**AGU Graduate School of Engineering & Science Department of electrical and Computer Engineering**

**Program Records**

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| **About the Program** | Abdullah Gül University (AGU) aims to be a research-oriented university with state-of–the-art facilities designed for multi-disciplinary research and graduate studies. AGU faculty with full experience in national and international research projects will produce benefits for all stakeholders. AGU pays special attention to building relationships with industry in order to establish efficient collaboration for qualified R&D projects.<br><br>The Electrical and Computer Engineering Department's PhD Program at AGU emphasizes advanced graduate education for cutting-edge research. Our research focuses on current high-growth fields like optics, photonics, nanotechnology, biomedical and bioinformatics, information and communications technology, power systems engineering, energy, control and automation.<br><br>All graduate students are encouraged to participate in funded research projects. Research projects are funded by TUBITAK, BAP, EU Framework Programs and industry. Applicants are strongly encouraged to apply for TUBITAK 2211 and TUBITAK 2215 scholarships. Internal funded scholarships will also be available for highly qualified candidates.<br><br>We believe that Electrical and Computer Engineering (ECE) PhD program at AGU will build its reputation based on the quality of its faculty members and graduate students. Bright, motivated and ambitious graduate students with renowned professors in their field will help to develop one of the best ECE programs. |
| **Program Goals** | By pursuing a graduate study in ECE program to attain an expertise in the offered fields and with their strong mathematics and physics background related to the advanced research topics; our students can<br>1. Conduct independent research and education activities at National an/or International industrial companies, R&D institutions and/or universities,<br>2. Follow latest developments in their filed of expertise and contribute to the literature |
| **Qualification Awarded** | PhD |
| **Length of Program & Credits** | 4 Year (excluding one year of English Preparatory Program)<br>240 ECTS |
| **Level of Qualification** | Third Cycle (PhD ) Degree; QF-EHEA: Level 3 ;EQF-LLL : Level 8 |
| **Mode of Study** | Full Time |
| **Field of Study** | 52- Engineering |
| **Admission Requirements** | A Master's diploma; an acceptable score from YDS (Foreign Language Exam), YÖKDİL (Foreign Language Exam for Higher Education Institutions), or TOEFL; an acceptable score from the Academic Personnel and Postgraduate Education Entrance Exam (ALES - Mathematical Score Type); a passing score at the oral interview for the concerned doctoral program. International students are admitted based on the criteria posted by the university.<br>Required minimum scores are as follows: 3.00 undergraduate GPA for applicants with an undergraduate diploma; 80 mathematical score from ALES; an acceptable score from YDS, YÖKDİL or TOEFL. Passing the oral interview for the concerned doctoral program. |

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| **Recognition of Credit Mobility** | **Course Substitution**: For course substitutions, medium of instruction of a previous course must be English, its final grade must be at least 3.00 out of 4.00 and approval of a relevant University Board is required.<br>**Lateral Transfer:** Spending at least one semester at the master's program currently enrolled in, taking at least 2 credit courses and passing them with at least 3.00 out of 4.00. |
| **Graduation Requirements & Regulations** | Successful completion of 7 Courses, Seminar and Ethics; a minimum grade point average (GPA) of 3.00; earning 240 ECTS credits; passing the PhD qualifying exam and successful submission of a thesis proposal and thesis. |

**Occupational Profiles of Graduates**

The main mission of the Graduate School of the Engineering & Science of AGU is to develop highly qualified entrepreneurs, researchers, high-level managers and academicians.

In parallel with this mission, graduates of ECE program can be occupied as researchers or managers in the companies working in the filed like optics, photonics, nanotechnology, biomedical and bioinformatics, information and communications technology, power systems engineering, energy, control and automation; or they can be occupied in universities as researchers or academicians in universities to study in similar filed.

**Access to Further Studies**

Graduates may apply to second cycle (Level 7 or Level 8) degree programs.

