

**TED UNIVERSITY**

**MATH 210**

**Numerical Methods in Engineering**

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**SYLLABUS/FALL 2015**

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## Course Information

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<b>Required or Elective</b>	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective	<b>Date</b>	September 2015
<b>Semester</b>	Fall 2015	<b>Class Hours and Classrooms</b>	<u>For ME Students:</u> M. 09:00 – 11:00, Rm. 211L W. 12:00 – 14:00 , Rm. 211L <u>For CE Students:</u> M. 09:00 – 10:50, Rm. A316L Th. 12:00 – 13:50 , Rm. A316L
<b>Course Credit Hours/ ECTS credits</b>	(3+0+1) 2 / 4	<b>Pre-requisite/ Co-requisite</b>	MATH 101 / MATH 203
<b>Level of Course</b>	Sophomore	<b>Language of Instruction</b>	<input checked="" type="checkbox"/> English <input type="checkbox"/> Turkish
<b>Instructors and their office hours</b>	<u>Assist. Prof. Dr. Özgür Uğraş Baran</u> (Email: ozgur.baran@tedu.edu.tr) (Rm. 349) (Office hours: Monday 11:00-12:00; Wednesday 15:00-18:00; Thursday 10:00-11:00 or by appointment) <u>Assist. Prof. Dr. Melih Çalamak</u> (Email: melih.calamak@tedu.edu.tr) (Rm. 361) (Office hours: Fridays 09:30-12:30 or by appointment)		
<b>Teaching Assistant(s)</b>	Arash Karshenass (Email: arash.karshenass@tedu.edu.tr) (Rm. 343) Onur Doğan (Email: onur.dogan@tedu.edu.tr) (Rm. 357)		
<b>Student Assistant(s)</b>	Onur Deniz Akan (Email: odeniz.akan@tedu.edu.tr) Semih Aydoğan (Email: semih.aydogan@tedu.edu.tr) Gizem Bilgin (Email: gizem.bilgin@tedu.edu.tr)		
<b>Textbook</b>	Numerical Methods for Engineers 6th Edition (2010) by Steven C. Chapra and Raymond P. Canale, McGraw-Hill.		
<b>Recommended Readings</b>	Introduction to MATLAB for Engineers (2010) by William J. Palm, McGraw-Hill		
<b>Course Web Pages</b>	Please register to Moodle page <a href="http://moodle.tedu.edu.tr">http://moodle.tedu.edu.tr</a> and regularly follow this link to have access to course materials.		

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## Course Description

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Numerical solution techniques for mathematical problems in engineering. Computer programming for solution of engineering problems. Numerical root finding. Numerical linear algebra. Numerical integration and differentiation. Solution techniques of ordinary differential equations.

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## Course Learning Outcomes

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On successful completion of this course students will be able to:

1. Use MATLAB programming environment for the solution of engineering problems and for the future engineering courses.
2. Perform basic programming techniques.
3. Consider iterative solution concepts, sensitivity, reliability and convergence of numerical solutions.

4. Perform numerical root finding techniques for certain types of problems and select appropriate technique for a specific problem type.
5. Find values within (intermediate) or outside (external) a given range utilizing iteration or extrapolation.
6. Perform appropriate numerical solution techniques for the solution of linear equations.
7. Use computers for linear algebra, differentiation and integration problems.
8. Solve matrices and ordinary differential equations with computers.

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## Course Assignments

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- A. **Homeworks and Project (40%):** There will be multiple homework and a final project involving computer programming and reporting. Projects will be assigned to groups of at most 3 students. It is possible to complete individual project. Projects should be reported clearly and grading will be based on both the computational results and report quality.
- B. **Midterm Exam (25%):** There will be 1 midterm exam in class. Date of the exam will be announced later.
- C. **Final (35%):** There will be a cumulative final. Date of the final will be announced at the end of the semester

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## Course Assessments & Learning Outcomes Matrix

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Assessment Methods	Course Learning Outcomes
Weekly Homeworks	#1, #2, #3, #4, #5, #6, #7
Project	#1, #2, #3, #4, #5, #6, #7
Midterm Exam	#3, #4, #5
Final Exam	#3, #4, #5, #6, #7

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## Extended Description

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Engineering problems have become more and more complex and computers are the main tool for engineering computations. Most of such problems require one or more of the following numerical techniques: root finding, interpolation/extrapolation, solution of linear algebra problems, differentiation and integration, solution of ordinary differential equations etc.. This course provides the students the basic skills for solving engineering problems with computers, where approximate answers are simpler/quicker/more readily available/useful than precise/exact mathematical/analytical solutions. The course starts with basic concepts of scientific and engineering computations. Finding of roots of the equations, interpolation/extrapolation, computerized solution of series of linear equations, numerical differentiation and integration, and solution of ordinary differential equations are the main topics. Practice hours and assignments involve application of knowledge gained in lectures through hands-on computer programming using Matlab as the main numerical calculation environment.

