

I. Course Information

Academic unit	School of Engineering							
Department	Electrical, Telecommunications, and Computer Engineering							
Code	GEL372							
English Title	Digital Electronics Laboratory							
French or Arabic Title (when applicable)								
Type	<input type="checkbox"/> C	<input type="checkbox"/> CTP	<input checked="" type="checkbox"/> TP	<input type="checkbox"/> P	<input type="checkbox"/> TD	<input type="checkbox"/> S	<input type="checkbox"/> TH	
Pre-requisites	GEL314							
Co-requisites								
Number of credits	1							
Hours per week per section	1 hour and 40 minutes							
Days	M 1335-1515 or 1700-1840 / F 1335-1515 or 1700-1840							
Instructor	Nisar Hakam							
Delivery Language:	<input type="checkbox"/> French	<input checked="" type="checkbox"/> English	<input type="checkbox"/> Arabic	<input type="checkbox"/> Other (specify):				
Offered	<input checked="" type="checkbox"/> Fall	<input type="checkbox"/> Spring	<input type="checkbox"/> Summer					

II. Course prerequisite knowledge and skills

Students should have taken the course of Digital Electronics (GEL314).

Students should be able to have a logical thinking in programming.

Students should be proactive to debug errors.

III. Instructor

Name and Title	Nisar Hakam
Category	<input type="checkbox"/> Full-time <input checked="" type="checkbox"/> Part-time
Office	
Email / Teams	nisar.hakam@usek.edu.lb <small>Replies are to be expected within the following 2 working days</small>
Office hours	

IV. Course Core Information

Course Description (*Slight introduction*):

This lab offers a hands-on introduction to digital systems. By the end of the course, students will be able to:

- Implement and analyse digital functions using fundamental logic gates and circuits.
- Write, simulate, and debug hardware descriptions in VHDL.
- Synthesize VHDL designs and deploy them onto an Altera FPGA board.
- Validate digital implementations through both simulation tools and physical hardware testing.

Course Goals

By the end of this lab course, students will be able to:

- Implement and analyze fundamental logic gates (AND, OR, NOT, NAND, NOR, XOR) using discrete components.
- Design and build basic combinational control circuits—such as encoders, decoders, multiplexers, and adders—by interconnecting logic gates.
- Model and realize sequential logic systems through finite state machines, including crafting state diagrams, tables, and timing analyses.
- Write, simulate, and synthesize hardware descriptions in VHDL to specify both combinational and sequential circuits.
- Deploy VHDL-based designs onto hardware platforms (e.g., FPGA boards), completing the full workflow from code to physical implementation.

Delivery Mode

Short description on the teaching strategy and approach.

This laboratory consists of application sessions and hardware/software implementations of the theoretical knowledge acquired from the course.

V. Course General Requirements

Writing Requirements

Students must be able to write precisely and coherently on the course topics in a manner that is comprehensible for the reader. Examples of such writing can be found in published papers, manuals, textbooks, and expository articles aimed at non-expert audiences.

Oral Requirements

Students must be able to express their thoughts clearly, pronounce correctly, listen actively, and participate effectively in discussions. Presentation skills, such as organization, confident delivery, and engaging the audience, are also important. Students should be adaptable in their communication style, open to different viewpoints, and demonstrate critical thinking skills.

Technical Requirements

Students should have basic computer literacy, including proficiency in word processing, internet research, and email communication. Additionally, depending on the field, students may need specific technical skills like programming, data analysis, laboratory techniques, or software proficiency.

The minimum technical skills required vary depending on the program or field of study. Students may need specific technical skills like programming, data analysis, laboratory techniques, or software proficiency. Add any specific requirements related to your course.

VI. Course Timetable

Timetable

Week	Topic	LO(s)	Assessment Activities	Learning Activities
1	Course overview, lab rules, equipment orientation	General overview of course material, as well as software and hardware	--	Demonstration
2	Number systems, binary codes, digital arithmetic	Reinforce practical knowledge about the digital systems	Quiz 1	Exercises
3	Logic gates and related devices.	Simulate and experiment the operation of a combinational circuit.	Quiz 2	Exercises
4	Boolean Algebra & Simplification	Experiment on Boolean identities and Karnaugh maps.	Quiz 3	Exercises
5	Combinational Circuits I	Learn the implementation of half and full adders as well as subtractors.	Quiz 4	Exercises
6	Combinational Circuits II	Implement a multiplexer, demultiplexer, encoder, decoder.	Quiz 5	Exercises
7	Sequential Circuits I	Implement Flip Flops (RS, JK, Toggle, D) and introduce the concept of setup and hold-time	Quiz 6	Exercises
8	Sequential Circuits II	Implement counters and shift registers..	Quiz 7	Exercises
9	Programmable Logic Devices I	Introduction to FPGA and FSM. Implementation using VHDL.	Assignment 1	Hands-on exercises