**Assessment & Grading Policy**

Based on Abdullah Gul University Graduate Education and Examination Regulation rules;

| Letter Grade | Coefficient | Score | Status | Letter Grade | Status |
|---|---|---|---|---|---|
| A | 4.00 | 90-100 | Pass | NA | Not Attended |
| A- | 3,67 | 87-89 | Pass | W | Withdrawn |
| B+ | 3,33 | 83-86 | Pass | S | Satisfactory |
| B | 3,00 | 80-82 | Pass | U | Unsatisfactory |
| B- | 2,67 | 77-79 | Pass | P | In Progress |
| C+ | 2,33 | 73-76 | Pass | EX | Exempt |
| C | 2,00 | 70-72 | Pass | | |
| C- | 1,67 | 64-69 | Conditional Pass | | |
| D+ | 1,33 | 56-63 | Conditional Pass | | |
| D | 1,00 | 50-55 | Conditional Pass | | |
| F | 0,00 | 0-49 | Failed | | |

**Program Outcomes**

PO1. The skills of using mathematics, science and engineering information in advanced research,

PO2. The skills of analyzing, designing and/or implementing an original system that will be able to solve an engineering problem,

PO3. The skills of using the required software, hardware and modern measurement equipments in their field of research,

PO4. The skills of planning independent research and implementing in detail,

PO5. The skills of following literature, listening to and making technical presentation, writing a paper in academic level,

PO6. The skills of innovative and interrogative thinking and finding original solutions

| **TQF-HE & Program Outcomes Coverage** | | **Knowledge** | **Skills** | **Competences** | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theoretical Conceptual | Cognitive Practical | Work Independently and Take Responsibility | | Learning | Communication and Social | Field Specific |
| | P01 | X | X | | | X | | X |
| | PO2 | X | X | | | X | | X |
| | PO3 | X | X | X | | X | | X |
| | PO4 | X | X | X | | | | X |
| | PO5 | X | X | X | | X | X | X |
| | PO6 | X | X | | | X | | X |
| **Institutional & Program Outcomes Coverage** | | IO1 | IO2 | IO3 | IO4 | IO5 | IO6 | IO7 |
| | P01 | X | X | | | X | | X |
| | PO2 | X | X | | | X | X | X |
| | PO3 | X | | | | X | | X |
| | PO4 | X | | | | X | X | |
| | PO5 | | | X | X | | X | |
| | PO6 | | X | X | | | | |

**Curriculum**

| Course Code | Course Name | Theoretical Hours | Practical Hours | Credits | ECTS |
|---|---|---|---|---|---|
| ECEXXX | ECE Course | 3 | 0 | 3 | 7,5 |
| ECEXXX | ECE Course | 3 | 0 | 3 | 7,5 |
| ECEXXX | ECE Course | 3 | 0 | 3 | 7,5 |
| TOTAL | | 9 | 0 | 9 | 22,5 |

(Semester 2) - Year 1

| Course Code | Course Name | Theoretical Hours | Practical Hours | Credits | ECTS |
|---|---|---|---|---|---|
| ECEXXX | ECE Course | 3 | 0 | 3 | 7,5 |
| ECEXXX | ECE Course | 3 | 0 | 3 | 7,5 |
| ECEXXX | ECE Course | 3 | 0 | 3 | 7,5 |
| TOTAL | | 9 | 0 | 9 | 22,5 |

(Semester 3) - Year 2

| Course Code | Course Name | Theoretical Hours | Practical Hours | Credits | ECTS |
|---|---|---|---|---|---|
| ECE500 | Seminar | | | | 5 |
| ECE697 | PhD Special Topics | | | | 30 |
| ECE699 | PhD Thesis | | | | 145 |
| TOTAL | | | | | |

(Semester 4) - Year 2

| Course Code | Course Name | Theoretical Hours | Practical Hours | Credits | ECTS |
|---|---|---|---|---|---|
| ECE | Ethics | | | | 7,5 |
| ECE697 | PhD Special Topics | | | | 30 |
| ECE699 | PhD Thesis | | | | 145 |
| TOTAL | | | | | |

(Semester 5) - Year 3

| Course Code | Course Name | Theoretical Hours | Practical Hours | Credits | ECTS |
|---|---|---|---|---|---|
| ECE697 | PhD Special Topics | | | | 30 |
| ECE699 | PhD Thesis | | | | 145 |
| TOTAL | | | | | |