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## Teaching Methods & Learning Activities

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| <input checked="" type="checkbox"/> Telling/Explaining | <input type="checkbox"/> Simulations & Games                         |
| <input type="checkbox"/> Discussions/Debates           | <input type="checkbox"/> Video Presentations                         |
| <input checked="" type="checkbox"/> Questioning        | <input type="checkbox"/> Oral Presentations/Reports                  |
| <input type="checkbox"/> Reading                       | <input type="checkbox"/> Concept Mapping                             |
| <input checked="" type="checkbox"/> Peer Teaching      | <input type="checkbox"/> Brainstorming                               |
| <input type="checkbox"/> Scaffolding/Coaching          | <input type="checkbox"/> Drama/Role Playing                          |
| <input checked="" type="checkbox"/> Demonstrating      | <input type="checkbox"/> Seminars                                    |
| <input checked="" type="checkbox"/> Problem Solving    | <input type="checkbox"/> Field Trips                                 |
| <input type="checkbox"/> Inquiry                       | <input type="checkbox"/> Guest Speakers                              |
| <input type="checkbox"/> Collaborating                 | <input checked="" type="checkbox"/> Hands-on Activities              |
| <input type="checkbox"/> Think-Pair-Share              | <input type="checkbox"/> Service Learning                            |
| <input type="checkbox"/> Predict-Observe-Explain       | <input type="checkbox"/> Web Searching                               |
| <input type="checkbox"/> Microteaching                 | <input type="checkbox"/> Experiments                                 |
| <input type="checkbox"/> Case Study/Scenario Analysis  | <input checked="" type="checkbox"/> Other(s): Projects and Homeworks |

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## Student Workload

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| <input checked="" type="checkbox"/> Lectures .....40 hrs        | <input type="checkbox"/> Resource Review ..... hrs                          |
| <input checked="" type="checkbox"/> Course Readings .....25 hrs | <input type="checkbox"/> Research Review ..... hrs                          |
| <input type="checkbox"/> Workshop ..... hrs                     | <input type="checkbox"/> Report on a Topic ..... hrs                        |
| <input type="checkbox"/> Online Discussion ..... hrs            | <input type="checkbox"/> Case Study Analysis ..... hrs                      |
| <input type="checkbox"/> Debate ..... hrs                       | <input type="checkbox"/> Oral Presentation ..... hrs                        |
| <input type="checkbox"/> Work Placement ..... hrs               | <input type="checkbox"/> Poster Presentation ..... hrs                      |
| <input type="checkbox"/> Field Trips/Visits ..... hrs           | <input type="checkbox"/> Demonstration ..... hrs                            |
| <input type="checkbox"/> Observation ..... hrs                  | <input type="checkbox"/> Web Designs ..... hrs                              |
| <input type="checkbox"/> Lab Applications ..... hrs             | <input type="checkbox"/> Mock Designs ..... hrs                             |
| <input type="checkbox"/> Hands-on Work ..... hrs                | <input type="checkbox"/> Team Meetings..... hrs                             |
| <input type="checkbox"/> Exams/Quizzes ..... hrs                | <input checked="" type="checkbox"/> Other: Homework and projects.....80 hrs |

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## Assessment Methods

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| <input checked="" type="checkbox"/> Test/Exam | <input type="checkbox"/> Observation                               |
| <input type="checkbox"/> Quiz                 | <input type="checkbox"/> Self-evaluation                           |
| <input type="checkbox"/> Oral Questioning     | <input type="checkbox"/> Peer Evaluation                           |
| <input type="checkbox"/> Performance Project  | <input type="checkbox"/> Portfolio                                 |
| <input type="checkbox"/> Written              | <input type="checkbox"/> Presentation (Oral, Poster)               |
| <input type="checkbox"/> Oral                 | <input checked="" type="checkbox"/> Other(s): Homework and Project |

