ISTANBUL TECHNICAL UNIVERSITY
DEPARTMENT OF MECHANICAL ENGINEERING

ENGINEERING MATHEMATICS - MAK 501E

FALL 2009

Instructor : Hasan GUNES (Room # 439)
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Lecture hours : Friday 9:30-12:30 (D361A)

Office hours : Tues. 10:30-12:30, Thurs. 13:30-16:00
Prerequisities : undergraduate mathematics

Course Description

Matrices and system of linear equations. Eigenvalue problems. Ordinary differential equations. Series solution. Special Functions. Partial differential equations: Elliptic, parabolic and hyperbolic equations. Separation of variables. Laplace Transforms, Fourier Transforms. Perturbation Methods.

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

Other References :

(1) Advanced Engineering Mathematics, Wylie, C.R., L.C. Barrett, McGraw-Hill, New York, 1995
(2) Elementary Applied Partial Differential Equations, Haberman, R., Prentice-Hall Inc., Englewood Cliffs, 1983.
(3) Advanced Mathematical Methods for Engineering and Science Students, Stephenson, G., P.M. Radmore, Cambridge University Press, Cambridge, 1990

Objectives :

- provide graduate students with the advanced analytical methods that will be bases for their research areas.
- use these analytical methods to obtain the closed form solutions of some of the basic engineering problems in thermo-fluids and vibrations.

Outcomes :

1. A sound understanding of the matrices and ability solve system of various algebraic equations.
2. A sound understanding of the important special functions and their use in the solution of engineering problems.
3. Ability to solve nonlinear ODEs via series solution methods.
4. Ability to employ the separation of variables to solve partial differential equations.
5. Ability to select and use an appropriate integral transform techniques to solve partial differential equations.
6. Ability to employ perturbation techniques to solve non-linear equations.

COURSE PLAN

Week	Topics
1	Matrices and systems of algebraic equations. Eigenvalues
2	Ordinary differential equations. Systems of linear ordinary differential equations.
3	Ordinary differential equations: Approximate solutions via Power Series
4	Ordinary differential equations: Solution near a singular point, Frobenius Series
5	Special functions: Gamma function, Error function, Bessel functions.
6	Modified Bessel functions, Legendre polynomials. Applications.
7	Partial differential equations: Classification. Separation of variables.
8	Canonical problems: Laplace's equation, diffusion equation, wave equation.
9	Solution of PDEs employing special functions.
10	Non-homogeneous problems: Heat flow with sources and non-homogeneous boundary conditions
11	Laplace transform and applications.
12	Fourier transform and applications.
13	Green's functions and applications.
14	Introduction to perturbation methods.

Assessment Criteria :

Midterm Exams	Quantity : **2**	Percentage **: % 40 = % 20 + % 20**
Homeworks	Quantity: **5**	Percentage : % **15**
Final Exam	Quantity: **1**	Percentage : % **45**

Copying, Cheating etc.: Students are strongly discouraged from doing their homework assignments solely in a group framework. Homework which displays evidence of verbatim copying will receive zero credit regardless of the source of the solution.

All announcements will be made on the following website:
http://atlas.cc.itu.edu.tr/~guneshasa

In order to be able to take the final exam

- You should attend at least 70% of the classes