MATH 0098 Elementary Algebra

Departmental Outline for MATH 0098

Elementary Algebra

Description: Topics include review of real numbers (order of operations, fractions, decimals, percents, and integers), solving and graphing linear equations and inequalities, operations with polynomials. An introduction to solving systems of linear equations and inequalities, factoring and operations with rationals. Applications will be emphasized.

Prerequisite: None.

Calculator: Students may have a scientific calculator. It is up to each instructor as to how much the students can use a calculator on tests.

Text: (Required) Introductory and Intermediate Algebra: A Combined Approach, Bittenger and Beecher.

Syllabus:

Chapter 1
Sections 1.1 - 1.8
Intro. to Algebra; the Real numbers; Addition, Subtraction, Multiplication, and Division of Real numbers; Properties of Real numbers; Simplifying Expressions; Order of Operations.

Chapter 2
Sections 2.1 - 2.8
Solving Equations via the Addition and Multiplication Principles; Applications and Problem Solving; Applications with Percents; Formulas; Solving Inequalities; Applications and Problem Solving with Inequalities.

Chapter 3
Sections 3.1 - 3.4
Graphs and Applications; Graphing Linear Equations; Intercepts; Applications and Data Analysis with Graphs.

Chapter 4
Sections 4.1 - 4.8
Integers as Exponents; Exponents and Scientific Notation; Addition, Subtraction, Multiplication, Division of Polynomials; Operations with Polynomials in Several Variables.

Chapter 5
Sections 5.1 - 5.9
Factoring Trinomials, Trinomial Squares, Differences of Squares, Sums and Differences of Cubes; Solving Quadratic Equations by Factoring; Applications and Problem Solving.

Chapter 6
Sections 6.1 - 6.9
Adding, Subtracting, Multiplying, and Dividing Rational Expressions; Least Common Multiples and Denominators; Solving Rational Expressions; Applications, Proportions, and Problem Solving; Formulas and Applications; Complex Rational Expressions; Variation and Applications.

MATH 0099 Intermediate Algebra

Departmental Outline for MATH 0099

Intermediate Algebra

Description: A transition from elementary algebra to college algebra. Topics include operations with radicals, graphing of linear and nonlinear functions, algebra of linear and nonlinear functions, systems of linear equations and inequalities, review of factoring and quadratic functions. Applications will be emphasized.

Prerequisite: None.

Calculator: Students may have a scientific calculator. It is up to each instructor as to how much the students can use a calculator on tests.

Text: (Required) Introductory and Intermediate Algebra: A Combined Approach, Bittenger and Beecher.

Syllabus:

Appendix E
As needed
Introductory Algebra Review

Chapter 7
Sections 7.1 - 7.6
Graphs, functions, and applications; domain, range.

Chapter 8
Sections 8.1 - 8.6
Systems of equations; elimination; systems of two and three variables.

Chapter 9
Sections 9.1 - 9.4
Inequalities; sets, interval notation; intersections, unions.

Chapter 10
Sections 10.1 - 10.8
Radical expressions, equations and functions; rational exponents

Chapter 11
Sections 11.1 - 11.8
Quadratic equations and functions; completing the square; quadratic formula.

MATH 1070 Elementary Statistics

Departmental Outline for MATH 1070

Elementary Statistics

Description: Descriptive statistics, basic probability and distribution of random variables, estimation and hypothesis tests for means and proportions, regression and correlation analysis of count data.

Prerequisite: Knowledge of high school algebra II, or equivalent.

Calculator Requirements: All students in MATH 1070 must have a calculator which is capable of finding square roots. It is highly recommended that they have a scientific calculator with 1-variable statistical functions. 2-variable statistical calculator is not required.

Note: The textbook expects students to have a 2-variable statistics calculator, so some accommodation may be necessary. A page of alternative formulas is available and can be handed out and provided on exams. Alternatively, results of calculations can be given and students are questioned on their use and interpretation. Microsoft© Excel can also be used for calculations requiring a 2-variable calculator.

Excel: Use of Excel is required and must contribute to the grade. One way to do this is to assign selected problems (or projects) to be done with Excel and to be turned in and graded.

eTraining: eTraining is also referred to as web-based training, or just-in-time training. It consists of modularized training courses, available over the web, anytime of the day or night, anywhere you have access to the Internet! Since the Student Technology Fee funds it, eTraining is FREE (for personal use only, one account per person) to Georgia State students who are eligible to register and Georgia State faculty and staff. **Students who lack experience using Excel are encouraged to take advantage of this resource.**

Texts:

1. (Required) The Basic Practice of Statistics, 3 rd Edition by David Moore, W. H. Freeman and Company, 2003, ISBN 0-7167-9623-6.
2. (Required) Excel Manual for Moore 's "The Basic Practice of Statistics," 3 rd edition, by Fred M. Hoppe, W. H. Freeman and Company, 2003, ISBN 0-7167-5891-1.
3. (Optional) Student Study Guide for the above text, by W. Notz, M. Fligner, and R. Sorice, W. H. Freeman and Company, 2003, ISBN 0-7167-5886-5.

Syllabus

Note: Optional (starred) sections should be omitted.

Chapter
Topics
No. of Pages

Ch. 1
Graphical methods
29 pages

Ch. 2
Numerical descriptive statistics
24

Ch. 3
Normal distribution
23

Ch. 4
Bivariate descriptive statistics
25

Ch. 5
Linear regression
(Part I Review)
30
(22)

Ch. 7
Sampling (emphasize simple random sampling)
24

Ch. 8
Experimental design (cover briefly)
24

Ch. 9
Basic probability
26

Ch. 10
Sampling distributions
31

Ch. 13
Confidence intervals (basics)
20

Ch. 14
Hypothesis tests (basics)
25

Ch. 15
Additional inference topics
(Part II Review)
17
(19)

Ch. 16
One-sample t-based inference
27

Ch. 17
Two-sample t-based inference
24

Ch. 18
One-sample inference for proportions
18

Ch. 19
Two-sample inference for proportions
(Part III Review)
19
(15)

Ch. 20
Chi-square tests
28

Total pages 442

Note: If additional time is available, add portions of Chapters 21 and/or 22.

