



ISTANBUL TECHNICAL UNIVERSITY
DEPARTMENT OF MECHANICAL ENGINEERING

**ENGINEERING MATHEMATICS - MIA 501E - CRN 13996
2016-2017 FALL**

Instructor : Hakan Öksüzöğlü (Gümüşsuyu, Room 435)
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Lecture hours : Tuesday 08:30 – 11:30 (MKB, A101 - 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 th Edition) | Topics |
|------|--------|------------------------------------|---|
| 1 | Sep 20 | Chap. 7,8 | Linear Algebra |
| 2 | Sep 27 | Chap. 1,2,3,4 | ODEs (First-Order, Second-Order and Higher-Order, Systems of ODE's) |
| 3 | Oct 04 | Chap. 1,2,3,4 | ODEs (First-Order, Second-Order and Higher-Order, Systems of ODE's) |
| 4 | Oct 11 | Chap. 1,2,3,4 | ODEs (First-Order, Second-Order and Higher-Order, Systems of ODE's) |
| 5 | Oct 18 | Chap. 5 | Series Solutions of Differential Equations, Special Functions |
| 6 | Oct 25 | | Midterm exam 1 |
| 7 | Nov 01 | Chap. 6 | Laplace Transforms |
| 8 | Nov 08 | | Mid- Semester Break |
| 9 | Nov 15 | Chap. 11 | Fourier Analysis |
| 10 | Nov 22 | Chap. 11 | Fourier Analysis |
| 11 | Nov 29 | Chap. 12 | Partial Differential Equations (PDE's) |
| 12 | Dec 06 | Chap. 12 | Partial Differential Equations (PDE's) |
| 13 | Dec 13 | | Midterm exam 2 |
| 14 | Dec 20 | Chap. 12 | Partial Differential Equations (PDE's) |
| 15 | Dec 27 | 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 25, 2016*, Midterm exam 2 will be given on *December 13, 2016*, between 09:00–11:00 am.
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- 70 % attendance to classes is a requirement to take the final exam.