MARMARA UNIVERSITY - FACULTY OF ENGINEERING

2017-2018 Spring

MATH2059 Numerical Methods

# COURSE DESCRIPTION FORM

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| **Offering Department** | Department of Computer Engineering | | Undergraduate must course (4th semester) |
| **Course Code** | MATH2059 | | |
| **Course Name** | Numerical Methods | | |
| **Language of Instruction** | English | | |
| **ECTS** | 4 | | |
| **Contact Hours** | Theoretical (T): 3 | Practice (U): 0 | Laboratory(L): 0 |
| **Pre-requisites** | MATH1001 Calculus I | | |
| **Instructor** | **Name** | Çiğdem Eroğlu Erdem | |
| | **E-mail** | cigdem.erdem@marmara.edu.tr | |
| **Course Materials** | **Mandatory** | S. C. Chapra, R. P. Canale, Numerical Methods for Engineers, 7th edition, McGraw Hill, 2015.<br><br>Lecture notes and announcements are shared via the class web page. | |
| | **Recommended** | S. C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, 3rd Edition, McGrawHill, 2012.<br>R. L. Burden and J. D. Faires, Numerical Analysis, Brooks/Cole, 2011. | |
| **Course Objectives** | The goal of this course is to introduce the student basic numerical methods and their applications in engineering. The students who pass this course will be able to apply numerical methods to the problems they face. | | |
| **Course Content** | Introduction to MATLAB; floating point arithmetic; solution of nonlinear equations with a single unknown; linear systems of equations; introduction to optimization; regression and interpolation; curve fitting; numerical differentiation and integration; numerical solution of differential equations. | | |
| **Learning Outcomes** | **LO1** | Use MATLAB programming to apply numerical algorithms and perform error analysis. | |
| | **LO2** | Solve nonlinear equations using numerical methods. | |
| | **LO3** | Solve linear systems of equations. | |
| | **LO4** | Apply basic optimization concepts using numerical methods. | |
| | **LO5** | Apply regression and interpolation methods to fit curves to data in engineering applications. | |
| | **LO6** | Apply numerical methods for differentiation, integration and differential equations. | |

| **Program Outcomes** | | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **LO6** |
|---|---|---|---|---|---|---|---|
| **PO1** | Adequate knowledge in mathematics, science (a) and computer engineering subjects (b) pertaining to the relevant discipline (1); ability to use theoretical and applied information in these areas to model and solve engineering problems (2). | | 1.a | | 1.a | 1.a | |
| **PO4** | Ability to devise (a), select, and use (b) modern techniques and tools needed for engineering practice (1); ability to employ information technologies effectively (2). | 1.b<br>2 | | | | | |
| **PO12** | Knowledge of advanced mathematics subjects including differential equations, integral calculus (a), linear algebra (b), statistics and probability (c), and discrete mathematics (d). | | | b | | | a |

| | **No** | **Week** | **Subjects** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **LO6** |
|---|---|---|---|---|---|---|---|---|---|
| **Subjects (Knowledge, Skills and Behaviours),**<br><br>**Contributions of Subjects to Learning Outcomes,**<br><br>**Assessment Methods** | **S1** | 1 | Introduction to numerical methods | | | | | | |
| | **S2** | 2-3 | MATLAB programming | MF, H, Q | | | | | |
| | **S3** | 4-5 | **Floating point arithmetic:** computer representation; error analysis | MF, Q | | | | | |
| | **S4** | 6-7 | Solution of nonlinear equations with a single unknown: bisection and fixed point methods; regula falsi method; convergence analysis | | MF, H,Q | | | | |
| | **S5** | 8 | **Solving linear systems of equations:** Gaussian elimination;pivotting; LU Decomposition | | | MF, H, Q | | | |
| | **S6** | 9 | **Introduction to optimization:** one dimensional optimization; multi variable optimization; constrained linear optimization. | | | | MF,H,Q | | |
| | **S7** | 10 | **Regression:** linear regression; polynomial regression; multivariate regression | | | | | MF,H,Q | |
| | **S8** | 11-12 | **Interpolation:** Lagrange polynomials, Divided differences, cubic splines, convergence analysis | | | | | MF,H,Q | |

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| | **S9** | 13 | Numerical differentiation and integration | | | | | | MF,H, Q |
| | **S10** | 14 | Differential equations | | | | | | MF, Q |

| | **No** | **Type** | **Weight** | **Implementation Rule** | **Make-up Rule** |
|---|---|---|---|---|---|
| **Assessment Methods and Weights** | **MF** | Midterm, Final | 70% | There will a midterm and a final exam. Exams will be closed boks and notes. Calculators are allowed. | Marmara University regulations will be followed for make-up exams. |
| | **Q** | Quiz | 15% | There will be at least 3 quizzes. The lowest quiz grade of each student will not be taken into account. | - |
| | **H** | Homeworks | 15% | There will be 3 MATLAB based homeworks. Late submissions will be penalized. | - |
| | **TOTAL** | | 100% | | |

**Determining Letter Grades**

- The letter grades will be determined based on the midterm and final exams, quizzes and homeworks.
- In order to determine the letter grade, a curve or catalog based method will be followed based on the total average scores of the students.
- The final exam score and the total average score of the student must be at least 35 to pass the course.
- According to Marmara University Undergraduate regulations, the weight of the final exam must be at least 40 out of 100.

| Assessment | Midterm | Quizzes | Homeworks | Final | TOTAL |
|---|---|---|---|---|---|
| Weight | 30 | 15 | 15 | 40 | 100 |

**Teaching Method, Student Work Load**

**Time Applied by the Instructor**

| **No** | **Method** | **Explanation** | **Hours** |
|---|---|---|---|
| **1** | Lectures | Lectures are given in class using the board or via presentations. Example questions are solved to enhance the concepts. | 14x3=42 |
| **2** | Problem Session/ Practice | Problems related to the course topics are solved on the board. | |
| **3** | Laboratory | Experiments are done in the laboratory or theoretical concepts covered during the lectures are practiced using computer exercises. | |
| **4** | Interactive Courses | Questions are asked to students during lectures and they are encouraged to guess the answers (peer learning is also in this category) | |
| **5** | Field Work | Students attend activities outside the campus. | |
| 6 | Midterm | Midterm exam is given during the midterm week. | 2 |
| 7 | Final | Final exam is given during the final exam week. | 2 |
| **Estimated Time to be Allocated by a Student** | | | |
| **8** | Project | The students carry out research about the problem given in the project, design and implement their solution and prepare a report. | |
| **9** | Homeworks | The students solve the problems given as homework. | 3x5=15 |
| **10** | Pre-class learning of Course Material | The students study and learn the new subjects from course materials. | |
| **11** | Review of Course Material | Students review the course subjects from course materials to prepare for the exams and homeworks. | 36 |
| **12** | Office Hour | Students ask questions to the instructor or the assistant during office hours. | 2 |
| **TOTAL** | | | 99 |

**Academic 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.

In case academic dishonesty is observed, the first authority is the instructor of the course. The instructor may decide to give the student zero for the homework(s)/lab(s)/exam(s), give the letter grade FF, or may take disciplinary action.