ME 210

APPLIED MATHEMATICS FOR MECHANICAL ENGINEERS

Sections 02 & 03

http://www.me.metu.edu.tr/courses/me210

Prof. Dr. Bülent E. Platin
# CLASS SCHEDULE

<table>
<thead>
<tr>
<th>Section</th>
<th>Surname</th>
<th>Room</th>
<th>Schedule</th>
<th>Instructor</th>
</tr>
</thead>
</table>
| 01      | AA-BZ   | G - 202 | Monday 12:40 – 13:30  
Thursday 09:40 – 11:30          | Dr. Merve Erdal             |
| 02      | CA-HZ   | G - 101 | Tuesday 13:40 – 15:30  
Thursday 13:40 – 14:30          | Dr. Bülent E. Platin       |
| 03      | IA-PA   | G - 101 | Tuesday 15:40 – 16:30  
Thursday 14:40 – 16:30          | Dr. Bülent E. Platin       |
| 04      | PB-ZZ   | G - 102 | Monday 09:40 – 11:30  
Thursday 13:40 – 14:30          | Dr. M. Metin Yavuz         |
<table>
<thead>
<tr>
<th>Instructor</th>
<th>Office</th>
<th>Office Hours</th>
<th>Phone</th>
<th>E-mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Merve Erdal</td>
<td>B-304</td>
<td>Appointment by e-mail</td>
<td>210-5237</td>
<td><a href="mailto:merdal@metu.edu.tr">merdal@metu.edu.tr</a></td>
</tr>
<tr>
<td>Dr. Bülent E. Platin</td>
<td>G-305</td>
<td>Appointment by e-mail</td>
<td>210-2583</td>
<td><a href="mailto:platin@metu.edu.tr">platin@metu.edu.tr</a></td>
</tr>
<tr>
<td>Dr. M. Metin Yavuz</td>
<td>G-304</td>
<td>Appointment by e-mail</td>
<td>210-2559</td>
<td><a href="mailto:ymetin@metu.edu.tr">ymetin@metu.edu.tr</a></td>
</tr>
</tbody>
</table>
### TEACHING ASSISTANTS

<table>
<thead>
<tr>
<th>Assistant</th>
<th>Office</th>
<th>Office Hours</th>
<th>Phone</th>
<th>E-mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serhat Bilyaz</td>
<td>A-147</td>
<td>Tuesday 11:00-12:00</td>
<td>210-5276</td>
<td><a href="mailto:bilyaz@metu.edu.tr">bilyaz@metu.edu.tr</a></td>
</tr>
<tr>
<td>Ali Murat Kayıran</td>
<td>A-208</td>
<td>Monday 10:00-11:00</td>
<td>210-2531</td>
<td><a href="mailto:mkayiran@metu.edu.tr">mkayiran@metu.edu.tr</a></td>
</tr>
<tr>
<td>Onur Özkan</td>
<td>A-145</td>
<td>Thursday 10:00-11:00</td>
<td>210-5278</td>
<td><a href="mailto:onozkan@metu.edu.tr">onozkan@metu.edu.tr</a></td>
</tr>
<tr>
<td>Eylül Şimşek</td>
<td>A-145</td>
<td>Wednesday 14:00-15:00</td>
<td>210-5278</td>
<td><a href="mailto:seylul@metu.edu.tr">seylul@metu.edu.tr</a></td>
</tr>
</tbody>
</table>
Prerequisites:

Topics: Basic differential and integral calculus;
Vectors and vector algebra;
Complex numbers and their manipulation.

Course: MATH 120 (or MATH 158)

Textbook:
For reference, you may consult the following sources:


There are plenty of more references in the library under the call numbers QA303, QA401, and TA330.
Course Grading:

- Final exam: 40 %
- 2 Midterm exams: 25 % each
- Homework Assignments + Quizzes + Attendance: 10 % (its category breakdown may differ among sections)

Examinations:

- Official dates of midterm examinations and the final examination will be announced by the Department.
- They all will be classical type with open books & open notes.
- The use of any kind of calculators or computers is not allowed.
- Make-up examinations may be given to those who have valid excuses, which are approved by the department. If you believe that you are entitled to take a make-up examination, you must contact with the course instructor within one week following the regular examination date.
Attendance:

- You are expected to attend all class meetings with no exceptions.
- Your attendance is essential and it will be closely observed.
- Please remember that students who attend class meetings and keep their own notes, on average, learn better, and perform significantly better in exams.
- You are required to attend only the section that you are registered to.

Quizzes:

- Some short quizzes may be given during lecture hours.
Homework Assignments:

- Bi-weekly homework problems will be assigned as regularly as possible.
- Absolutely no extensions will be granted for the due dates of the collected assignments.
- Even though team-work efforts are encouraged, they must not go beyond discussions on the solution methods used and/or cross-checking the results of your number-crunching. **You will have to face with all consequences of handing in solutions, which are duplicates of others.**
- In your homework solutions, if you use sources other than your lecture notes, they should be properly referenced.
- When you need to use readily available software packages like MathCad and MATLAB, you must supply all the input/output evidences in printed form as well as the source listings of your programs.
- You will get credit for both content and presentation of your assignments.
- Please refer to the “How to Submit a Successful HW Assignment” page in the web site of the course for additional tips and an example on proper format for homework solutions.
Scholastic Conduct:

- All written work turned in for grading must be an independent and individual effort.