(Semester 6) - Year 3

| Course Code | Course Name | Theoretical Hours | Practical Hours | Credits | ECTS |
|---|---|---|---|---|---|
| ECE697 | PhD Special Topics | | | | 30 |
| ECE699 | PhD Thesis | | | | 145 |
| TOTAL | | | | | |

(Semester 7) - Year 4

| Course Code | Course Name | Theoretical Hours | Practical Hours | Credits | ECTS |
|---|---|---|---|---|---|
| ECE697 | PhD Special Topics | | | | 30 |
| ECE699 | PhD Thesis | | | | 145 |
| TOTAL | | | | | |

(Semester 8) - Year 4

| Course Code | Course Name | Theoretical Hours | Practical Hours | Credits | ECTS |
|---|---|---|---|---|---|
| ECE697 | PhD Special Topics | | | | 30 |
| ECE699 | PhD Thesis | | | | 145 |
| TOTAL | | | | | |

**Courses Descriptions**

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|---|---|
| Code | **ECE 501** |
| Name | **Linear Systems** |
| Hour per week | 3 (3 + 0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Spring |
| Type | Elective |
| Prerequisites | none |
| Content | The purpose of this course is to provide the students with the fundamental tools of linear system design, analysis, and control. The course content includes Introduction to Linear Systems, State-space representation and analysis, Solution for state-space linear time-invariant (LTI) systems, Controllability and Observability, State Feedback Control, Optimal Control, Stability, Discrete-time systems, Design Considerations and Steady-state accuracy, MIMO systems, Passivity, Polynomial representations and designs. |

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|---|---|
| Code | **ECE 506** |
| Name | **Advanced Theory of Power Electronics** |
| Hour per week | 3 (3+0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate / Master, Ph.D. |
| Semester | Spring |
| Type | Elective |
| Prerequisites | EE 451 Power Electronics |
| Content | Fundamental concepts in Power Electronics. DC Machine Drives. E-Class Converter Operating Principles. DC Motor Control with E-Class Converter. Operating E-Class Converter as a DC/AC Inverter. Harmonic Reduction Techniques in Inverters. Voltage Source Inverters-VSI PWM Techniques, Advantages and Disadvantages. New VSI Techniques, Advantages and Disadvantages. Forced Commutated Converters and Inverters. Force "d Commutated Current Source Inverters-CSI. Resonant Power Converters |

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|---|---|
| Code | **ECE 510** |
| Name | **Architectures of Current and Future Internet** |
| Hour per week | 3 (3+0) |
| Credit | 3 |
| ECTS | 10 |
| Level/Year | Graduate / Master, Ph.D. |
| Semester | Fall |
| Type | Elective |
| Prerequisites | COMP 308 Computer Networks |
| Content | Explanation of the current and future Internet architecture will be given throughout the course. The main components and key mechanisms of the current Internet architecture like address resolution and routing will be investigated. Also, the Information Centric Networking (ICN), one of the key issues of the Future Internet paradigm will be discussed with its core concepts, potential architectures, and research directions. |

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|---|---|
| Code | **ECE 511** |
| Name | **Computer Networks** |
| Hour per week | 3 (3 + 0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Fall |
| Type | Elective |
| Prerequisites | none |
| Content | This course provides a comprehensive overview of computer networks and mobile communications technologies. The topics include computer networks, Internet, TCP/IP, transport layer protocols, routing layer protocols, medium access control protocols, wireless channel models, cellular networks and wireless local area networks. After completing the course, students will get a basic understanding about the computer networks and mobile communications, and related problem solving discipline using mathematics / engineering principles. |

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|---|---|
| Code | **ECE 512** |
| Name | **Wireless Sensor Networks** |
| Hour per week | 3 (3 + 0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Spring |
| Type | Elective |
| Prerequisites | none |
| Content | This course provides a comprehensive overview of wireless sensor networks and their real-world applications. The topics include wireless sensor network protocols, network architectures and management, error control techniques, optimal packet size design, cross-layer communication protocol solutions, localization algorithms, ZigBee, IEEE 802.15.4, 6LowPAN, underwater and underground sensor networks, wireless sensor and actor networks, and wireless multimedia sensor networks. After completing the course, students will get an advanced understanding about the wireless sensor networks and related problem solving discipline using mathematics / engineering principles. |

