DOKUZ EYLÜL ÜNİVERSİTESİ
FEN-EDEBİYAT FAKÜLTESİ
2009-2010 YAZ OKULUNDA AÇILACAK OLAN
MATEMATİK BÖLÜMÜ DERS İÇERİKLERİ

MAT 2036
DIFFERENTIAL EQUATIONS II
(3+1)

Catalog Description Theory of the first-order differential equations.
Existence and uniqueness theorem of the initial value problem.
Theory of the differential equations systems.
Existence and uniqueness theorem of the initial value problem for systems.
Theory of linear systems of differential equations.
Theory of higher-order differential equations.
Initial value and boundary value problems for differential equations.
Sturm-Liouville problems for the second order linear differential equations.
Orthogonal complete set of eigenfunctions and Fourier series expansion.

Textbook

Fundamentals of Differential Equations and Bounadry Value Problems" by R. Kent Nagle, Edward B. Saff. Addisson-Wesley Publishing Company

Introduction to Ordinary Differential Equations. Ross Sh.L.
Blaisdell Publishing Company, New York, 1966.

Course Outline

Topics First Order Ordinary Differential Equations
Direction Fields and The approximation Method of Euler
Preliminary Discussion of Existence and Uniqueness of solutions of IVP's
Differential inequalities
Integral Inequalities and Gronwall's Lemma
Integral Equations
The Uniqueness Teorem
Picard's Method, Preparation for the Existence Theorem
Proof of The Existence Theorem
Continuation of the solution
Dependence on the initial value
Dependence on f(x,y)
Existence and Uniqueness for the Systems and higher order ODE's
Boundary value Problems and Eigenvalue Problems
Regular Sturm-Liouville Eigenvalue Problems
Eigenvalues and Eigenfunctions
Oscillation and Comparison Theorem
Fourier Series

MAT 1025
Calculus I
(3+2)

Text book: THOMAS' CALCULUS, Early Transcendentals, 11. Ed.

Course Outline:

1. Introduction: ……**(1 week)**
Real Numbers. Functions and their graphs, exponential functions, trigonometric func., inverse func. and logarithms.

2. Limits and continuity. ……**(2 weeks)**
Rates of Change and Limits.
Calculating Limits Using the Limit Laws. Precise Definition of a Limit. One-Sided Limits and Limits at Infinity. Infinite Limits and Vertical Asymptotes. Continuity.
Tangents and Derivatives.

3. Differentiation ……**(2 weeks)**
The Derivative as a Function. Differentiation Rules. The Derivative as a Rate of Change. Derivatives of Trigonometric Functions. The Chain Rule and Parametric Equations. Implicit Differentiation. Related Rates. Linearization and Differentials.

4. Applications of Derivatives. ……**(2 weeks)**
Extreme Values of Functions. The Mean Value Theorem. Monotonic Functions and the First Derivative Test. Concavity and Curve Sketching. Applied Optimization Problems. Indeterminate Forms and L'Hopital's Rule. Newton's Method. Antiderivatives.

5. Integration. ……**(2 weeks)**
Estimating with Finite Sums. Sigma Notation and Limits of Finite Sums. The Definite Integral. The Fundamental Theorem of Calculus. Indefinite Integrals and the Substitution Rule. Substitution and Area Between Curves.

6. Applications of Definite Integrals. ……**(2 weeks)**
Volumes by Slicing and Rotation About an Axis. Volumes by Cylindrical Shells.
Lengths of Plane Curves. Areas of Surfaces of Revolution

7. Transcendental Functions. ……**(1 week)**
Inverse Functions and their Derivatives. Natural Logarithms. The Exponential Function. a^x and $\log_a x$. Exponential Growth and Decay. Relative Rates of Growth. Inverse Trigonometric Functions. Hyperbolic Functions.

8. Techniques of Integration. …… .**(2 weeks)**
Basic Integration Formulas. Integration by Parts. Integration of Rational Functions by Partial Fractions. Trigonometric Integrals. Trigonometric Substitutions. Integral Tables and Computer Algebra Systems. Numerical Integration.

