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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** | *Selective Compulsory*  |
| **Computer Engineering** | *Selective Compulsory* |
|  |  |
| **Course Code**  | **EE 472** |
| **Course Name** | **Power Electronics** |
| **Language of Instruction** | **English** |
| **Type of Course** | *Course* |
| **Level of Course** | **Undergraduate** |
| **Hours per Week** | **Lecture: 3** | **Laboratory:**  | **Recitation:**  | **Practical:**  | **Studio:** | **Other:** |
| **ECTS Credit** | **7** |
| **Grading Mode** | **Letter Grade** |
| **Pre-requisites** | *PHYS 102, MATH 102* |
| **Co-requisites** | **-** |
| **Registration Restriction** | *-* |
| **Educational Objective** | 1. the principles of operation of power electronic converters
2. dc-dc, dc/ac, ac/ac and ac/dc power converters
3. switching losses and heat sink selection
4. Control of the converters
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| **Course description** |  Basic calculations about electrical power, harmonics, energy and Fourier series. Controlled and uncontrolled half and full bridge rectifiers, Buck, boost and buck-boost DC / DC converters, Power supplies, Designing DC to AC inverters with their controls algorithms,   AC / AC choppers,  Simulating converters, Selecting semiconductor switching devices, driver circuits and heat sink for converters. |
| **Learning Outcomes** | **LO1** | To calculate power and harmonics of power system |
| **LO2** | To design and control DC/DC converters |
| **LO3** | To design and control DC/AC converters |
| **LO4** | To design and control AC/AC converters |
| **LO5** | To design and control DC/AC converters |
| **LO6** | To select semiconductor switch and driver for the converters |
|  |  |
| **PART II ( Faculty Board Approval)** |
| **Basic Outcomes (University-wide)** | **No.** | **Program Outcomes** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **LO6** |
| **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** | **LO5** | **LO6** |
| **S1** | *1* | Power, harmonics and THD calculation | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* |
| **S2** | *2* | Introducing software to design circuit | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* |
| **S3** | *3* | Switching devices and drivers | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* |
| **S4** | 4 | Buck and Boost converters | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* |
| **S5** | 5 | Buck Boots ConverterMagnetics Circuit design | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* |
| **S6** | 6 | Flyback and Forward Converters | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* |
| **S7** | 7 | AC/AC Converters | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* |
| **S8** | 8 |  AC/AC Converters | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* |
| **S9** | 9 |  Half bridge Rectifier  | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* |
| **S10** | 10 | Full bridge Rectifier | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* |
| **S11** | 11 | Controlled Half and Full bridge Rectifier | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* |
| **S12** | 12 | Basics of Inverters | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* |
| **S13** | 13 | Control Inverters and PWM techniques | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* |
| **S14** | 14 | Switching losses Selecting Heat sinks for semiconductors | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* | *A1-A4-A8* |
| **Assessment Methods, Weight in Course Grade, Implementation and Make-Up Rules**  | **No.** | **Type** | **Weight** | **Implementation Rule** | **Make-Up Rule** |
| **A1** | **Exams** |  60 | *No electronics allowed in the exams except calculators open book and note. Two exams, final and midterm* | *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** | 10 | *No electronics allowed in the exams except calculators. Close book and notes* | *The student is informed about a make up exam in case his/her excuse is valid and an accompanying doctors report is provided.* |
| **A3** | **Homework** | 10 |  |  |
| **A4** | **Project** | 20 | *Equally weighed two design projects, handed on 8. week and 13. week.* | *in case his/her excuse is valid and an accompanying doctors report is provided, deadline is extended one week.* |
| **A5** | **Report** | 0 |  |  |
| **A6** | **Presentation** | 0 |  |  |
| **A7** | **Attendance/ Interaction** | 0 |  |  |
| **A8** | **Class/Lab./****Field Work** | 0 |  |  |
| **A9** | **Other** | 0 |  |  |
| **TOTAL** | **100%** |
| **Evidence of Achievement of Learning Outcomes** | Designing power supply and inverters. A student should have at least 50 point from all exams including quiz and completing at least one design project with full grade. |
| **Method for Determining Letter Grade** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Assesment | M. Exam 1 | Quiz | Final  | Homework | Project | Total |
| Point | 20 | 10 | 40 | 10 | 20 | 100 |

The table below is used to convert the total point over 100 to 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** | Covering the topics  | 32 |
| **2** | **Interactive Lecture** | Verifying the design with mathematical software and real time simulation programs  | 28 |
| **3** | **Recitation** | Doing more example and repeating some topics that students have difficulties of understanding | 28 |
| **4** | **Laboratory** |  |  |
| **5** | **Practical** | Checking the design projects | 10 |
| **6** | **Field Work** |  |  |
| ***Time expected to be allocated by student*** |
| **7** | **Project** | Two design projects are implemented, and reports are prepared. | 40 |
| **8** | **Homework** | Converter designs | 32 |
| **9** | **Pre-class Learning of Course Material**  | Reading the materials | 28 |
| **10** | **Review of Course Material** | Studying the topics from different books | 10 |
| **11** | **Studio** |  |  |
| **12** | **Office Hour** | Asking unclear topics to instructors | 14 |
| **TOTAL** | *222* |
| **IV. PART** |
| **Instructor** | **Name** | Selim Börekci |
| **E-mail** | sborekci@akdeniz.edu.tr |
| **Phone Number** | 0544 270 7960 |
| **Office Number** |  |
| **Office Hours** |  |
| **Course Materials** | **Mandatory** |  |
| **Recommended** | Power Electronics By Daniel Hart |
| **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 for 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.  |