00					
Participation and Assessments	10.00					
Project	20.00					
Second Midterm	15.00					



## **Course Notes:**

1-Lecture notes.

2-Handouts.

## **Recommended books:**

Massimo Banzi, Getting Started with Arduino, OcReilly books, 2011. Edward Lee and Sanjit Seshia, Introduction to Embedded Systems, A Cyber-Physical Systems Approach, LeeSeshia.org, 2011