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|---|---|
| Code | **ECE 513** |
| Name | **Introduction to Robotics** |
| Hour per week | 3 (3 + 0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Fall |
| Type | Elective |
| Prerequisites | none |
| Content | The purpose of this course is to provide the students with the fundamental tools of robotic system design, analysis, modeling, and control. The course content includes robot classifications, Rigid motions, Homogeneous transformations, Robot forward kinematics, Robot inverse kinematics, Differential kinematics and Jacobians, Motion planning and trajectory generation, Robot dynamics, Mobile robots, Independent joint control, and Robot sensors and actuators. The course provides self-learning and creative thinking abilities. |

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| Code | **ECE 520** |
| Name | **Flat Panel Display Technologies** |
| Hour per week | 3+0 (Theory + Practice) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate / M.Sc.-Ph.D. |
| Semester | Fall-Spring |
| Type | Elective |
| Prerequisites | General Semiconductor Physics and Electronics Engineering Background |
| Content | Displays overview, Color science and engineering, Photo-physical mechanisms, Liquid crystal displays, Liquid crystal displays, Organic light emitting diodes and displays, Plasma displays, Field emission displays, Electroluminescent displays, Future of the display technology |

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| Code | **ECE 521** |
| Name | **Geometrical Optics** |
| Hour per week | 3+0 (Theory + Practice) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Fall, Springs |
| Type | Elective |
| Prerequisites | None |
| Content | Ray optics and Fermats' principle aberration and dispersion in optical systems, thin lens equations, ray tracing, Gaussian beam propagation, interference of light, single and double slit interference, optical resonators and their types and applications, modulation of light and modulation devices. |

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| Code | **523** |
| Name | **Photonics** |
| Hour per week | 3+0 (Theory + Practice) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Fall |
| Type | Elective |
| Prerequisites | None |
| Content | Photonics course intends to focus on basic concepts of light and photonics with their applications. This course includes contents from electromagnetic spectrum and its properties; beam optics and beam propagation; polarization of light; generation and detection of light; modulation of light via electro optic and acousto optic modulators; fiber optic cable and transmission of light through fiber optic cable. |

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| Code | **ECE 524** |
| Name | **Fiber optic communication** |
| Hour per week | 3+0 (Theory + Practice) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Springs |
| Type | Elective |
| Prerequisites | None |
| Content | In this course, the fiber optic communication links and the sub components will be covered. The content of this course is: optical transmitters and recievers, |

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| | fiber optic based amplifiers, fiber optic cable properties and types, modulation of light, power budged in optical fiber links and multi channel systems. |

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| Code | **ECE 530** |
| Name | **Digital Image Processing** |
| Hour per week | 3 (Theory) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Fall, Springs |
| Type | Elective |
| Prerequisites | |
| Content | The principle objectives of this course are to provide an introduction to basic concepts and methodologies for digital image processing, and to develop a foundation that can be used as the basis for further study and research in this field. |

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|---|---|
| Code | ECE543 |
| Name | Fundamentals of BioMEMS |
| Hour per week | 3 (Theory) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Fall |
| Type | Elective |
| Prerequisites | |
| Content | • Fundamentals of instrumentation<br>• Anatomy terms<br>• Protein, DNA, Cell and cell membrane<br>• Origin of bio-signals.<br>• Circulation, neural and muscle systems<br>• Transducers, and instrumentation circuitry<br>• Classification of bio-signals and fundamental features<br>• Bio-signal processing<br>• Frequency Domain characterization<br>• Frequency domain analysis, FFT, filtering artifact removal |