MATH 1070 – Content Standards

Title: Elementary Statistics

Course Description: Prerequisite High School Algebra II.

Descriptive statistics, basic probability and distribution of random variables, estimation and hypothesis tests for means and proportions, regression and correlation, analysis of count data.

Goals. The goals of Elementary Statistics are for students to develop skills that will allow them to gather, organize, display and summarize data. They should be able to draw conclusions or make predictions from the data and assess the relative chances for certain events happening.

The following standards are offered as guidelines for assessing student progress, judging the effectiveness of instructional programs, and developing curricular units. The subject matter outlined in these standards represents the minimum knowledge in which a student should demonstrate proficiency at the successful completion of the course.

CS 1. Quantitative Reasoning

Students will use quantitative reasoning in problem solving including: Geometric and symbolic representation and manipulation and pattern recognition.

CS 2. Graphical and numerical summaries, normal distribution

Students will be able to construct and interpret graphical displays of univariate data such as the stem plot, histogram, box plot, and time plot; calculate and interpret summary statistics such as the mean, median, standard deviation, and five number summary; describe and use density curves such as the uniform and normal density curves; use the normal density curve to calculate proportions.

CS 3. Graphical and numerical summaries for bivariate data

Students will be able to construct and interpret graphical displays of bivariate data: scatter plots, regression lines, residual plots, outliers, and influential points; discuss the meaning of the correlation coefficient and the least-squares regression line.

CS 4. Samples and experimental designs

Students will be able to select a simple random sample using a table of random digits; recognize biased sampling such as voluntary and convenience sampling; describe some experimental designs such as completely randomized and block designs.

CS 5. Sample distributions, probability and random variables

Students will demonstrate knowledge and be able to examine and understand and use basic probability concepts including the following: sample spaces of possible outcomes of random experiments, random variables and their probability distributions, the sampling distribution of the mean and the central limit theorem.

CS 6. Z-tests and confidence intervals for means

Students will demonstrate the ability to understand and use the vocabulary of statistical inference including: confidence intervals, confidence levels and margins of error in general, confidence level in general as the probability to give a correct estimate of the confidence intervals for the mean of a normal population of known variance, or the difference between means of two normal populations of know variances, null and alternative hypotheses, rejection

region in terms of the population(s) standard deviation(s) and sample size(s), level of significance and p-values for one and two sided tests for means, when the variance(s) of the underlying normal population(s) is (are) known, or the sample is large.

CS 7. Z-tests and confidence intervals for proportions

Students will demonstrate the ability to make design and make correct inferential statements about: sampling distribution of a sample proportion, confidence intervals for a (difference between two) population proportion(s), and sample size for a required margin of error.

CS 8. T-tests and confidence intervals for means of normal populations

Students will demonstrate the ability to understand and apply inferential statements including: confidence level as the probability to give a correct estimate of the mean (difference of means) of a (two) normal population(s), when the standard deviation(s) is (are) unknown; level of significance and p-values for one and two sided tests for means, when the variance(s) of the underlying normal population(s) is (are) unknown.

CS 9. Chi-square tests for two-way tables

Students will be able to arrange general bivariate categorical data in several groups into a two-way table of counts in all the groups. Students explain what null hypothesis the chi-square statistic tests in a specific two-way table; use percents, comparison of expected and observed counts, and the components of the chi-square statistic to see what deviations from the null hypothesis are important; make a quick assessment of the significance of the statistic by comparing the observed value to the degrees of freedom.

CS 10. Applications

When applying analytic, algebraic, geometric, and algorithmic techniques to solving applied statistical problems students will:

• Use appropriate technology

• Communicate how the problem is modeled by a mathematical/statistical formulation and how to interpret the results of the statistical analysis.

MATH 1101 Introduction to Mathematical Modeling

Departmental Outline for MATH 1101

Introduction to Mathematical Modeling

Description: Mathematical modeling using graphical, numerical, symbolic, and verbal techniques to describe and explore real-world data and phenomena. Emphasis is on the use of elementary functions to investigate and analyze applied problems and questions, on the use of appropriate supporting technology, and on the effective communication of quantitative concepts and results.

Prerequisite: Knowledge of high school algebra II, or equivalent. This includes algebraic expressions, first degree equations and inequalities, exponents, radicals, solving and graphing linear equations, factoring quadratic expressions, and other topics. Some of these topics are reviewed in Chapter 0.

Calculator: Students may have a scientific calculator. It is up to each instructor as to how much the students can use a calculator on tests.

Text: (Required) Explorations in College Algebra, 3nd Edition, by Kime and Clark, Wiley & Sons, ISBN: 0-471-46576-3.

Syllabus:

Chapter 1
Making Sense of Data and Functions

Chapter 2
Rates of Change and Linear Functions

Chapter 3
When Lines Meet: Linear Systems

Chapter 4
The Law of Exponents and Logarithms: Measuring the Universe

Chapter 5
Growth and Decay: An Introduction to Exponential Funtions

Chapter 6
Logarithmic Links: Logarithmic and Exponential Functions

Chapter 8
Quadratic and Other Polynomial Functions

MATH 1101 – Content Standards

Title: Introduction to Mathematical Modeling

Course Description: Prerequisite: High School algebra II or equivalent. This course is NOT an appropriate prerequisite for precalculus or calculus courses.

Mathematical modeling using graphical, numerical, symbolic, and verbal techniques to describe and explore real-world data and phenomena. Emphasis is on the use of elementary functions to investigate and analyze applied problems and questions, on the use of appropriate supporting technology, and on the effective communication of quantitative concepts and results.

Click here for departmental outline.