PROJECTS, TERM PAPERS AND/OR LABORATORY WORK

There are 3 midterm exams, homework for each week and a final exam.

MAT 1026
Calculus II
(3+2)

Text book: THOMAS' CALCULUS, Early Transcendentals, 11. Ed.

Course Outline:

1. Improper Integrals. …… **(1 week)**

2. Infinite Sequences and Series. …… **(2 weeks)**
Sequences. Infinite Series. The Integral Test. Comparison Tests. The Ratio and Root Tests. Alternating Series, Absolute and Conditional Convergence. Power Series. Taylor and Maclaurin Series. Convergence of Taylor Series; Error Estimates. Applications of Power Series. Fourier Series.

3. Vector-Valued Functions ……**(2 weeks)**
Vector Functions. Modeling Projectile Motion. Arc Length and the Unit Tangent Vector T. Curvature and the Unit Normal Vector N. Torsion and the Unit Binormal Vector B.

4. Partial Derivatives. ……**(3 weeks)**
Functions of Several Variables. Limits and Continuity in Higher Dimensions. Partial Derivatives. The Chain Rule. Directional Derivatives and Gradient Vectors.
Tangent Planes and Differentials. Extreme Values and Saddle Points. Lagrange Multipliers. Partial Derivatives with Constrained Variables. Taylor's Formula for Two Variables.

5. Multiple Integrals. ……**(3 weeks)**
Double Integrals. Areas, Moments and Centers of Mass*. Double Integrals in Polar Form. Triple Integrals in Rectangular Coordinates. Masses and Moments in Three Dimensions. Triple Integrals in Cylindrical and Spherical Coordinates. Substitutions in Multiple Integrals.

6. Integration in Vector Fields. ……**(3 weeks)**

Line Integrals. Vector Fields, Work, Circulation, and Flux. Path Independence, Potential Functions, and Conservative Fields. Green's Theorem in the Plane. Surface Area and Surface Integrals. Parametrized Surfaces. Stokes' Theorem. The Divergence Theorem and a Unified Theory.

PROJECTS, TERM PAPERS AND/OR LABORATORY WORK

There are 3 midterm exams, homework for each week and a final exam.

MAT 1027
Fundamentals of Mathematics I
(3+1)

Prerequisities : None
Textbook : Chapter Zero, Fundamental Notions of Abstract Mathematics- Carol Schumaher
References:

Course Outline

What is Proof (3 weeks)
First definitions, symbolic Logic, truth tables, totology and contradiction, open sentences, proof techniques, direct and indirect proofs, examples.

Sets (2 weeks)
Sets, Russell's set, universal set, complement of a set. Operations on sets, union, intersection, difference of sets.

Mathematical induction (1 week)

Relations (4 weeks)
Cartesian products of sets, relations, equivalence relations, equivalence classes, quotient set, order relations, partial orderings, well ordered sets, upper and lower bounds, infimum and supremum.

Functions (4 weeks)
Functions, properties of functions, image and inverse image of functions, one to one, onto functions, invertible functions, inverse of a function.

Grading 6 Mid-Term Exams (50%), Final Exam (50%).

MAT 1028
Fundamentals of Mathematics II
(3+1)

Prerequisities : None
Textbook : Chapter Zero, Fundamental Notions of Abstract Mathematics- Carol Schumaher
References:

Course Outline

Elementary Number Theory **(3 weeks)**
Divisibility in integers, congruences, Euclidean algorithm, greatest common divisors, ….

Countability **(2 weeks)**
Cardinality of sets, continium hypothesis,…..

Construction of Number sets **(2 weeks)**
Construction of Z,Q and R, peano axioms….

Properties of Real Numbers **(3 weeks)**
Supremum, infimum, Dense sets, ….

Basic Algebra **(4 weeks)**

Groups, rings, fields, polynomials,….

