GAU, Faculty of Engineering

Course Unit Title	Embedded Systems
Course Unit Code	SEN422
Type of Course Unit	Compulsory for SE
Level of Course Unit	4th year BSc
National Credits	3
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	3
Practice (hour/week)	0
Laboratory (hour/week)	0
Year of Study	4
Semester when the course unit is delivered	8
Mode of Delivery	Face to face
Language of Instruction	English
Prerequisites	ENG102
Corequisites	ENG205
Recommended Optional Programme Components	

Objectives of the Course:

- This course aims to equip students with the ability to design, implement, and evaluate embedded systems using both low-level and high-level programming
- Students will develop competency in analyzing system requirements and constraints to create efficient, reliable, and resource-aware embedded solutions
- Students will gain hands-on experience in designing, testing, and debugging embedded systems.
- Students will be able to work effectively both independently and in teams to develop embedded system applications, communicate technical results clearly, and engage in lifelong learning to adapt to evolving microcontroller

Learning Outcomes

When this course has been completed the student should be able to		Assess.
1	Analyze the properties of various microcontroller architectures and famililes	1
2	Analyse the architecture of microcontroller-based systems, focusing on CPU, memory, and I/O subsystems.	1,3,6
3	Develop and debug embedded software in assembly and C languages, using effective tools and techniques.	1,3,6
4	Design and implement embedded systems both hardware and software levels	1,3,6
5	Design and implement hardware interfaces by integrating microcontroller peripherals.	1,3,6

Assessment Methods: 1. Written Exam, 2. Oral Exam, 3. Assignment, 4. Project/Report, 5. Presentation, 6. Lab Work

Course's Contribution to Program

		CL
1	Ability to understand and apply knowledge of mathematics, science, and engineering	2
2	Ability to design and conduct experiments as well as to analyze and interpret	3
3	Ability to work in multidisciplinary teams while exhibiting professional responsibility and ethical conduct	2
4	Ability to apply systems thinking in problem solving	4
5	Knowledge of contemporary issues while continuing to engage in lifelong learning	3

6	Ability to use the techniques, skills and modern engineering tools necessary for engineering practice	3
7	Ability to express their ideas and findings, in written and oral form	2
8	Ability to design and integrate systems, components or processes to meet desired needs within realistic constraints	4
9	Ability to approach engineering problems and effects of their possible solutions within a well structured, ethically responsible and professional manner	4

CL: Contribution Level (1: Low, 2: Medium, 3: High)

Course Contents

Week	Chapter	Subject	Exams
1		Microprocessors, Microcontrollers, Computer Architectures, Embedded Systems	
2		Block Diagrams, Register structures and memory organizations	
3		Instruction sets, RISC, CISC and Assembly Languages- Microchip Pic and Atmel	
4		Applications- LEDs and Switches	
5		Applications- 7-Segment displays	
6		Physical connections and peripherals	
7		Higher Level programming- Microchip XC8	
8			Midterm
9		Applications- LCD displays, Keypads and Keyboards	
10		Interrupts, Timers and timer applications	
11		ADC applications	
12		32-bit MCU Examples	
13		Higher Level programming- 32-bit compilers	
14		Applications with 32-bit microcontrollers	
15			Final

Recommended Sources

- PIC Microcontrollers and Embedded Systems using assembly and C for pic18, Mazidi et.al. Pearson, 2008
- MPLAB® XC8 C Compiler User's Guide, Microchip, 2016.
- Richard H. Barnett, Sarah Cox, Larry O'Cull, Embedded C Programming and the Atmel AVR, 2003

Assessment

Midterm	25 %
Final exam	45 %
Assignments	15 %
Quiz	15 %

ECTS Allocated Based on the Student Workload

Activities	Number	Duration (hour)	Total Workload (hour)
In-class lecture (including exam weeks)	13	3	39
Midterm exam	1	2	2
Midterm exam preparation	1	20	20
Final exam	1	2	2
Final exam preparation	1	20	20
Quiz	2	3	6
Assignment	10	4	40
Project/presentation/report writing	0	0	0

Lab and tutorial	0	0	0
Self-study	15	3	45
Total Workload			174.00
Total Workload / 30 (h)			5.80
ECTS Credit of the Course			6