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|---|---|
| Code | Electric Power Distribution System Engineering |
| Name | ECE 553 |
| Hour per week | 3(3 + 0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Fall, Springs |
| Type | Elective |
| Prerequisites | NA |
| Content | Power distribution system modeling, primary and secondary system, voltage control and capacitor control and usage of a programming language during the course of these analyses will be aimed. At the end of the course, student will learn how to analyze distribution systems in general, load characteristics and nature of loads, application of distribution transformers, design of sub transmission lines and distribution substation, design considerations of primary systems, design considerations of secondary systems, voltage drop and power loss calculations, application of capacitors to distribution systems, distribution system voltage regulation, power system harmonics. |

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| Code | **ECE 555** |
| Name | **Advanced Theory of Electrical Machines** |
| Hour per week | 3 (3+0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate / Master, Ph.D. |
| Semester | Fall |
| Type | Elective |
| Prerequisites | None |
| Content | DC motor transient and steady state equations, Derivation of transfer functions of DC motor, Controller design for dc motor control, Review of induction machine theory, Derivation of equivalent circuits of induction machine, Derivation of equivalent circuit used in the field oriented controlled induction machine, Analysis of induction machine in per-unit system, Equivalent circuit of induction machine used in the transients, Analysis of induction machine for unbalanced cases with symmetrical components, Analysis of induction machine for non-sinusoidal supply cases by means of harmonic equivalent circuit. |

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| Code | **ECE 560** |
| Name | **Neural Networks** |
| Hour per week | 3 (3 + 0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate / anytime |
| Semester | Fall - Spring |
| Type | Elective |
| Prerequisites | - |
| Content | This course provides an introduction to neural networks. It covers single and multi-layer networks, backpropagation algorithm, network training algorithms, regularization, Bayesian neural networks, self organizing maps and extreme learning machine. The course also provides applications of neural networks for classification, regression, clustering and feature selection. Methods will be implemented by a neural network software and applied on various machine learning problems. |

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| Code | **ECE 561** |
| Name | **Bioinformatics** |
| Hour per week | 3 (3 + 0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate / anytime |
| Semester | Fall - Spring |
| Type | Elective |
| Prerequisites | - |
| Content | This course introduces computational techniques for mining the large amount of information produced by recent advances in molecular biology, such as genome sequencing and microarrray technologies. Together with the minimal biological background necessary for a computer-engineering student, some of the most basic and useful algorithms for sequence analysis and their applications to current genomics research will be presented. Topics to be covered also include clustering and classification algorithms for the analysis of gene expression data, methods to analyze large scale biological networks. |

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| Code | **ECE 562** |
| Name | **Machine Learning** |
| Hour per week | 3 + 0 (Theory + Practice) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate / 1, 2, 3, 4 |
| Semester | Fall, Spring |
| Type | Elective |
| Prerequisites | Introduction to Computer Programming, Probability and Statistics, Linear Algebra |
| Content | The course provides a broad introduction to the techniques that enable computers to learn from and make predictions on data. Fundamental learning methods will be covered including classification, regression, linear models, neural networks, support vector machines, dimension reduction, ensembles, and advanced learning techniques. Methods will be implemented by a machine learning software and applied on various learning problems. |

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| Code | **ECE 565** |
| Name | **Data Mining** |
| Hour per week | 3 (3 + 0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate / anytime |
| Semester | Fall |
| Type | Elective |
| Prerequisites | - |
| Content | This course provides an introduction to data mining. It covers data representation, data preprocessing, fundamental pattern discovery techniques such as frequent itemset and association rule detection, and basic concepts of classification and clustering algorithms. This course also presents performance evaluation and testing methods of classification algorithms. Through a course project, the students will program a data mining software and apply the concepts to a real problem. |

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| Code | **ECE 576** |
| Name | **Nonlinear Control** |
| Hour per week | 3 (3 + 0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Fall/Spring |
| Type | Elective |
| Prerequisites | none |
| Content | The purpose of this course is to provide the students with the fundamental tools of nonlinear system design, analysis, modeling, and control. The course content includes Review of Linear Control Systems, Introduction to Nonlinear Systems, Second and Higher Order Systems, Input-State and Input-Output stability, Nonlinear Forms, Stabilization with Feedback Control, Robust Stabilization with Feedback Control, Tracking with feedback control, Observers for State-Feedback Control, Integral Control, Passivity. The course provides self-learning and creative thinking abilities. |