1. Algebra. Students will demonstrate the ability to:
a. Graph points.
b. Graph linear, piecewise linear, exponential, logarithmic, and quadratic equations and functions. and identify horizontal asymptotes.
c. Determine the equation of a line given two points or one point and the slope.
d. Determine the absolute value of a quantity.
e. Solve and estimate solutions to linear, quadratic, exponential, and logarithmic equations, including use of the properties of exponents and common and natural logarithms.
f. Solve linear systems of two equations by substitution and elimination, including systems that have a unique solution, no solution, or many solutions.
g. Simplify expressions using the laws of exponents and logarithms.
h. Calculate average rate of change of any function.
i. Perform arithmetic calculations to answer questions regarding two-variable data presented in tabular, graphical, or equation form.
j. Express and compare very large and very small numbers using scientific notation and orders of magnitude.
k. Employ the relationship $y = bx \Leftrightarrow \log b\ y = x$ to solve exponential and logarithmic equations.
l. Factor quadratic expressions.
m. Complete the square of quadratic expressions.
n. Express the square root of negative numbers in terms of the imaginary unit, i.
o. Given conversion factors, convert units of measure.
p. Use the quadratic formula to solve quadratic equations.

2. Functions. Students will demonstrate:
a. An understanding of the definitions of function, domain, range, independent and dependent variables, and input and output.
b. The ability to determine if tables, graphs, and equations represent functions.
c. The ability to determine the domain and range of functions as mathematical abstractions or in a physical context.
d. The ability to compose functions.
e. The ability to determine from the graph of a function the values of the independent variable for which the function increases, decreases, or remains constant.

3. Linear Functions. Students will demonstrate the ability to:
a. Determine when two real-world variables are related by a linear or piecewise linear function.
b. Model the behavior of two real-world variables that are directly proportional or are related by a linear or piecewise linear function using tables, graphs, equations, or combinations thereof.
c. Use a linear function to approximate the value of a non-linear function.
d. Interpret the intersection of the graphs of linear functions as equilibrium points.
e. Evaluate linear and piecewise linear functions.
f. Define, calculate, and interpret average rate of change as slope.
g. Define the linear function and the general equation of the linear function.

4. Exponential Functions. Students will demonstrate the ability to:
a. Determine when two real-world variables are related by an exponential function.
b. Model the behavior of two real-world variables that are related by an exponential function using tables, graphs, equations, or combinations thereof including such applications as population growth and decay, radioactive decay, simple and compound interest, inflation, the Malthusian dilemma, musical pitch, and the Rule of 70.
c. Change the base of an exponential function to determine rate of growth/decay, growth/decay factor, and effective and nominal interest rate.
d. Express continuous growth/decay in terms of the number e.
e. Evaluate exponential functions.
f. Determine the exponential equation model from the table or graphical model.
g. Compare linear to exponential growth.

5. Logarithmic Functions. Students will demonstrate:
a. The ability to determine when two real-world variables are related by a logarithmic function.
b. The ability to model the behavior of two real-world variables that are related by a logarithmic function using tables, graphs, equations, or combinations thereof including such applications as pH and the decibel system.
c. Their understanding of the natural logarithm.
d. The ability to graph logarithmic functions.

6. Polynomial and Quadratic Functions. Students will demonstrate the ability to:
a. Predict the shape of graphs of polynomial functions degree n.
b. Estimate horizontal intercepts of polynomial functions from their graphs.
c. Determine the horizontal intercepts of polynomial functions in factored form.
d. Determine when two real-world variables are related by a quadratic function by calculating the average rate of change of the average rates of change.
e. Model the behavior of two real-world variables that are related by a quadratic function using tables, graphs, equations, or combinations thereof including such applications as maximum area for fixed perimeter, minimum perimeter for fixed area, free fall, maximum profit, and break-even analysis.
f. Determine the vertex, axis of symmetry, and horizontal and vertical intercepts of quadratic functions in either the a-b-c or a-h-k forms.
g. Convert quadratic functions from the a-b-c form to the a-h-k form and vice versa.

MATH 1111 College Algebra

Departmental Outline for MATH 1111

College Algebra

Graphs; equations and inequalities; complex numbers; functions;polynomial, rational, exponential, and logarithmic functions;linear systems.

Prerequisite: Grade of C or higher in MATH 0099 or a suitable score on the math placement test.

Calculator: Students may have a scientific calculator. It is up to each instructor as to how much the students can use a calculator on tests.

Text: (Required) Precalculus, 3rd Edition, by Lial, Hornsby, and Schneider, Addison-Wesley, ISBN 0-321-22762-X

Syllabus:

Lesson	Sec.	Topics
1	R4	Syllabus, MyMathLab, Factoring
2	R5, R6	Rational Expressions, Rational Exponenets
3	R7, 1.1	Radical Expressions, Linear Equations
4	1.2, 1.3	Applications of Lin. Eq., Complex Numbers
5	1.4, 1.5	Quadratic Eq., Quadratic Applic.
		Review 1
		Test 1
6	1.6	Other Equations
7	1.7, 1.8	Ineq., Absolute Value Eq. and Ineq.
8	2.1	Graphs of Eq.

9	2.2	Functions
10	2.3, 2.4	Linear Functions, Lines
		Review 2
		Test 2
11	2.5	Graphs of Functions
12	2.6	Graphing Techniques
13	2.7	Functions Operations and Difference Quotients
14	3.1	Quadratic Functions
15	3.2, 3.3	Synthetic Div, Remainder Thm, Zeroes of Polys
16	3.4, 3.5	Poly. Graphs, Rational Function Graphs
		Review 3
		Test 3
17	4.1	Inverse Functions
18	4.2, 4.3	Exponential Func., Log Func.
19	4.4	Evaluating Exp and Log Func
20	9.1	Sys. of Lin. Eqs.
21	9.2/9.7	Matrix Solutions, Matrix Operations
		Review 4
		Test 4
		Final Review

MATH 1113 Precalculus

Departmental Outline for MATH 1113

Precalculus

Description: Trigonometric functions, identities, inverses, and equations; vectors; polar coordinates, conic sections.

Prerequisite: Grade of C or higher in MATH 1111, a suitable score on the math placement test, or departmental approval.

