**KOÇ UNIVERSITY**
**College of Arts and Sciences**
**Department of Physics**

**Course:** MATH503 Applied Mathematics
**Credits:** 3
**Semester:** Fall 2003
**Instructor:** Professor **Tekin Dereli**
Office: Science 159, Phone: 1510, E.mail: tdereli@ku.edu.tr
Office hours: By appointment
Lecture hours: Mondays and Wednesdays, 12.30-13.45, Scie 129

**Description:** Linear algebra: generalized vector space, eigenvalue problem, diagonalization, quadratic forms. Field theory: divergence theorem, Stokes' theorem, irrotational fields. Sturm-Liouville theory, Bessel functions, Legendre polynomials. Partial differential equations: diffusion, wave and Laplace equations by separation of variables and Sturm-Liouville theory. Weighted residual method. Integral transform and Green's function solution of the partial differential equations. Complex variables, variational calculus and introduction to perturbation methods. Engineering applications.
**Textbook:** *Advanced Engineering Mathematics* E. Kreyszig (Wiley, 8th edition, 1999)

**Grading:** Homework 20%
1. Midterm 25%, November 10, 2003
2. Midterm 25%, December 8, 2003
Final Exam 30%, January 19, 2004.

**Content:**
Chapter: 8 Vector differential calculus. Grad, Div, Curl.
Chapter: 9 Vector integral calculus. Integral theorems.
Chapter: 6 Linear algebra: Matrices, vectors, determinants.
Chapter: 7 Matrix eigenvalue equations.
Chapter: 10 Fourier series, integrals and transforms.
Chapter: 11 Wave equation, Heat equation, Laplace equation.
Chapter: 12 Complex numbers.
Chapter: 13 Analytic functions.
Chapter: 14 Power series.
Chapter: 15 Complex integration.

**Remember:**

1. Attendance will be taken in the classes. Any student who misses more than 9 lectures with or without excuse automatically fails.

2. In the exams no exchange of information among students should take place. You are expected to hand in your own work in all the exams and HW assignments.

3. For the homework you may discuss the problems, consult your teachers and use the library and internet. However, the submitted work must be totally yours. You must not submit work done in groups, transfer files or copy from a book.

4. Late homework is going to be accepted but you loose half the grade.

**Course plan:**

Week:1 Vector differential calculus. Grad, Div, Curl. Dot product and cross product of vectors. Vector valued functions. Gradient of a vector field.

Week:2 Curves and tangents. Arc length. Divergence and curl of a vector field. Line integrals.

Week:3 Surfaces. Areas by double integration. Triple integration. Volumes. Divergence theorem. Stokes' theorem. HW1

Week:4 Matrices. Matrix addition and multiplication. Linear systems of equations. Gauss elimination.

Week:5 Linear independence. Solutions of linear systems. Existence and uniqueness. Determinants. Inverse of a matrix. Vector spaces. Inner products. Linear transformations. HW2

Week:6 Holiday

Week:7 Eigenvalues and eigenvectors. Bases. Change of bases. Matrix diagonalization. Orthogonal matrices. Unitary matrices. HW3

Week:8 (1. Midterm) Periodic functions. Fourier series expansion. Even and odd functions. Fourier integrals. Sine and cosine transforms. Fourier transforms in general.

Week:8 Partial differential equations. Separation of variables. **Reminder:** Power series solution of Sturm-Liouville type ordinary differential equations.

Week:9 Holiday

Week:10 Wave equation: solution by Fourier series. Heat equation: solution by Fourier series. Laplace equation in cylindirical and spherical coordinates. HW4

Week:11 (2. Midterm) Complex numbers. Powers and roots. Complex functions. Conformal mappings.

Week:12 Derivative. Cauchy-Riemann conditions. Exponential and logarithmic functions. Power series expansions. Convergence tests.

Week:13 Complex line integrals. Cauchy integral formula. HW5

Week:14 Laurent series. Poles and zeroes. Residue theorem.

Week:15 Contour integrals. Applications. HW6