



ISTANBUL TECHNICAL UNIVERSITY  
DEPARTMENT OF MECHANICAL ENGINEERING

**ENGINEERING MATHEMATICS - MIA 501E - CRN 14196  
2017-2018 FALL**

**Instructor** : Hakan Öksüzöğlü (Gümüşsuyu, Room 435)  
**Phone, e-mail** : (0 212 293 13 00 ext 24 64), hoksuzoglu@itu.edu.tr  
**Lecture hours** : Tuesday 08:30 – 11:30 (MKB, D368A - Gümüşsuyu)  
**Office hours** : See my web page <http://web.itu.edu.tr/hoksuzoglu/> for up to date hours.  
**Prerequisites** : Undergraduate mathematics

**Course Description:**

**Linear Algebra:** Matrices, Vectors, Determinants, Linear Systems, Matrix Eigenvalue Problems. **Ordinary Differential Equations (ODEs):** First-Order ODEs, Second-Order Linear ODEs, Higher-Order Linear ODEs, Systems of ODE's, Series Solutions of ODEs. Special functions. Laplace Transforms. **Fourier analysis:** Series, Integrals, and Transforms. **Partial Differential Equations (PDEs).**

**Textbook:**

Erwin Kreyszig, "*Advanced Engineering Mathematics*"  
John Wiley & Sons, Inc. New York, 2006, 9th Edition.

**Other references :**

- 1- Dennis G. Zill, Michael R. Cullen, "*Advanced engineering mathematics*" Jones and Bartlett Publishers , 2006
- 2- Peter V. O'Neil, "*Advanced Engineering Mathematics*" Thomson Brooks/Cole, Australia, 2003.
- 3- C. Ray Wylie, Louis C. Barrett, "*Advanced engineering mathematics*" Imprint New York : McGraw-Hill, 1995

**Objectives:**

- 1) Provide graduate students with the advanced analytical methods that will form the basis for their research areas.
- 2) A sound understanding of linear algebra and systems of linear equations.
- 3) To give a feel what an ODE is and what is meant by solving it.
- 4) To extend the concepts from first-order to second-order ODEs and to present the properties of linear ODEs.
- 5) Extension of the concepts and theory from second-order to higher order ODEs.
- 6) Solving systems of ODE's.
- 7) Solving linear ODEs by using series solutions techniques.
- 8) An introduction to important special functions and their use in the solution of engineering problems.
- 9) To introduce the Laplace transform method for solving linear ODEs and corresponding initial value problems.
- 10) Theory and applications of Fourier analysis methods.
- 11) To give a feel to solve important Partial Differential Equations (PDEs).

**Outcomes:**

- 1) Understanding the basics of linear algebra, solutions of linear systems of equations and eigenvalue problems.
- 2) Ability to solve first, second and nth order ODEs. Ability to solve systems of ODE's.
- 3) Ability to perform series solution methods in the solution of ODEs.
- 4) Understanding the applications of various special functions in engineering problems.
- 5) Application of Laplace transforms in the solution of linear ODEs and initial value problems.
- 6) A sound understanding of Fourier analysis in terms of Fourier series, transforms and integrals and their applications.
- 7) Being familiar with the most widely used PDEs and their solutions.

## COURSE PLAN

Week	Date	Textbook (9 <sup>th</sup> Edition)	Topics
1	Sep 12	Chap. 7,8	Linear Algebra
2	Sep 19	Chap. 1	ODEs (First-Order)
3	Sep 26	Chap. 2	ODEs (Second-Order)
4	Oct 3	Chap. 3,4	ODEs (Higher-Order and Systems)
5	Oct 10	Chap. 5	Series Solutions of ODEs, Special Functions
6	Oct 17		<b>Midterm exam 1</b>
7	Oct 24	Chap. 6	Laplace Transforms
	Oct 31		<b>Mid- Semester Break</b>
8	Nov 7	Chap. 11	Fourier Analysis
9	Nov 14	Chap. 11	Fourier Analysis
10	Nov 21	Chap. 12	Partial Differential Equations (PDE's)
11	Nov 28	Chap. 12	Partial Differential Equations (PDE's)
12	Dec 5		<b>Midterm exam 2</b>
13	Dec 12	Chap. 12	Partial Differential Equations (PDE's)
14	Dec 19	Chap. 12	Partial Differential Equations (PDE's)

### Assessment Criteria:

Midterm Exams                      Quantity: 2 , Percentage: 25% +25%  
 Final Exam                              Quantity: 1 , Percentage: 50%

### Remarks:

- In order to be able to take the final exam, the minimum value of the average of the midterm exams is 40.
- There isn't any make-up exam for the midterm exams.
- Midterm exam 1 will be given on *October 17, 2017*, Midterm exam 2 will be given on *December 5, 2017*, between 09:00–11:00 am.
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- 70 % attendance to classes is a requirement to take the final exam.