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|  | **ECTS Course Description Form** |
| **PART I (Senate Approval)** |
| **Offering School**  | **Engineering** |
| **Offering Department** | **Electrical and Electronics Engineering** |
| **Program(s) Offered to** | **Electrical and Electronics Engineering** | **Compulsory** |
| **Computer Engineering** | **Compulsory** |
| **Industrial Engineering** | **Elective** |
| **Course Code**  | EE 221L |
| **Course Name** | Digital Systems Laboratory |
| **Language of Instruction** | English |
| **Type of Course** | Laboratory |
| **Level of Course** | Undergrad |
| **Hours per Week** | **Lecture: 0** | **Laboratory: 2** | **Recitation:**   | **Practical:**  | **Studio:** | **Other:** |
| **ECTS Credit** | **2** |
| **Grading Mode** | **Letter Grade** |
| **Pre-requisites** | - |
| **Co-requisites** | *EE 221 Digital Systems and EE 221L Digital Systems I Laboratory courses should be taken concurrently within a semester* |
| **Registration Restriction** | - |
| **Educational Objective** | The course teaches the students how digital circuits are designed and analysed through hands-on demos and experiments. They will be able to apply their gained knowledge to both the analysis and design of combinational and sequential digital circuits. |
| **Course description** | This course covers experiments involving the basic concepts of digital systems, such as Number systems, Boolean algebra, logic networks and their simplification, canonical forms. Combinatorial circuits. Adders, decoders, encoders, multiplexers, flip-flops, sequential circuit analysis and design, registers, and counters. |
| **Learning Outcomes** | **LO1** | Be able to describe and use a variety of digital circuit components |
| **LO2** | Be able to design and model digital systems, combinational and sequential |
| **LO3** | Be able to use a hardware description language for system modelling and simulation |
| **LO4** | Implement digital systems on reconfigurable programmable logic devices |
| **LO5** | Be able to design and implement hardware digital systems incorporating memory modules. |
| **PART II (Faculty Board Approval)** |
| **Basic Outcomes (University-wide)** | **No.** | **Program Outcomes** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** |  |
| **PO1** | **Ability** to communicate effectively and write and present a report in Turkish and English.  | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO2** | **Ability** to work individually, and in intra-disciplinary and multi-disciplinary teams. | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO3** | **Recognition** of the need for life-long learning and **ability** to access information, follow developments in science and technology, and continually reinvent oneself. | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO4** | **Knowledge** of project management, risk management, innovation and change management, entrepreneurship, and sustainable development. | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO5** | **Awareness** of sectors and **ability** to prepare a business plan. | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO6** | **Understanding** of professional and ethical responsibility and **demonstrating** ethical behaviour. | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **Faculty Specific Outcomes** | **PO7** | **Ability to develop, select and use modern techniques and tools necessary for engineering applications and ability to use information technologies effectively.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO8** | **Recognition of the effects of engineering applications on health, environment and safety in the universal and societal dimensions and the problems of the time and awareness of the legal consequences of engineering solutions.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO9** | **Ability to identify, define, formulate and solve complex engineering problems; and electing and applying appropriate analysis and modelling methods for this purpose.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **Discipline Specific Outcomes (program)** | **PO10** | **Gains comprehensive knowledge in mathematics, natural sciences, related engineering fields and general engineering subjects.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO11** | **Able to identify complex engineering problems and solve them with appropriate methods of analysis.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO12** | **Able to design a complex electronic system that meets the desired performance by using modern design techniques and taking real life conditions into account.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO13** | **Able to develop new techniques and tools for solution of current engineering problems.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO14** | **Able to use computer software and hardware technologies together with information technologies in an effective way.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO15** | **Able to produce innovative solutions for solution of current engineering problems by gathering data through experiment design and interpretation of results.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO16** | **Able to actively work individually or in teams where engineers from the same or different disciplines are involved.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO17** | **Gains competency in effective written and verbal communication, presentation and preparation of technical reports in Turkish and English.**  | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO18** | **Constantly increases knowledge with the awareness of lifelong learning by closely following the developments in science and technology.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO19** | **Acts in accordance with scientific and ethical principles and the standards used in engineering practice at every stage of career** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO20** | **Able to describe concepts related to business life such as project management, risk management, change management, entrepreneurship and sustainability.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO21** | **Gains awareness of the legal consequences of engineering solutions developed together with the effect of engineering applications on health, environment and safety on a universal and social scale.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO22** | **Able to solve problems involving probability and statistics, derivative and integral calculations, multivariable mathematics, linear algebra, differential equations, and complex variables, and their electrical and electronics applications.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO23** | **Able to organize projects and events for the social environment they live in with the awareness of social responsibility and implement them.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **PO24** | **Able to plan and direct activities for employees under their responsibility to develop within the framework of a project.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
|  |  |  |  |  |  |  |  |  |
| **PART III ( Department Board Approval)** |
| **Course Subjects, Contribution of Course Subjects to Learning Outcomes, and Methods for Assessing Learning of Course Subjects** | **Subjects** | **Week** |  | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **LO6** |
| **S1** | 1 | Experiment 1: Logic gates | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 |  |
| **S2** | 2 | Experiment 1: Logic gates | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 |  |
| **S3** | 3 | Experiment 2: Boolean algebra theorems | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 |  |
| **S4** | 4 | Experiment 2: Boolean algebra theorems | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 |  |
| **S5** | 5 | Experiment 3: Multiplexers | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 |  |
| **S6** | 6 | Experiment 3: Multiplexers | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 |  |
| **S7** | 7 | Experiment 4: Flip-flops | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 |  |
| **S8** | 8 | Experiment 4: Flip-flops | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 |  |
| **S9** | 9 | Experiment 5: Flip-flop conversions | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 |  |
| **S10** | 10 | Experiment 5: Flip-flop conversions | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 |  |
| **S11** | 11 | Experiment 6: Shift registers | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 |  |
| **S12** | 12 | Experiment 6: Shift registers | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 |  |
| **S13** | 13 | Experiment 7: Counters | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 |  |
| **S14** | 14 | Experiment 7: Counters | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 | A2-A5-A8 |  |
| **Assessment Methods, Weight in Course Grade, Implementation and Make-Up Rules**  | **No.** | **Type** | **Weight** | **Implementation Rule** | **Make-Up Rule** |
| **A1** | **Exam** |  |   |  |
| **A2** | **Quiz** | 20% | No electronic devices are allowed in the quizzes except calculators  | The student is informed about a make-up quiz in case his/her excuse is valid and an accompanying doctor’s report is provided. |
| **A3** | **Homework** |  |  |  |
| **A4** | **Project** |  |  |  |
| **A5** | **Report** | 70% | Students are required to submit a detailed lab report on the conducted experiment within one week. | n/a |
| **A6** | **Presentation** |  | - | - |
| **A7** | **Attendance/ Interaction** |  | - | - |
| **A8** | **Class/Lab./****Field Work** | 10% | Experiments as part of the class are performed by the students in groups. Students’ lab performance is evaluated. | The student is informed about a make-up lab in case his/her excuse is valid and an accompanying doctors report is provided. |
| **A9** | **Other** |  |  |  |
| **TOTAL** | **100%** |
| **Evidence of Achievement of Learning Outcomes** | Students are required to perform experiments in lab sessions and write a report for each lab. A weighted average is calculated for each student based on the percentage of each assessment method. To pass the course, students are required to obtain a minimum score out of 100, which is announced by the instructor. This score is determined based on the class average. |
| **Method for Determining Letter Grade** | The scores of 7 pre-lab quizzes, and 7 lab reports are used to calculate the final score. The maximum score contribution from each assessment category is shown below.