Calculator: Students may have a scientific calculator. It is up to each instructor as to how much the students can use a calculator on tests.

Text: (Required) Precalculus: Functions and Graphs, 5th Edition by Barnett & Ziegler, McGraw-Hill, ISBN 0-07-241220-8

Syllabus

Chapter 2
Sections 2.3 - 2.6 Some review of functions, graphing, composition, and inverses

Chapter 5
Sections 5.1 - 5.7, 5.9 Trigonometric functions

Chapter 6
Sections 6.1 - 6.3, 6.5 Trigonometric identities and equations

Chapter 7
Sections 7.1 - 7.5 Triangles, vectors, polar coordinates

Chapter 11
Sections 11.1 - 11.5 Conic sections and parametric equations

Math 1113 Precalculus

Catalog course description. Prerequisite: Math 1111, or departmental approval. Trigonometric functions, identities, inverses, and equations; vectors; polar coordinates, conic sections.

Goals. Prepare students for a course in calculus by consolidating their understanding of algebraic, trigonometric, exponential, and logarithmic functions, and the introduction of ideas leading to the concepts of limit and derivative.

Course Content Standards

The following standards are offered as guidelines for assessing student progress, judging the effectiveness of instructional programs, and developing curricular units. The subject matter outlined in these standards represents the minimum knowledge in which a student should demonstrate proficiency at the successful completion of the course.

CS1. Quantitative Reasoning

Students will use quantitative reasoning in problem solving situations including: geometric an symbolic representation and manipulation; pattern recognition; translating mathematics into words and words into mathematics; recognizing incorrect answers and arguments and knowing when an answer is reasonable; being able to write out a solution in a logical and clear form rather than presenting a collection of unidentified intermediate numbers that may end with the final numerical answer.

CS2. Algebraic Functions

Students will use functions and related concepts including: recognition of a function in either graphical, table, implicit, or explicit form; be able to find domains and ranges and determine if a function is one-to-one; perform operations of functions including composition, finding inverses, and finding difference quotients; graphically determine when a functions is increasing, decreasing, constant, one-to-one, continuous, and even or odd; apply basic graph transformations including $af(x)$, $f(x) + d$, $f(x – c)$, $f(bx)$, $f(x)$, $f(x)$ to the parent functions; graph a function defined as piecewise.

CS3. Defining the Trigonometric Functions

Students will use circular and trigonometric functions and related concepts including: find exact values of the functions by using the unit circle, wrapping function, and special triangles; know the relationship between radian measure and degree measure and be able to convert from one unit to the other; know the definition of the six (6) trigonometric functions as related to the right triangle; distinguish between right angled and oblique triangles and recognize the appropriate method needed to solve the triangle (Law of Sines, Law of Cosines, Pythagorean Theorem)

CS4 Use of Trigonometric Functions

Students will demonstrate knowledge of and be able to use trigonometry. Specifically: (1) given one of the trig values of an angle in a certain quadrant, be able to find the other five trigonometric functions through identities not limited to Pythagorean, identity, reciprocal identities, even/odd identities and quotient identities, (2) solve oblique triangles using the Law of Sines, and Law of Cosines, and work related applied problems, (3) graph the basic six trigonometric functions, including sine and cosine functions with applied graph transformations; identify the domain, range, period, amplitude and phase shifts of the functions. (4) find the exact values of the inverse trig functions, (5) solve linear and quadratic trigonometric equations and equations with compound angles.

CS5. Mathematical Proofs

Students will demonstrate an understanding of mathematical proofs and related concepts by specifically developing: sum, difference, and co-function identities, double angle and half angle formulas, and sum to product and product to sum identities.

CS6. Analytic Geometry

Students will be demonstrate knowledge of and be able to use analytic geometry concepts and related techniques, including polar coordinates and conic sections including: convert polar to rectangular coordinates and vice versa; sketch graphs of polar functions including cardioids, roses, circles, and spirals; identify equations of parabolas, hyperbolas, and ellipses and sketch their graphs.

CS7. Vectors

Students will demonstrate an understanding of algebraic and geometric vectors and be able to use them to model situations and solve problems.

CS8 Applications and Technology

When applying analytic, algebraic, geometric and algorithmic techniques to solving applied problems, students should be able to use technology when appropriate. Care should be taken to ensure that use of technology is not accompanied by a decrease in mathematical or fundamental understanding.

MATH 1220 Survey of Calculus

Departmental Outline for MATH 1220

Survey of Calculus

Description: Differential and integral calculus of selected real-valued functions of one and several variables with applications.

Prerequisite: Grade of C or higher in MATH 1111, College Algebra or equivalent

Calculator: Students may have a scientific calculator. It is up to each instructor as to how much the students can use a calculator on tests.

Text: (Required) *Calculus for Business, Economics, Life Sciences, and Social Sciences*, 10th Edition by Barnett and Ziegler, Prentice-Hall, ISBN 0131432613

Syllabus

Chapter 1
Sections 1.1, 1.3, 1.4 Review of linear and quadratic equations

Chapter 3
Sections 3.1 - 3.7 Rates of change and limits, calculating derivatives

Chapter 4
Sections 4.1 - 4.4 Continuity, increasing and decreasing functions, local extrema, second-order derivatives, absolute extrema (section 4.5 is optional)

Chapter 2
Sections 2.2 and 2.3 Review of exponential and logarithmic functions

Chapter 5
Sections 5.1 - 5.4 Interest, derivatives of exponential and logarithmic functions, general chain rule

Chapter 6
Sections 6.1 - 6.2, 6.4 - 6.5 Indefinite integrals, substitution, definite integrals, area

Chapter 7
Sections 7.1 - 7.3 Area between curves, applications of integration, integration by parts

Chapter 8
Sections 8.1 - 8.3 Multivariable calculus: functions, partial derivatives, max/min

MATH 1220 – Content Standards

Title: Survey of Calculus

Course Description: Prerequisite MATH 1111.

Differential and integral calculus of selected real-valued functions of one and several real variables with applications.