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|---|---|
| Code | **ECE581** |
| Name | Computer Architecture |
| Hour per week | 3 (3 Theory + 0 Practice) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Springs |
| Type | Elective |
| Prerequisites | - |
| Content | This course provides the major concepts and design philosophies of computer architecture and explains the principles, tradeoffs, and implementation details of microprocessors. The course introduces the basic mechanisms such as pipeline, branch prediction, multi-threaded execution which are utilized in the current state of the art microprocessors. Also, laws of performance evaluation of a modern computer will be explained in the course to measure if a computer meets functional, performance, energy consumption, cost, and other specific goals. After completing the course, students will get a basic understanding about the topics relevant to design of microprocessors of the present and will be able to foresee problems and possible solution directions for the future architectural designs. |

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|---|---|
| Code | **ECE582** |
| Name | **Parallel Archictures** |
| Hour per week | 3 (3 Theory + 0 Practice) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Springs |
| Type | Elective |
| Prerequisites | - |
| Content | The main objective of the course is to build a strong understanding of the fundamentals of the architecture of parallel computers and the tradeoffs made in their design. Parallel computers are now almost everywhere and different types of parallelisms are exploited in the computer hardware. These parallelisms, such as, multi-core architectures, parallel memory systems, vector architectures, dataflow machines, and interconnection networks will be explained in the class. |

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|---|---|
| Code | **ECE 585** |
| Name | **Semiconductor Device Fundamentals** |
| Hour per week | 3+0 (Theory + Practice) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate / M.Sc.-Ph.D. |
| Semester | Fall-Spring |
| Type | Elective |
| Prerequisites | General Semiconductor Physics and Electronics Engineering Background |
| Content | Crystal structure-atoms and electrons, Energy bands and charge carrier in semiconductors, Optical absorption, luminescence, carrier lifetime and diffusion, Junctions, Field effect transistors-Bipolar junction transistors, Photodiodes, Light emitting diodes, Solar cells, Lasers |

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|---|---|
| Code | **ECE 589** |
| Name | **Interdisciplinary Introduction to Quantum Engineering** |
| Hour per week | 3 (Theory) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate / 1, 2 |
| Semester | Fall |
| Type | Elective |
| Prerequisites | None |
| Content | Interdisciplinary introduction to basic concepts of modern engineering of small scale objects; Learning the social impact of modern engineering; Learning the role of modern engineering in the solution of global challenge problems. The course covers: basic principles of quantum approach to modern engineering; concepts of engineering for quantum dots, wires, wells and nanoscale objects; concepts of special and energy control of small scale objects; basic concepts of quantum computation and quantum communication; application of quantum engineering to bio- and medical technologies; social impacts of quantum engineering; role of quantum engineering in the developing of modern and forthcoming technologies; contribution of quantum engineering to solving global challenge problems. |

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|---|---|
| Code | **ECE 607** |
| Name | **Design of Variable Reluctance Machines** |
| Hour per week | 3 (3+0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate / Master, Ph.D. |
| Semester | Fall |
| Type | Elective |
| Prerequisites | EE 308 Electrical Machines and Drives |
| Content | Fundamentals of VRM Analysis. Practical VRM Configurations. Current Waveforms for Torque Production. VRM Drives. Nonlinear Analysis. Performance Analysis of VRMs and VRM Drives by Software Simulations. Loss, Efficiency and Torque Calculations. Paper Reviews on the Subject. Evaluation of Selected Studies Carried on Reviewed Papers by means of Software Simulations. Step Motors. Various Configurations of Step Motors. Step Motor Control Methods and Step Motor Drives. Paper Reviews on the Subject. |

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| Code | **ECE 608** |
| Name | **Theory of Field Orientation Control** |
| Hour per week | 3 (3+0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate / Master, Ph.D. |
| Semester | Fall |
| Type | Elective |
| Prerequisites | ECE 550 Advanced Theory of Electrical Machines |
| Content | Vector Control and Field Orientation in Synchronous Machines. Current and |

