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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** | **Elective** |
| **Computer Engineering** | **Elective** |
| **Industrial Engineering** | **Elective** |
| **Course Code**  | EE 432 |
| **Course Name** | Digital Communications |
| **Language of Instruction** | **English** |
| **Type of Course** | *Course* |
| **Level of Course** | **Undergraduate** |
| **Hours per Week** | **Lecture: 3** | **Laboratory:**  | **Recitation:**  | **Practical: 2** | **Studio:** | **Other:** |
| **ECTS Credit** | **7** |
| **Grading Mode** | **Letter Grade** |
| **Pre-requisites** | EE 332, EE 431 |
| **Co-requisites** | **-** |
| **Registration Restriction** | *-* |
| **Educational Objective** | The aim of this course is to gain the ability to apply sampling theorem, digital communication bases and techniques in digital communication systems. |
| **Course description** | This course is an introduction to the theory of digital communication. The course will cover the general structure of digital communication systems, real and complex random vectors, signal space representations, digital modulation / demodulation techniques, digital data transmission over noisy channels and ideal receiver design, bit error probability in digital data communication, techniques and basic limits of data communication, entropy, channel capacity and coding methods. |
| **Learning Outcomes** | **LO1** | Identification of signals and modulation types in digital communication systems |
|  | **LO2** | Calculation of digital communication system performance |
|  | **LO3** | Design and analyze an efficient digital communication system |
|  | **LO4** | Designing channel equalization and symbol synchronization systems |
|  | **LO5** | Interpret the results of numerical communication coding techniques according to performance analysis |
| **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 behavior. | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
| **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.** | 🗸 | 🗸 | 🗸 | 🗸 | 🗸 |  |
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| **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** |  |  |
| **S1** | 1 | Basic concepts in digital communication | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 |  |  |
| **S2** | 2 | Pulse modulation | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 |  |  |
| **S3** | 3 | Sampling theory | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 |  |  |
| **S4** | 4 | Pulse amplitude, pulse duration, pulse site modulation, coding, transformers | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 |  |
| **S5** | 5 | Pulse amplitude, pulse duration, pulse site modulation, coding, transformers | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 |  |
| **S6** | 6 | Differential pulse code modulation | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 |  |
| **S7** | 7 | Baseband digital information transmission | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 |  |
| **S8** | 8 | Entropy, channel capacity account | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 |  |
| **S9** | 9 | Source coding, pulse code modulation (PCM) design and performance analysis | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 |  |
| **S10** | 10 | Channel equalization, symbol synchronization | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 |  |
| **S11** | 11 | Coding and decoding | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 |  |
| **S12** | 12 | Inter-symbol interference and impact shaping | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 |  |
| **S13** | 13 | Digital data transmission and ideal receiver design in noisy channels | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 |  |
| **S14** | 14 | Bit error rate in base band information transmission | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 | A1-A4-A9 |  |
| **Assessment Methods, Weight in Course Grade, Implementation and Make-Up Rules**  | **No.** | **Type** | **Weight** | **Implementation Rule** | **Make-Up Rule** |
| **A1** | **Exam** | %55 | No electronics allowed in the exams except calculators  | The student is informed about a make up exam in case his/her excuse is valid and an accompanying doctors report is provided. |
| **A2** | **Quiz** |  |  |  |
| **A3** | **Homework** |  |  |  |
| **A4** | **Project** | %35 | Projects determined as part of the class are performed by the students in groups. Project demonstration is made on a day during finals week. A group report is submitted at the last day of the final exams. | The student is informed about a make up project demonstration in case his/her excuse is valid and an accompanying doctors report is provided. |
| **A5** | **Report** |  | - | - |
| **A6** | **Presentation** |  | - | - |
| **A7** | **Attendance/ Interaction** |  | - | - |
| **A8** | **Class/Lab./****Field Work** |  | - | - |
| **A9** | **Other (Practice)** | %10 | Simulations of digital communication systems are made with **MATLAB** software. The tasks are determined in the course each week. The sum of application simulations is presented on a specified day at the end of the semester. The application report is delivered on the day of presentation. | The student is informed about a make up practice demonstration in case his/her excuse is valid and an accompanying doctors report is provided. |
| **TOTAL** | **100%** |
| **Evidence of Achievement of Learning Outcomes** | At least one question from each subject is asked during the exams. Students are required to a project that involve the class content, and write a report for each lab and the project. A weighted average is calculated for each student based on the percentage of each assessment method. Students are required to collect a minimum score over 100, which is announced by the instructor, to pass the course. This score is determined based on class average. |
| **Method for Determining Letter Grade** | Maximum scores from each contributor is shown below.

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| --- | --- | --- | --- | --- | --- |
| Assesment | Exam 1  | Final  | Practice | Project | Total |
| Point | 20 | 35 | 10 | 35 | 100 |

The table below is used to conver the total point over 100 to letter grade:

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Point | 100-95 | 94-90  | 89-85 | 84-80 | 79-75 | 74-70 | 69-65 | 64-60 | 60-50 | >50 |
| 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** | Class content is explained by writings on the board and computer presentations. | 3x14 |
| **2** | **Interactive Lecture** |  |  |
| **3** | **Recitation** | Sample questions are solved by writing on the board. | 3x6 |
| **4** | **Laboratory** |  |  |
| **5** | **Practical** | Digital communication systems are simulated with the specified **MATLAB** software. | 3x6 |
| **6** | **Field Work** |  |  |
| ***Time expected to be allocated by student*** |
| **7** | **Project** | A project is implemented, and a report is prepared | 6x6 |
| **8** | **Homework** | Application simulation results are reported. | 2x6 |
| **9** | **Pre-class Learning of Course Material**  | Next class’ material is read before the class | 2x14 |
| **10** | **Review of Course Material** | Previous class material is reviewed each week | 2x14 |
| **11** | **Studio** |  |  |
| **12** | **Office Hour** | One-to-one meetings for discussions | 2x14 |
| **TOTAL** | *210* |
| **IV. PART** |
| **Instructor** | **Name** | Jehad HAMAMREH |
| **E-mail** | Jehad.hamamreh@antalya.edu.tr |
| **Phone Number** |  |
| **Office Number** |  |
| **Office Hours** | Determined during each semester, 2 hours per week. |
| **Course Materials** | **Mandatory** |  |
| **Recommended** | “Communication Systems”, Simon Haykin, 4th Edition“Digital Communications: Fundamentals and Applications”, 2nd Edition, Bernard Sklar, Prentice Hall |
| **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 a 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.  |