The following standards are offered as guidelines for assessing student progress, judging the effectiveness of instructional programs, and developing curricular units. The subject matter outlined in these standards represents the minimum knowledge in which a student should demonstrate proficiency at the successful completion of the course.

1. Locate and describe discontinuities in functions.

2. Evaluate limits for polynomial and rational functions

3. Compute and interpret the derivative of a polynomial, rational, exponential, or logarithmic function.

4. Write the equations of lines tangent to the graphs of polynomial, rational, exponential, or logarithmic functions at given points.

5. Compute derivatives using the product, quotient and chain rules on polynomial, rational, exponential, and logarithmic functions.

6. Solve problems in marginal analysis in business and economics using the derivative.

7. Interpret and communicate the results of a marginal analysis.

8. Graph functions and solve optimization problems using the first and second derivatives and interpret the results.

9. Compute antiderivatives and indefinite integrals using term by term integration or substitution techniques.

10. Evaluate certain definite integrals.

11. Compute areas between curves using definite integrals.

12. Solve application problems for which definite and indefinite integrals are mathematical models.

13. Solve application problems involving the continuous compound interest formula.

14. Describe functions of several variables.

15. Compute partial derivatives.

16. Find local extrema of functions of two variables.

MATH 2030 Principles of Mathematics

Departmental Outline for MATH 2030

Principles of Mathematics

Description: Designed for teachers at the elementary and middle school level; topics included are numerical systems, sets and relations, primes and divisors, binary operations and properties, rational numbers and real numbers.

Prerequisite: Grade of C or higher in MATH 1101 or MATH 1111.

Calculator: Students may have a scientific calculator. It is up to each instructor as to how much the students can use a calculator on tests.

Texts: (Required) Mathematics for Elementary Teachers: A Conceptual Approach, 5th Edition by Albert B. Bennett & Ted L. Nelson, WCB McGraw Hill, 2001 and Mathematics for Elementary Teachers: An Activity Approach,5th Edition by Albert B. Bennett & Ted L. Nelson, WCB McGraw Hill, 2001

Syllabus

Chapter 1

Sections 1.1 - 1.3 Problem solving

Chapter 2

Sections 2.1 - 2.3 Sets, functions, and reasoning

Chapter 3

Sections 3.1 - 3.4 Whole numbers

Chapter 4

Sections 4.1 - 4.2 Number theory

Chapter 5

Sections 5.1 - 5.3 Integers and fractions

Chapter 6

Sections 6.1 - 6.4 Decimals: rational and irrational numbers

Chapter 7

Sections 7.1 - 7.3 Statistics

At least one lab will be done from each chapter. Labs may be done in a variety of ways including individually, in groups or as a basis for special projects.

Math 2030 Principles of Mathematics

Course Content Standards

The following standards are offered as guidelines for assessing student progress, judging the effectiveness of instructional programs and developing curricular units. These standards describe what a student should be able to demonstrate at the completion of the course.

Problem solving

Students will be able to apply and adapt a variety of appropriate strategies to solve problems including:

• Solve problems that arise in mathematics and in other contexts.

• Apply and adapt a variety of appropriate strategies to solve problems

• Monitor and reflect on the process of mathematical problem solving

• Construct number meanings through real-world experiences and the use of physical materials.

• Relate the mathematical language and symbolism of operations to problem situations and informal language.

• Interpret the multiple uses of numbers encountered in the real world.

• Develop meaning for the basic operations by modeling and discussing a rich variety of problem situations.

• Relate the mathematical language and symbolism of operations to problem situations and informal language.

• Estimate and judge reasonableness of numerical results.

• Relate mathematical symbols to mathematical ideas.

• Relate subtraction to addition.

• Recognize, extend, and create patterns.

• Explore the use of variables and open sentences to express relations.

• Extend the number system to fractions and decimals.

• Relate algebraic ideas to geometric representations.

• Relate multiplication to addition, arrays, and Cartesian products.

• Relate division to subtraction and multiplication.

• Explore the use of variables and open sentences to express relations.

• Use models to represent mathematical ideas.

• Represent situations and number patterns with tables, graphs, and verbal rules.

• Use models to represent mathematical ideas.

• Represent situations and number patterns with tables, graphs and verbal rules.

• Understand the concepts of variable, expression, and equation.

• Formalize situations and number patterns with tables, graphs, verbal rule, and equations and explore the interrelationships of those representations.

• Analyze tables and graphs to identify properties and relationships.

• Solve linear equations using concrete, informal, and formal methods.

• Investigate inequalities and nonlinear equations informally.

• Apply algebraic methods to solve a variety of mathematical problems.

Sets, Functions, and Reasoning

Students will be able to develop an understanding of sets and should represent, analyze and generalize a variety of patterns and functions using words, tables and graphs including:

• Construct number meanings through real-world experiences and the use of physical materials.

• Relate the mathematical language and symbolism of operations to problem situations and informal language.

• Interpret the multiple uses of numbers encountered in the real world.

• Develop meaning for the basic operations by modeling and discussing a rich variety of problem situations.

• Relate the mathematical language and symbolism of operations to problem situations and informal language.

• Estimate and judge reasonableness of numerical results.

• Identify, describe, and draw lines, line segments, lines of symmetry, rays, angles, and parallel and perpendicular lines.

• Relate numbers to points on a line.

• Understand betweeness, closeness, rounding, and approximating.

• Understand closeness, rounding, and approximating.

• Recognize and describe mathematical relations and functions.

• Explore concepts of operational inverses.

• Expand the number system.

• Use relations and functions to solve problems.

• Recognize and describe relations and functions.

• Represent data in tables and graphs.

• Exhibit relationships graphically. • Use Venn diagrams and truth tables in problem solving involving set theory and logic.

• Use inductive and deductive reasoning.

• Use counting principles.

Whole Numbers

Students will be able to develop a sense of whole numbers and represent and use them in a number of ways including:

• Construct number meanings through real-world experiences and the use of physical materials.