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| | Torque Control via CSI and PWM Drives. Torque Control via Current Regulated PWM Drive. Vector Control and Field Orientation in Induction Machines. Independent Flux and Torque Control. Induction Machine Flux and Torque Control via CSI, PWM, and CRPWM Drives. Slip Calculator and Its Errors. Direct and Indirect Field Orientation. DQ Model of Induction Machines. Stator, Rotor, Synchronous and Arbitrary Reference Frames and Induction Machine Models in Various Reference Frames. Complex Vector Notation. Complex Vector Models of Induction Machine. Digital Computer Simulation and Analysis of Induction Machines by means of Developed Models. Paper Reviews on the Subject. Evaluation of Selected Studies Carried on Reviewed Papers by means of Software Simulations. |

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|---|---|
| Code | **ECE641** |
| Name | Fundamentals of BioMEMS |
| Hour per week | 3 (Theory) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Fall |
| Type | Elective |
| Prerequisites | |
| Content | • Nanotechnology and its applications<br>• Materials and specifications<br>• Fabrication Process: Etching, Deposition and patterning<br>• Surface properties<br>• Nanotechnology based transduction<br>• Microfluidics<br>• Micro/nano biosensors<br>• Standard laboratory methods<br>• Micro/nano cantilevers<br>• Biochips<br>• Application of MEMS to medicine and biology |

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|---|---|
| Code | **ECE 645** |
| Name | **Biosensors** |
| Hour per week | 3 (Theory + Practice) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Fall/Springs |
| Type | Elective |
| Prerequisites | |
| Content | • Nano/Micro technology applications for Biosensing<br>• Materials and specifications<br>• Surface properties<br>• Transduction mechanisms<br>• Microfluidics<br>• Micro/nano biosensors<br>• Standard laboratory methods for biosensing<br>• Cantilever/Carbon Nanotube Biosensors<br>• Target based Biosensing |

| **Code** | **ECE 652** |
|---|---|
| Name | Advanced Power System Analysis |
| Hour per week | 3(3 + 0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Fall, Springs |
| Type | Elective |
| Prerequisites | NA |
| Content | Power system modeling, power flow calculation and short circuit studies and learning of usage of a programming language during the course of these analyses will be aimed. At the end of the this class, student will learn how to analyze power system in general, there phase system and connection (delta-y), power systems in per-unit system, admittance matrix modeling and usages, derivation of network reduction, derivation of Z bus modification, power Flow Calculation by using gauss-seidel and newton Raphson methods, symmetrical and unsymmetrical components, short circuit calculation, economic operation of power systems. |

| Code | **ECE 654** |
|---|---|
| Name | **Power System Stability** |
| Hour per week | 3 (3 + 0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate |
| Semester | Fall, Spring |
| Type | Elective |
| Prerequisites | ECE 652 |
| Coordinator(s) | Assoc. Prof. Dr. Ahmet Onen |
| Content | This course intends to teach the students power system stability problem and handling, creating controller for stability issues and usage of a programming language on power system applications. The course covers the following topics: Introduction to power system structures and simulation, Synchronous machine modeling, Excitation system modeling, Turbine-Governor modeling, Interconnected multi-machine modeling, Transient stability analysis, Linearized modeling and the control problem, Signal analysis, Power System Stabilizer (PSS) design, Voltage Stability, Frequency Stability. |

| Code | **ECE 686** |
|---|---|
| Name | **Semiconductor Process and Device Fabrication** |
| Hour per week | 3 (3+0) |
| Credit | 3 |
| ECTS | 7,5 |
| Level/Year | Graduate / Master, Ph.D. |
| Semester | Spring |
| Type | Elective |
| Prerequisites | None |
| Content | This course introduces the fundamentals of microfabrication process and reviews the developments, materials and clean room protocols. The topics are photolithography, masking and patterning of materials, semiconductor oxidation and diffusion, ion implantation, thermal processing, etching, metal and dielectric deposition for contacts, gate and interconnect engineering, metrology and process control systems, packaging, MEMS devices. |