Grading 6 Mid-Term Exams (50%), Final Exam (50%).

MAT 1030
Discrete Mathematics
(3+1)

Catalogue Description Mat 130 Discrete Mathematics (3+1).
Counting, inclusion and exclusion, recurrences, generating functions, searching and sorting, complexity and graphs.

TextBook Discrete and Combinatorial Mathematics, R. Grimaldi, Pearson, Addison Wesley, 5th ed IE. 2004, ISBN 0-321-21103-0.

References Discrete Mathematics and its Applications, Kenneth H. Rosen McGraw Hill International Ed 6th ISBN-13: 978-007-124474-9.

Course Outline: Topics

1. Counting 1 week
Pigeonhole principle, permutations of sets, combination of sets, Binomial Theorem, Multinomial theorem

2. Inclusion-Exclusion 1 week
The principle of inclusion and exclusion

3. Applications of Inclusion-Exclusion 2 weeks
Derangements, Euler's ϕ function, onto functions

4. Recurrence relations 2 weeks
Recursive definitions, induction, solving linear homogeneous recurrences, solving linear nonhomogeneous recurrences.

5. Special recurrence relations 1 week
Catalan numbers, Stirling numbers of the first kind and Stirling numbers of the second kind

6. Generating functions 2 weeks
Ordinary generating functions, exponential generating functions, solving relations by the method of generating functions.

7. The growth of functions 1 week
Big O, big Ω, big Θ notations

8. Searching and sorting 1 week
Binary search, bubble sort, insertion sort, merge sort and their complexity

9. Applications of number theory 1 week
Euclidean algorithm, complexity, RSA cryptology

10. Graphs 1 week

Paths, cycles, planar graphs, connectivity, graph isomorphism Euler Ian and Hamiltonian graphs, platonic solids, graph coloring, application of trees.

11. Discrete Probability ***1 week***
Probability, independence, binomial distribution, Bayes' Theorem, Expected value and Variance.

Grading: ***25% is almost every week quizzes, no make up quiz but the two minimum quizzes will be excluded from the over all grading. 25% is one mid-term exam and 50% is the final exam.***

MAT 2029
ALGORITHMS AND PROGRAMMING
(2+2)

I. Prerequisites: None
II. TextBook: Susan K. Baumann and Steven L. Mandell "QBASIC"
III. Course Description: Problem solving on computer, writing programs in a programming language.
IV. Course Outline:

1. Introduction to Computer Programming Logic, Algorithms and Flowcharts, (3 weeks)
   Briefly computer logic, problem solving by computer, writing algorithm (drawing flowchart), examples,
2. Structure of a programming Language, (1 week)
   Introducing The QuickBasic(QB) Editor, Syntax of a program for QB,
3. Variables and Variable Types, Input and Output Commands, (1 week)
   Classifying data types, Numeric and Alpha numeric variables, basic input-output commands, examples,
4. Built in Arithmetic and Character Functions, (1 week)
   ABS(), SQR(), SIN() - COS(), INT(), EXP(), LOG(), LEFT$(), RIGHT$(), MID$(), LEN(), INSTR(), SPACE$(), UCASE$(), LCASE$(), examples
5. Control Statements, Loops, (2 weeks)
   IF-THEN-ELSE statemens, Do-Loop, For-Next loops, examples,
6. Arrays, (2 weeks)
   Defining and using indexed variables,
7. Subprograms, (2 weeks)
   DEF-FN, Function, and Sub defining,
8. User-Defined Data Types, File Operations. (2 weeks)
   Reading, writing, editing datas in a user-file.

V. Grading: a midterm (50%) and final examination (50%).

MAT 2035
Differential Equations
(3+1)

Catalog Description The notions of differential equations and their solutions.
First – order equations for which exact solutions are obtainable.
Explicit methods of solving higher order linear differential equations.
Laplace transform solution of linear differential equations with constant coefficients.
Sistems of two linear differential equations of the first order.