• Understand our numeration system by relating counting, grouping and place value concepts.

• Interpret the multiple uses of numbers.

• Develop meaning for the four basic operations.

• Relate the mathematical language and symbolism of operations to problem situations and informal language.

• Identify fractions using physical models, both as parts of a whole and parts of a set.

• Construct number meanings through real world experience and the use of physical materials.

• Understand our numeration system by relating counting, grouping and place value concepts.

• Interpret the multiple uses of numbers encountered in the real world.

• Develop meaning for the basic operations by modeling and discussing a rich variety of problem situations.

• Relate the mathematical language and symbolism of operations to problem situations and informal language.

• Develop, represent, and use order relations for whole numbers, fractions and decimals (rational numbers) and integers.

• Apply the basic operations to integers.

• Understand how the basic arithmetic operations are related to one another.

• Develop and use fractional exponents, negative exponents, and radicals.

• Estimate and judge reasonableness of numerical results.

Number Theory

Students will be able to develop number theory concepts including:

1. Construct number meanings through real world experience and the use of physical materials.

2. Develop and apply number theory concepts (e.g., primes, factors, and multiples) in real-world and mathematical problem situations.

3. Develop meaning for the basic operations by modeling and discussing a rich variety of problem situations.

4. Estimate and judge reasonableness of numerical results.

5. Identify and Use Divisibility Tests

6. Identify and Use Greatest Common Factors

7. Identify and Use Least Common Multiples

8. Interpret the multiple uses of numbers encountered in the real world.

9. Investigate whether numbers are odd or even, prime or composite.

10. Recognize, extend, and create patterns.

11. Relate the mathematical language and symbolism of operations to problem situations and informal language.

12. Use models to represent mathematical ideas.

Integers and Fractions

Students will be able to develop a sense of integers and fractions and use them in a number of ways, including:

1. Apply operations for the real number systems to a variety of mathematical situations.

2. Apply the basic operations to integers.

3. Apply understanding of whole number operations to fractions.

4. Compare numbers to each other in terms of greater than, less than, or equal to and explore different representations of the same number.

5. Construct number meanings through real world experience and the use of physical materials.

6. Develop concepts of fractions and mixed numbers.

7. Develop meaning for the basic operations by modeling and discussing a rich variety of problem situations.

8. Develop, represent, and use order relations for whole numbers, fractions (rational numbers) and integers.

9. Estimate and judge reasonableness of numerical results.

10. Expand the number system.

11. Explore concepts of operational inverses.

12. Identify fractions using physical models, both as parts of a whole and parts of a set.

13. Interpret the multiple uses of numbers encountered in the real world.

14. Investigate relationships among fractions, decimals, and percents.

15. Perform arithmetic operations with rational numbers.

16. Recognize, extend, and create patterns. 17. Relate division to subtraction and multiplication.

18. Relate mathematical symbols to mathematical ideas.

19. Relate numbers to points on a line.

20. Relate subtraction to addition.

21. Relate the mathematical language and symbolism of operations to problem situations and informal language.

22. Understand and apply ratios, proportions to a wide variety of situations.

23. Understand and appreciate the need for numbers beyond the whole numbers.

24. Understand betweeness, closeness, rounding, and approximating.

25. Use models to represent mathematical ideas.

Decimals, Rational and Irrational Numbers

Students will be able to develop a sense of decimals, rational numbers and irrational numbers and use them in a number of ways, including:

1. Apply fractions and decimals to problem situations, including money.

2. Apply operations for the real number systems to a variety of mathematical situations.

3. Apply understanding of whole number operations to fractions and decimals.

4. Compare numbers to each other in terms of greater than, less than, or equal to and explore different representations of the same number.

5. Construct number meanings through real world experience and the use of physical materials.

6. Develop and use fractional exponents, negative exponents, radicals.

7. Develop concepts of fractions and decimals with standard symbols.

8. Develop concepts of fractions, mixed numbers and decimals.

9. Develop meaning for the basic operations by modeling and discussing a rich variety of problem situations.

10. Develop the real number system.

11. Develop, represent, and use order relations for whole numbers, fractions and decimals (rational numbers) and integers.

12. Estimate and judge reasonableness of numerical results.

13. Explore concepts of operational inverses.

14. Explore the properties of rational numbers

15. Extend the number system to fractions and decimals.

16. Interpret the multiple uses of numbers encountered in the real world.

17. Investigate relationships among fractions, decimals, and percents.

18. Perform arithmetic operations with real numbers.

19. Recognize, extend, and create patterns.

20. Relate numbers to points on a line

21. Relate the mathematical language and symbolism of operations to problem situations and informal language.

22. Understand the Pythagorean Theorem by relating it to rational and irrational numbers.

23. Understand and apply ratios, proportions, and percents to a wide variety of situations.

24. Understand and appreciate the need for numbers beyond the whole numbers.

25. Understand betweeness, closeness, rounding, and approximating.

26. Understand our numeration system by relating counting, grouping and place value concepts.

27. Understand, represent, and use numbers in a variety of equivalent forms (integer, fraction, decimal, percent, exponential and scientific notation) in real-world and mathematical problem situations.

28. Understand our decimal system by relating grouping and place value concepts.

29. Use percentages, orders of magnitude, ratios, and proportions to express relationships between quantities.

Statistics

Students will be able to develop an understanding of statistics and should be able to analyze data and make inferences about the real world including:

1. Apply measures of central tendency.

2. Apply measures of variability.

3. Apply measures of relative standing.

4. Collect, organize, and describe data.

5. Construct and draw inferences from charts, tables, and graphs.

6. Construct, read, and interpret displays of data, including picture, bar, circle, and line graphs.

7. Construct, read, and interpret tables, charts, and graphs.

8. Explore concepts of sampling.

9. Formulate and solve problems that involve collecting, organizing, and analyzing data.

10. Make inferences and convincing arguments and evaluate arguments that are based on data analysis.

11. Recognize statistical methods and probability models as powerful decision-making tools.

12. Understand and apply measures of central tendency, variability, and correlations.

13. Use line fitting to predict from data.

14. Use descriptive and inferential statistics.

MATH 2211 Calculus of One Variable I

Departmental Outline for MATH 2211

Calculus of One Variable I

Description: Limits and continuity, differentiation, Mean Value Theorem for derivative, applications of differentiation, definition of the integral, Fundamental Theorem of Calculus, applications of integration to area.