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## Tentative Course Outline

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Week	Topics
1	<ul style="list-style-type: none"><li>• MATLAB Programming</li></ul>
2	<ul style="list-style-type: none"><li>• MATLAB Programming</li></ul>
3	<ul style="list-style-type: none"><li>• MATLAB Programming</li></ul>
4	<ul style="list-style-type: none"><li>• Approximations and Round-Off Errors</li><li>• Truncation Errors and the Taylor Series</li><li>• Root finding</li><li>• Graphical methods</li></ul>
5	<ul style="list-style-type: none"><li>• Bracketing methods</li><li>• Simple fixed point iteration</li><li>• The Newton-Raphson Method</li></ul>
6	<ul style="list-style-type: none"><li>• Least Square Regression</li><li>• Linear regression</li><li>• Polynomial regression</li><li>• Multiple linear regression</li></ul>
7	<ul style="list-style-type: none"><li>• Interpolation/Extrapolation</li><li>• Newton's Divided-Difference Interpolating Polynomials</li><li>• <b>MIDTERM</b></li></ul>
8	<ul style="list-style-type: none"><li>• Integration</li><li>• The Trapezoidal Rule</li><li>• Simpson's Rule</li></ul>
9	<ul style="list-style-type: none"><li>• Integration with unequal segments</li><li>• Open integration formulas</li><li>• Multiple integrals</li></ul>
10	<ul style="list-style-type: none"><li>• Numerical differentiation</li><li>• High-accuracy differentiation formulas</li><li>• Richardson extrapolation</li></ul>
11	<ul style="list-style-type: none"><li>• Time integration</li><li>• Euler's method</li></ul>
12	<ul style="list-style-type: none"><li>• Runge-Kutta method</li><li>• Systems of equations</li></ul>
13	<ul style="list-style-type: none"><li>• Linear algebra and matrices</li><li>• Gauss elimination</li><li>• Techniques for improving Gauss elimination</li></ul>
14	<ul style="list-style-type: none"><li>• Gauss-Jordan</li><li>• Special matrices</li><li>• Gauss-Seidel</li></ul>
15	<ul style="list-style-type: none"><li>• <b>Review</b></li></ul>

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## Course Policies and Some Remarks

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### *Attendance*

You are expected to attend all classes. Classes start on time. Please be respectful of your classmates by being on time. Cell phones should be turned off and kept out of sight. Please do not use your computers during class time.

### *Calculator Policy*

You may use a graphing calculator or software that does symbolic calculations during exams.

### *Plagiarism*

Collaboration on non-collected homework and in studying is strongly encouraged; however, the work you hand in must be solely your own. Sharing written work before it is turned in to be graded is academic dishonesty. For more information on TEDU policy on intellectual integrity see the link

[http://www.tedu.edu.tr/Assets/Documents/News/Public/TEDU\\_Ogrenci\\_El\\_Kitabi\\_2012.pdf](http://www.tedu.edu.tr/Assets/Documents/News/Public/TEDU_Ogrenci_El_Kitabi_2012.pdf)

### *Disability Support*

If you have a disabling condition which may interfere with your ability to successfully complete this module, please contact Dr. Aslı Bugay (email: [asli.bugay@tedu.edu.tr](mailto:asli.bugay@tedu.edu.tr)) or Dr. Tolga İnan (email: [tolga.inan@tedu.edu.tr](mailto:tolga.inan@tedu.edu.tr)). For more information please see Handbook for Registered Students.

### *Make Up Exams*

Make-up exams for midterm exams will NOT be offered generally. If you have a legitimate reason for missing an exam, then you must arrange to make up the exam BEFORE the scheduled time of the exam. The only exceptions are illness or emergency (e.g., death in family, a traffic accident, etc.). In case of an illness or emergency you need to supply a documentation that supports your claim.

Also please read the document given in the link [http://www.tedu.edu.tr/tr-TR/Content/Akademik/Akademik\\_Belgeler/Yonetmelikler\\_ve\\_Yonergeler.aspx](http://www.tedu.edu.tr/tr-TR/Content/Akademik/Akademik_Belgeler/Yonetmelikler_ve_Yonergeler.aspx)