EEE 213 – INTRODUCTION TO LOGIC DESIGN

Course Code	Course Name	Semester	
EEE 213	Introduction to Logic Design	Fall ☒ Spring ☐ Summer ☐	
Hours		**Credit**	**ECTS**
Theory	**Practice** / **Lab**	3	5
3	0 / 0		

Course Details	
Department	Electrical and Electronics Engineering
Course Language	English
Course Level	Undergraduate ☒ Graduate ☐
Mode of Delivery	Face to Face ☒ Online ☐ Hybrid ☐
Course Type	Compulsory ☒ Elective ☐
Lecturer(s)	Dr. Şenol Gülgönül
Course Objectives	Understand Fundamental Concepts: Grasp the basic principles of digital design, including binary systems, Boolean algebra, and logic gates. Design and Analyze Combinational Circuits: Learn to design and analyze combinational logic circuits using various methods and tools. Sequential Circuits: Understand the operation and design of sequential circuits, including flip-flops, counters, and registers. Understanding Basic Microcontroller Architecture: Learn the basics of microcontroller architecture and how logic circuits are used within them.
Course Content	Introduction to Digital Systems: Overview of digital systems and their applications. Understanding the difference between analog and digital systems. Number Systems and Codes: Study of binary numbers, including binary arithmetic and conversion between binary and other number systems. Boolean Algebra and Logic Gates: Fundamentals of Boolean algebra, including Boolean functions and their properties. Introduction to basic logic gates (AND, OR, NOT) and universal gates (NAND, NOR). Simplification of Boolean expressions using Boolean algebra and Karnaugh maps. Combinational Logic Design: Design and analysis of combinational circuits. Techniques for designing circuits such as adders, subtractors, multiplexers, demultiplexers, encoders, and decoders. Implementation of combinational logic using various methods.

	Sequential Logic Design: Introduction to sequential circuits and their components, including flip-flops, latches, counters, and registers. Design and analysis of synchronous and asynchronous sequential circuits. State machines and their applications. Memory and Programmable Logic: Overview of memory devices such as ROM, RAM, and their types. Introduction to FPGAs and their use in digital design. Microcontroller Basics: Understanding the basic architecture of microcontrollers and how logic circuits are used within them. Introduction to the role of microcontrollers in digital systems.
Course Method/ Techniques	Lecture ☒ Question & Answer ☐ Presentation ☐ Discussion ☐
Prerequisites/ Corequisites	
Work Placement(s)	

Textbook/References/Materials

- Digital Design Global Edition by Morris Mano and Micheal Ciletti

Course Category				
Mathematics and Basic Sciences	☒		Education	☐
Engineering	☒		Science	☒
Engineering Design	☒		Health	☐
Social Sciences	☐		Profession	☒

Weekly Schedule

No	Topics	Materials/Notes
1	Introduction to Logic	Chapter-1
2	Decimal to Binary	Chapter-2
3	Boolean Algebra,	Chapter-2
4	Truth Table	Chapter-2
5	Karnaugh Map	Chapter-3
6	Adder, ALU	Chapter-4
7	Decoder, Mux, FPGA	Chapter-4
8	Midterm Exam	
9	Sequential Circuits	Chapter-5
10	D-flip Flop	Chapter-5

11	Registers	Chapter-6
12	Counters	Chapter-6
13	Memory ROM, RAM	Chapter-7
14	MCU Architecture	Chapter-7
15	MCU Architecture	Chapter-7
16	Final Exam	

Assessment Methods and Criteria		
In-term studies	**Quantity**	**Percentage**
Attendance		
Lab		
Practice		
Fieldwork		
Course-specific internship		
Quiz/Studio/Criticize		
Homework		
Presentation / Seminar		
Project	1	20%
Report		
Seminar		
Midterm Exam	1	20%
Final Exam	1	60%
	Total	**100%**
Contribution of Midterm Studies to Success Grade		40%
Contribution of End of Semester Studies to Success Grade		60%
	Total	**100%**

ECTS Allocated Based on Student Workload			
Activities	**Quantity**	**Duration (Hrs)**	**Total Workload**
Course Hours	16	3	48
Lab			
Practice			
Fieldwork			
Course-specific Work Placement			
Out-of-class study time	16	5	80
Quiz/Studio/Criticize			
Homework			
Presentation / Seminar			
Project	1	50	50
Report			
Midterm Exam and Preparation for Midterm	1	23	23
Final Exam and Preparation for Final Exam	1	24	24
Total Workload			**225**
Total Workload / 25			**9**
ECTS Credit			**5**

Course Learning Outcomes	
No	**Outcome**
L1	Understand Boolean Algebra and Logic Circuits
L2	Understand basic Combinatorial logic circuits
L3	Understand basic Sequential logic circuits
L4	Design a logic circuit for given requirements
L5	Understand FPGA and MCU architectures

Contribution of Course Learning Outcomes to Program Competencies/Outcomes

Contribution Level: 1: Very Slight, 2: Slight, 3: Moderate, 4: Significant, 5: Very Significant

	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P11**					**Total**
L1	5	5	5	5	5	5	5	5	4	4	4					-
L2	5	5	5	5	5	5	5	5	4	4	4					-
L3	5	5	5	5	5	5	5	5	4	4	4					-
L4	5	5	5	5	5	5	5	5	4	4	4					-
L5	5	5	5	5	5	5	5	5	4	4	4					-
															Total	-

i. Sufficient knowledge in the fields of mathematics, natural sciences, and related engineering disciplines; the ability to apply theoretical and practical knowledge in solving complex engineering problems.

ii. The ability to identify, formulate, and solve complex engineering problems; the ability to select and apply appropriate analysis and modeling methods for this purpose.

iii. The ability to design a complex system, process, device, or product to meet specific requirements under realistic constraints and conditions; the ability to apply modern design methods for this purpose.

iv. The ability to select and use modern techniques and tools required for the analysis and solution of complex problems encountered in engineering applications; the ability to effectively use information technologies.

v. The ability to design experiments, conduct experiments, collect data, analyze results, and interpret findings for the investigation of complex engineering problems or discipline-specific research topics.

vi. The ability to work effectively in intra-disciplinary and multidisciplinary teams; the ability to work independently.

vii. The ability to communicate effectively both orally and in writing; proficiency in at least one foreign language; the ability to write effective reports, understand written reports, prepare design and production reports, make effective presentations, and give and receive clear and understandable instructions.

viii. Awareness of the necessity of lifelong learning; the ability to access information, track developments in science and technology, and continuously renew oneself.

ix. Acting in accordance with ethical principles, knowledge of professional and ethical responsibilities, and the standards used in engineering applications.

x. Knowledge of business practices such as project management, risk management, and change management; awareness of entrepreneurship and innovation; knowledge of sustainable development.

xi. Knowledge of the impact of engineering practices on health, environment, and safety at global and societal levels, and awareness of contemporary engineering issues; awareness of the legal consequences of engineering solutions.