Prerequisite: MATH 1113 Precalculus or equivalent.

Calculator: Students may have a scientific calculator. It is up to each instructor as to how much the students can use a calculator on tests.

Texts: (Required) Calculus: One and Several Variables, 9 th Edition by Salas & Hille & Etgen, Wiley, 2003, ISBN 0-471-23120-7.

Syllabus

Chapter 2
Sections 2.1 - 2.6
Limits

Chapter 3
Sections 3.1 - 3.8
Differentiation

Chapter 4
Sections 4.1 - 4.8
Applications of differentiation

Chapter 5
Sections 5.1 - 5.9
Integration

Chapter 6
Sections 6.1 - 6.2, 6.6
Area, Volume by washers, Fluid pressure

The sections at the end of each chapter labeled "Projects and Explorations using Technology" are optional, and are a source of graphing calculator problems.

CONTENT STANDARDS FOR

MATH 2211, CALUCLUS OF ONE VARIABLE I

Course Description: Prerequisite: Math 1113, or the equivalent

Limits and Continuity, Differentiation, Mean Value Theorem for Derivatives; applications of differentiation; definition of the integral; Fundamental Theorem of Calculus; applications of integration to area.

Goals.

Course Content Standards. The following content standards are offered as guidelines for assessing student progress, judging the effectiveness of instructional programs, and developing curricular units. These standards describe what a student should be able to demonstrate at the completion of the course.

The content standards are labeled CS1 through CS9 and carry a further designation such as CS1A, CS4B, or both. The “A” designation indicates topics that are used explicitly in the course, but introduced in earlier courses. Although these topics are reinforced in Math 2211, they may be considered prerequisite material. The “B” designation indicates that topics are introduced in Math 2211.

CS 1A. Quantitative Reasoning

Students will use quantitative reasoning in problem solving situations including:

Geometric, symbolic, algebraic, and analytic representation and manipulation of quantitative information;

Pattern recognition.

CS 2A. The Real Number System

Students will use algebraic and order properties of the real number system and subsystems of the set of real numbers.

CS 3A. Functions.

Students will use and investigate functions and related concepts including:

Representations of functions using formulas, graphs, and parameters;

Operations on functions defined by arithmetic operations, composition, and inversion;

Types of elementary functions such as polynomial, rational, radical, absolute value, trigonometric, and piecewise-defined functions.

CS 3B. Functions.

Students will use and investigate properties of functions and their graphs involving monotonicity, extrema, concavity, and other salient features.

CS 4B. Limits and Continuity.

Students will demonstrate knowledge of and be able to use concepts and techniques related to limits and continuity including:

Performing analytic and graphical interpretations of concepts;

Evaluating limits;

Determining points of continuity/discontinuity of functions;

Applying properties of limits and continuity related to operations on functions.

CS 5A. Analytic Geometry.

Students will demonstrate knowledge of and be able to use analytic geometry concepts and related techniques including:

Conic sections;

Representations and transformations involving rectangular coordinate systems.

CS 6B. Differentiation.

Students will demonstrate an understanding of the derivative at a point, derivative functions, and related concepts including:

Interpretation of the derivative at a point in terms of difference quotients, slopes of tangent lines and (instantaneous and average) rates of change;

The Mean Value Theorem for derivatives and related results;

Applying properties of differentiation related to elementary functions and operations on functions;

Application of the derivative to investigating properties of functions;

Implicit differentiation and differentials.

CS 7B. Integration.

Students will demonstrate an understanding of integration and related concepts including: The definite integral as an accumulation of small quantities;

The Fundamental Theorem of Calculus and antiderivatives;

The Mean Value Theorem for integrals;

Applying properties of integration related to elementary functions, operations on functions, and elementary substitutions;

Applications of integration in a variety of contexts.

CS 8A. Applications.

While applying analytic, algebraic, geometric, and algorithmic techniques to solving applied problems students will:

Use appropriate technology;

Communicate how the problem is modeled by a mathematical formulation, and how to interpret the result of the mathematical analysis.

CS 9A. Mathematical Proof.

Students will demonstrate an understanding of mathematical proof and related concepts including:

Analysis of the logical structure of mathematical proofs and derivations;

Use contradictions and counter examples appropriately;

Use mathematical induction.

CS 9B. Mathematical Proof.

Students will demonstrate an understanding of the rudiments of ε,δ−proofs.

MATH 2212 Calculus of One Variable II

Departmental Outline for MATH 2212

Calculus of One Variable II

Description: Applications and techniques of integration; transcendental and trigonometric functions; polar coordinates; infinite sequences and series; indeterminate forms; improper integrals.

Prerequisite: MATH 2211 Calculus of One Variable I or equivalent.

Calculator: Students may have a scientific calculator. It is up to each instructor as to how much the students can use a calculator on tests.

Texts: (Required) Calculus: One and Several Variables, 9 th Edition by Salas & Hille & Etgen, Wiley, 2003, ISBN 0-471-23120-7.

Syllabus

Chapter 7
Sections 7.1 - 7.4
Sections 7.6 - 7.7
Log and exponential functions
Exp. growth & inverse trig functions

Chapter 8
Sections 8.1 - 8.5
Integration by parts; trig functions; trig substitution; partial fractions

Chapter 9
Sections 9.3 - 9.9
Polar coordinates, area, curves, parametric functions, arc length

Chapter 10
Sections 10.1
Sections 10.2 - 10.4
Sections 10.5 - 10.6
Sections 10.7
Least Upper Bound axiom
Sequences
L'Hospital's Rule
Improper Integrals

Chapter 11
Sections 11.1 - 11.9
Infinite series, sigma notation, series of numbers, Taylor and power series

The ideas associated with proofs will be incorporated into this course. Section 11.8 will be discussed and problems from that section assigned.