- This includes all homework assignments, exams and any other submitted material that will be graded.

- Academic dishonesty, including any form of cheating and plagiarism will not be tolerated and may result in failure of the course and/or formal disciplinary proceedings that may lead to suspension or dismissal.

- Cheating includes but is not limited to such acts as offering or receiving unpermitted assistance in the exams, using any type of unauthorized written material during the exams, handing in any part or all of someone else’s work as your own, copying from the Internet.

- Plagiarism is a specific form of cheating. It means using someone else’s work without giving credit; it is a literary theft.
Communication and Announcements:

- Try to keep all communication channels open with the teaching staff.
- We are willing to help you learn the course material in the best way you can.
- Try to visit the staff during their office hours for a face-to-face discussion.
- Do not hesitate to use phone or e-mail to reach them if you are away.
- All announcements and communications of general interest will be posted on the course Web site.
- You must also check your e-mail frequently for any announcements regarding the course.

Course Web Site:
For all information regarding the course, visit the course web site:
www.me.metu.edu.tr/courses/me210/
# Tentative Course Outline

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
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<tbody>
<tr>
<td>1</td>
<td>Definition of a matrix. Equality, addition, subtraction, multiplication by a constant, properties of these operations (commutative, associative, distributive). Transpose of a matrix. Special square matrices (symmetric, skew symmetric, diagonal, identity, null, triangular, banded, etc.). Matrix multiplication and its properties. Definition of a determinant, minors, cofactors. Evaluation of a determinant.</td>
</tr>
<tr>
<td>2</td>
<td>Some important properties of determinants. Sub-matrices and the rank of a matrix. Linear dependence and independence of vectors. Linear systems of algebraic equations. Inhomogeneous and homogeneous linear equations. Fundamental theorem of linear systems; the cases of unique solution, infinitely many solutions and no solution depending on rank information for a system of m equations and n unknowns; geometrical interpretation of these cases in plane geometry.</td>
</tr>
<tr>
<td>3</td>
<td>Solution of a set of linear algebraic equations by the Cramer's rule. Solution of a set of linear algebraic equations by Gauss elimination. Examples on Gauss elimination. Solution of a set of linear algebraic equations by the Cramer's rule. Solution of a set of linear algebraic equations by Gauss elimination. Examples on Gauss elimination.</td>
</tr>
</tbody>
</table>
## Tentative Course Outline

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
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<tbody>
<tr>
<td>5</td>
<td>Similar matrices, similarity transformations. Invariance of eigenvalues, trace and determinant of a square matrix under similarity transformation. Diagonalization. Examples on Diagonalization.</td>
</tr>
</tbody>
</table>
Tentative Course Outline

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Directional derivative, gradient of a scalar function. Geometrical significance of gradient (level surfaces, normal vector to a surface). Physical significance of gradient (direction of highest rate of change) and directional derivative. Vector fields obtained from potentials (conservative vector fields and potential functions).</td>
</tr>
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</table>
**Tentative Course Outline**

<table>
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<tr>
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</table>
Objectives of the Course and Related Student Learning Outcomes:

At the end of this course, the students will,

1. Learn the basic concepts used in advanced vector analysis such that they will be able to
   - Formulate and use parametric and closed form representations of curves and surfaces in engineering/mathematical problems
   - Identify, formulate and use gradient, divergence and curl operations in solving engineering/mathematical problems

2. Learn the evaluation of line, surface and volume integrals such that they will be able to
   - Identify, formulate and solve engineering/mathematical problems involving line, surface, double, and triple integrals
   - Identify, formulate and use integral theorems in solving engineering/mathematical problems
Objectives of the Course and Related Student Learning Outcomes:

At the end of this course, the students will,

3. Learn basic concepts in linear algebra and their applications for analysis and solution of engineering/mathematical problems such that they will be able to
   - Use basic matrix properties and operations for identifying solution characteristics of systems of linear algebraic equations
   - Solve systems of linear algebraic equations analytically
   - Identify, formulate and solve eigenvalue-eigenvector problems analytically
   - Identify similarity of matrices and use it towards diagonalization of matrices

4. Learn complex function analysis and their applications towards analysis and solution of engineering/mathematical problems such that they will be able to
   - Perform basic operations with complex numbers in both rectangular and polar forms
   - Identify some basic complex functions and to use their properties
   - Identify and formulate analyticity concept in mathematical/ engineering functions
Objectives of the Course and Related Student Learning Outcomes:

At the end of this course, the students will,

5. Enhance their analytical thinking and problem analysis skills such that they will be able to
   - Identify the appropriate mathematical tool to be used for the solution of a given problem and formulate accordingly
   - Follow a logical sequence of progression in solution, upon formulation of the problem

6. Become aware of the relevance of the learnt mathematical tools to engineering applications such that they will be able to
   - Identify the relevance of learnt mathematical tools to the solution of a given engineering problem
Objectives of the Course and Related Student Learning Outcomes:

At the end of this course, the students will,

7. Appreciate the use of some modern computational tools for the solution of complex engineering/mathematical problems such that they will be able to
   ▪ Use at least one computational tool in solving engineering/ mathematical problems that involve vector analysis, line/surface/volume integration, linear algebra and complex numbers

8. Enhance their technical written presentation skills such that they will be able to
   ▪ Report analysis, solution and results in a logical sequence within a standard engineering format.
Any questions