Textbook

Fundamentals of Differential Equations and Bounadry Value Problems" by R. Kent
Nagle, Edward B. Saff. Addisson-Wesley Publishing Company
Introduction to Ordinary Differential Equations. Ross Sh.L. Blaisdell Publishing Company, New York, 1966.

Course Outline
Topics

Classification of Differential Eq., Their Origin and Application, Solutions and Initial Value Problems, Existence and Uniqueness of Solt
First Order Diff. eq; Seperable Eq.,Exact Eq
Linear Eq.,Integrating Factors, Homogeneous Equations
Bernoulli Eq.,Applications of First Order Equations
Higher Order Linear Diff. Eqs. Basic Theory.,Wronskian, Reduction of Order
Homogeneous Linear Eqs. with Constant Coefficients, Cauchy-Euler Equations
Nonhomogeneous Eqs.,Method of Undetermined Coefficients
Annihilator Method, Variation of Parameters
Power Series Solutions to Linear Differential
Definition of the Laplace Transform, Properties of the Laplace Transform, Inverse Laplace Transform
Solving Initial Value Problems by Laplace Transform, Laplace Transforms and Special Functions, Convolution
Matrix Methods for Linear Systems, Linear Systems in Normal Form, Homogeneous Linear Systems with Constant Coefficients
Nonhomogeneous Linear Systems, The Matrix Exponential Function

MAT 3052
Partial Differential Equations
(4+0)

Course Description: Classification of partial differential equations. Formation of equations. Linear first-order equations. Quasilinear first-order equations: Method of characteristics: Lagrange's method. Cauchy problem. An existence and uniqueness theorem. Classification of second-order linear equations. Canonical forms: Reduction to hyperbolic, parabolic and elliptic equations. Cauchy problem. Cauchy-Kowalewski theorem. Adjoint operator. Green's formula. Self-adjoint differential operator. Initial and boundary value problems in bounded regions.

Textbooks: R. Denemeyer, "Introduction to Partial Differential Equations and Boundary Value Problems", McGraw-Hill, 1968.
E. Zauderer, "Partial Differential Equations of Applied Mathematics", John-Wiley, 1989.
References: 1. I. Sneddon, "Elements of Partial Differential Equations", McGraw-Hill, 1957.
2. F. John, "Partial Differential Equations", Springer Verlag, 1910.
3. D. Bleecker and G. Csordas, "Basic Differential Equations", International Press, 1996.

4. P. Duchateau and D.W. Zachmann, “Theory and Problems of Differential Equations”, Schaum’s Outline Series, McGraw-Hill, 1986.
5. F. Ayres, “Theory and Problems of Partial Differential Equations”, Schaum’s Series, 1972.

Course Outline:

1.Introduction……(1 week)
Definition and classification of partial differential equations. Formation of equations.

2.First-Order Equations……(4 weeks)
Linear Equations. Quasilinear equations. Method of characteristics. (Lagrange’s method). Characteristic curves. Cauchy problem for linear and quasilinear equations. An existence and uniqueness theorem.

3.Linear Second-Order Equations and Characteristics……..(5 weeks)
Linear second-order equations in two independent variables. Canonical forms. Reduction to hyperbolic, parabolic and elliptic equations. Second-order equations in n independent variables. Cauchy problem in two independent variables. Cauchy-Kowalewski theorem.

4.Adjoint Differential Operators……..(1/2 week)
Adjoint differential operator. Green’s formula. Self-adjoint differential operator.

5.Initial and Boundary-Value Problems in Bounded Regions…….(3/2 weeks)
Dirichlet, Neumann and Robin (mixed) type boundary conditions. Laplace’s and Poisson’s equation. Properties of harmonic functions. Sturm-Liouville problems and generalized Fourier series. Separation of variables in Laplace’s equation. Vibrating string, separation of variables. Initial value problem for heat equation. Boundary and initial value problems for heat equation. Inhomogeneous equations: Duhamel’s principle.

There are 2 midterm exams, homeworks for each weak and a final exam.