10	Programmable Logic Devices II	Implementation using VHDL after describing the digital system.	Assignment 2	Hands-on exercises
11	Timing & Signal Integrity.	Introduction to propagation delays, glitches, timing analysis	Assignment 3	Hands-on exercises
12	Debugging & Measurement Techniques.	Usage of oscilloscope to debug faults in a digital system	Assignment 4	Hands-on exercises
13	Digital System Design I.	Project proposal, iterative prototyping.	Mini project	Hands-on exercises
14	Digital System II.	Final demo.	Mini project	Project
15	Final Exams			

VII. Course Material

Required Texts	Maini, A. K. (2007). Digital Electronics: Principles, Devices and Applications. John Wiley & Sons.
Supplemental References	
Required Materials	Software: Quartus II and ModelSim

VIII. Course Grading System

Provide information about each assignment and assessment activity and specify their weight in the overall grade.

All course grades will be regularly shared with students, preferably on the e-learning platform.

The course final examinations date will be published by the Registrar Office in due time. No test or examination shall be given during the last two weeks before the regular examination period.

Passing grade

A minimum grade of is required for this course.

The Grading policy can be found in the **Academic Rules and Regulations** published on the website.

Grading criteria

Grading type	Total amount	Percentage
Attendance	-	10%
Quizzes	7	35%
Assignments	4	20%
Project	1	35%

IX. Course Policies and Support to students

The USEK **Academic Rules and Regulations** is the official document of record concerning academic programs and regulations. It can be found at www.usek.edu.lb.

Class attendance policy

Students can, for valid and justified reasons, be absent for a number of teaching hours equal to three teaching weeks (20% of the course's number of hours, i.e., 9 hours = 6 sessions of an hour and 15 minutes each). However, they are responsible for learning material covered in class and will fail all graded class activities (quizzes, tests, presentations, discussions, etc.) organized during these absences.

Students who exceed the authorized limit of absences will not be allowed to sit for their final exam. They must officially withdraw from the course before the official deadline, otherwise, they will be given the grade FW (Fail to Withdraw).

Students with an excused absence will be permitted to make up coursework or complete an equivalent assignment agreed upon with the instructor.

Absence to Mid-term and final exam

A student who does not show up for the Mid-term and final exams, for any reason, is given, by the teacher, a failing grade of zero. If this absence is due to special justifiable circumstances, such as:

- Death of a family member or relative.
- Hospitalization, attested by a medical report from the hospital.
- Tested positive to COVID-19, attested by a PCR test with a QR code.
- Serious accident, attested by an official report from a sworn expert.

Then the student can present a petition with supporting documents at the Student Affairs Office within the 24 hours following the missed exam. The request will be accepted for a valid justification or in case of a recurrence. A student who has shown up for the exam cannot, in any case, present a petition for a make-up exam.

The Mid-term and final exams policy can be found at www.usek.edu.lb.

Late Submission

Assignments are expected to be submitted by the designated deadlines. Late submissions may result in grade penalties unless prior arrangements have been made with the instructor.

Academic Integrity

Plagiarism and any form of academic dishonesty are strictly prohibited. All work submitted must be your own, unless otherwise specified.

Students are expected to practice the highest possible standards of academic integrity. Any deviation from this expectation will result in an academic penalty of the student failing the assignment and may result in additional disciplinary measures. This includes, but not limited to, improper citation of sources, using another student's work, and any other form of academic misrepresentation. Suspicions of use of artificial intelligence aids will be considered as alleged violations of Cheating.

The Academic Integrity policy can be found at www.usek.edu.lb.

Netiquette

Students are expected to communicate with each other and with the instructor in a learning community. They are expected to be respectful, polite, and knowledgeable during oral and written communication and when posting to the class discussion forums.

Arrangements for Students with Special Needs

USEK empowers students to manage challenges and limitations imposed by special needs. Students with disabilities are encouraged to contact the Access Office by sending an email to accessoffice@usek.edu.lb, for any accommodation needed to fulfill course requirements (within the first week of the semester).

Writing Center

The USEK Writing Center offers writing assistance to students. Its main mission is to develop their writing skills and provide free writing support for students of all levels and at any stage of the writing process by offering in-person consultations during which writers can brainstorm ideas, adopt different writing approaches and strategies, and receive feedback from a well-trained tutor. For assistance student are encouraged to contact the center by sending an email to writingcenter@usek.edu.lb.

Technical Support

The Enterprise and Information Technology Services (EITS) at USEK provides essential assistance to students for resolving technical issues and ensuring smooth access to digital resources. It offers guidance and troubleshooting for hardware and software problems, assists with network connectivity, and helps students navigate learning management systems and online platforms.

Latest Update on	Signature
31/08/2025	Nisar Hakem