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| --- | --- | --- | --- | --- |
| Assessment | Pre-lab Quizzes | Lab Performance | Lab Report | Total |
| Point | 20 | 10 | 70 | 100 |

The table below is used to convert the total point out of 100 to a letter grade:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Point | 100-75 | 74-70  | 69-65 | 64-60 | 59-55 | 54-50 | 49-45 | 44-40 | 39-35 | 34-30 |
| Grade | A | A- | B+ | B | B- | C+ | C | C- | D+ | D |

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| **Teaching Methods, Student Work Load** | **No** | **Method** | **Explanation** | **Hours** |
| ***Time applied by instructor*** |
| **1** | **Lecture** |  |  |
| **2** | **Interactive Lecture** |  |  |
| **3** | **Recitation** |  |  |
| **4** | **Laboratory** | Experiments are demonstrated and performed | 2x7 |
| **5** | **Practical** |  |  |
| **6** | **Field Work** |  |  |
| ***Time expected to be allocated by student*** |
| **7** | **Project** |  |  |
| **8** | **Homework** | A report on the lab work is prepared | 3x7 |
| **9** | **Pre-class Learning of Course Material**  | Next labs’ material is read before the lab | 1x7 |
| **10** | **Review of Course Material** | Previous lab material is reviewed every second week | 1x7 |
| **11** | **Studio** |  |  |
| **12** | **Office Hour** | One-to-one meetings for discussions | 1x7 |
| **TOTAL** | *56* |
| **IV. PART** |
| **Instructor** | **Name** | Shah Rahman |
| **E-mail** | shah.rahman@antalya.edu.tr |
| **Phone Number** |  |
| **Office Number** | A1-62 |
| **Office Hours** | *Determined during each semester (1 hour per week)* |
| **Course Materials** | **Mandatory** |  |
| **Recommended** | *Digital Design (with an introduction to the Verilog HDL),* 5th edition*,* by Mano, M. Morris and Ciletti, Michael. D. |
| **Other** | **Scholastic Honesty** | Violations of scholastic honesty include, but are not limited to cheating, plagiarizing, fabricating information or citations, facilitating acts of dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. Any form of scholastic dishonesty is a serious academic violation and will result in disciplinary action. |
| **Students with disabilities** | Reasonable accommodations will be made for students with verifiable disabilities. |
| **Safety Issues**  | The course does not require any special safety precautions. |
| **Flexibility** | Circumstances may arise during the course that prevents the instructor from fulfilling each and every component of this syllabus; therefore, the syllabus is subject to change.  Students will be notified prior to any changes.  |