**ABDULLAH GÜL UNIVERSITY**
**GRADUATE SCHOOL OF ENGINEERING & SCIENCE**
**ELECTRICAL AND COMPUTER ENGINEERING PROGRAM**
**COURSE DESCRIPTION AND SYLLABUS**

| Course Title | Code | Semester | T+L Hours | Credit | ECTS |
|---|---|---|---|---|---|
| SCIENTIFIC COMPUTING WITH MATLAB | ECE-551 | FALL-SPRING | 3 + 0 | 3 | 10 |

| | |
|---|---|
| **Prerequisite Courses** | N/A |

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|---|---|
| **Type** | Selective |
| **Language** | English |
| **Coordinator** | Prof. Bülent Yılmaz |
| **Instructor** | Prof. Bülent Yılmaz |
| **Adjunt** | none |
| **Aim** | -Learn the details of MATLAB and practice them in various types of problems.<br>-Acquire theoretical concepts in scientific computing or numerical techniques and apply them in MATLAB. |
| **Learning Outcomes** | • learn and apply the concepts like scripts, variables, plots, vectors, matrices, indexing, functions, for and while loops, structure and cell arrays, debugging,<br>• apply this knowledge in relatively complex scenarios,<br>• grasp the idea of unavoidable errors in computing,<br>• learn root-finding methods and apply them in various mathematical functions in MATLAB,<br>• understand the fundamental approaches used in solving systems of linear equations, least-squares fitting of a curve to data, interpolation, numerical integration and derivation, and optimization and apply them in MATLAB. |
| **Course Content** | • Getting Started with MATLAB<br>• User Defined Functions and Loops<br>• Vectorization<br>• Symbolic Math<br>• Data Structures<br>• Solving Systems of Linear Equations<br>• Curve Fitting<br>• Finding Roots of a Polynomial<br>• Interpolation<br>• Optimization<br>• Numerical Differentiation and Integration |

**WEEKLY TOPICS AND PRELIMINARY STUDY**

| Week | Topic | Preliminary Study |
|---|---|---|
| 1 | Motivation of the course | The relevant articles from the literature |
| 2 | Getting Started with MATLAB<br>• Script, variables, arrays<br>• Indexing and plotting | The relevant articles from the literature |
| 3 | • User Defined Functions<br>• Relational Operators<br>• for and while loops<br>• Advanced plotting | The relevant articles from the literature |
| 4 | • Vectorization<br>• Symbolic Math<br>• File I/O | The relevant articles from the literature |
| 5 | • Probability and Statistics<br>• Data Structures (cell arrays and structure)<br>• Debugging | The relevant articles from the literature |
| 6 | • Review of Linear Algebra<br>• Solving Systems of Linear Equations | The relevant articles from the literature |
| 7 | • Least Squares Fitting of a Curve to Data | The relevant articles from the literature |
| 8 | • Least Squares Fitting of a Curve to Data | The relevant articles from the literature |
| 9 | Midterm Exam | The relevant articles from the literature |

| | | |
|---|---|---|
| 10 | • Nonlinear Equations<br>• Polynomials<br>• Finding the Roots of a Function | The relevant articles from the literature |
| 11 | • Interpolation | The relevant articles from the literature |
| 12 | • Optimization | The relevant articles from the literature |
| 13 | • Numerical Differentiation | The relevant articles from the literature |
| 14 | • Numerical Integration | The relevant articles from the literature |
| 15 | • Graphical User Interfaces | The relevant articles from the literature |
| 16 | Final Exam | |

| **SOURCES** | |
|---|---|
| **Lecture Notes** | Lecture slides |
| **Other Sources** | **Additional Materials:**<br>• Gerald Recktenwald, Numerical Methods with MATLAB: Implementation and Application, Prentice-Hall, Inc., New Jersey, 2000. |

| **COURSE MATERIALS SHARING** | |
|---|---|
| **Documents** | Lecture notes and slides |
| **Homeworks** | Students will be given one homework every two weeks |
| **Exams** | 1 Midterm and 1 Final Exams |

| **EVALUATION SYSTEM** | | |
|---|---|---|
| **SEMESTER STUDY** | **NUMBER** | **CONTRIBUTION** |
| Midterm | 1 | 25 |
| Homework | 6 | 30 |
| Presentations | 2 | 10 |
| Quiz | 5 | 15 |
| **SUB-TOTAL** | | 80 |
| **Contribution of Semester Study** | | 80 |
| **Contribution of Final Exam** | 1 | 20 |
| **TOTAL** | | 100 |

| **Course Category** | |
|---|---|
| Sciences and Mathematics | 50% |
| Engineering | 50% |
| Social Sciences | 0% |

| **RELATIONSHIPS BETWEEN LEARNING OUTCOMES AND PROGRAM QUALIFICATIONS** | | | | | | | |
|---|---|---|---|---|---|---|---|
| No | Program Qualifications | Contribution Level | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | |
| 1 | Ability to use math, science and engineering knowledge in advanced research | | | | | x | |
| 2 | Ability to design, realize and analyze a novel system to solve engineering problems | | | | x | | |
| 3 | To be able to use modern measurement equipment, hardware and software for expertise area research | | | x | | | |
| 4 | Ability to plan and do detailed independent research | | | | x | | |
| 5 | Ability to do literature search, technical presentation, and prepare scientific manuscript | | | | x | | |
| 6 | Be able to do critical and creative thinking and finding innovative methods | | | x | | | |

*Increasing from 1 to 5.

| **ECTS / WORK LOAD TABLE** | | | |
|---|---|---|---|
| Activities | Number | Duration (Hours) | Total Work Load |
| Course Length (includes exam weeks: 16x total course hours) | 16 | 3 | 48 |
| Out-of-class Study Time (Pre-study, practice) | 16 | 5 | 80 |
| Internet search, library work, literature search | 16 | 4 | 64 |
| Presentation | 2 | 15 | 30 |
| Homework | 6 | 7 | 42 |
| Midterm | 1 | 15 | 15 |
| Final Exam | 1 | 20 | 20 |
| **Total Work Load** | | | 299 |
| **Total Work Load / 30** | | | 299/30 |
| **Course ECTS Credit** | | | 10 |