CONTENT STANDARDS FOR

MATH 2212, CALUCLUS OF ONE VARIABLE II

Course Description: Prerequisite: Math 2211

Applications and techniques of integration; transcendental and trigonometric functions; polar coordinates; infinite sequences and series; indeterminate forms; improper Integrals.

Goals.

Course Content Standards. The following content standards are offered as guidelines for assessing student progress, judging the effectiveness of instructional programs, and developing curricular units. These standards describe what a student should be able to demonstrate at the completion of the course.

The content standards are labeled CS1 through CS10 and carry a further designation such as CS1A, CS4B, or both. The “A” designation indicates topics that are used explicitly in the course, but introduced in earlier courses. Although these topics are reinforced in Math 2212, they may be considered prerequisite material. The “B” designation indicates that topics are introduced in Math 2212.

CS 1A. Quantitative Reasoning

Students will use quantitative reasoning in problem solving situations including:

Geometric, symbolic, algebraic, and analytic representation and manipulation of quantitative information;

Pattern recognition.

CS 2A. The Real Number System

Students will use algebraic and order properties of the real number system and subsystems of the set of real numbers.

CS 3A. Functions.

Students will use and investigate functions and related concepts including:

Representations of functions using formulas, graphs, and parameters;

Operations on functions defined by arithmetic operations, composition, and inversion;

Types of elementary functions such as polynomial, rational, radical, absolute value, trigonometric, and piecewise-defined functions.

Properties of functions and their graphs involving monotonicity, extrema, concavity, and other salient features.

CS 4A. Limits and Continuity.

Students will demonstrate knowledge of and be able to use concepts and techniques related to limits and continuity including:

Performing analytic and graphical interpretations of concepts;

Evaluating limits;

Determining points of continuity/discontinuity of functions;

Applying properties of limits and continuity related to operations on functions.

CS 4B. Limits and Continuity.

Students will evaluate limits of indeterminate form.

CS 5A. Analytic Geometry.

Students will demonstrate knowledge of and be able to use analytic geometry concepts and related techniques including conic sections.

CS 5B. Analytic Geometry. Students will demonstrate knowledge of and be able to use representations and transformations involving rectangular and polar coordinate systems.

CS 6A. Differentiation.

Students will demonstrate an understanding of the derivative at a point, derivative functions, and related concepts including:

Interpretation of the derivative at a point in terms of difference quotients, slopes of tangent lines and

(instantaneous and average) rates of change;

The Mean Value Theorem for derivatives and related results;

Applying properties of differentiation related to elementary functions and operations on functions;

Application of the derivative to investigating properties of functions;

Implicit differentiation and differentials.

CS 6B. Differentiation.

Students will use the derivatives of exponential/logarithmic functions, and apply the technique of logarithmic differentiation.

CS 7A. Integration.

Students will demonstrate an understanding of integration and related concepts including:

The definite integral as an accumulation of small quantities;

The Fundamental Theorem of Calculus and antiderivatives;

The Mean Value Theorem for integrals;

Applying properties of integration related to elementary functions, operations on functions, and elementary substitutions;

Applications of integration in a variety of contexts.

CS 7B. Integration.

Students will demonstrate an understanding of integration and related concepts including:

Integrals involving exponential and logarithmic functions;

Integration by parts and other techniques of integration;

Evaluation of improper integrals.

CS 8B. Sequences and Series.

Students will demonstrate an understanding of sequences, series, and related concepts including:

Limits of sequences, sums of series, and radii of convergence;

Geometric series, alternating series, power series, and Taylor polynomials;

Tests of convergence and absolute convergence.

CS 9A. Applications.

While applying analytic, algebraic, geometric, and algorithmic techniques to solving applied problems students will:

Use appropriate technology;

Communicate how the problem is modeled by a mathematical formulation, and how to interpret the result of the mathematical analysis.

CS 10A. Mathematical Proof.

Students will demonstrate an understanding of mathematical proof and related concepts including:

Analysis of the logical structure of mathematical proofs and derivations;

Use contradictions and counter examples appropriately;

Use mathematical induction.

The rudiments of ε,δ−proofs

MATH 2215 Multivariate Calculus

Departmental Outline for MATH 2215

Multivariate Calculus

Description: Real-valued functions of several variables, limits, continuity, differentials, directional derivatives, partial derivatives, chain rule, multiple integrals, applications.

Prerequisite: MATH 2212 Calculus of One Variable II or equivalent.

Calculator: Students may have a scientific calculator. It is up to each instructor as to how much the students can use a calculator on tests.

Texts: (Required) Calculus: One and Several Variables, 9 th Edition by Salas & Hille & Etgen, Wiley, 2003, ISBN 0-471-23120-7.

Syllabus

Chapter 12
Sections 12.1 - 12.7
Vectors

Chapter 13
Sections 13.1 - 13.5
Vector Calculus

Chapter 14
Sections 14.1 - 14.6
Functions of Several Variables

Chapter 15
Sections 15.1 - 15.9
Gradients and Extremes

Chapter 16
Sections16.1 - 16.10
Double & Triple Integrals

Chapter 17
Sections 17.1 - 17.2
Line Integrals

MATH 2420 Discrete Mathematics

Departmental Outline for MATH 2420

Discrete Mathematics

Description: Introduction to discrete structures which are applicable to computer science. Topics include number bases, logic, sets, Boolean algebra, and elementary concepts of graph theory.

Prerequisite: MATH 1220 Survey of Calculus or Math 1113 Precalculus.

Calculator: Students may have a scientific calculator. It is up to each instructor as to how much the students can use a calculator on tests.

Texts: (Required) Discrete Mathematics, 3 rd Edition by Susanna Epp, ITP, 2004, ISBN 0-534-35945-0.

Syllabus

Chapter 1
Sections 1.1 - 1.5
The Logic of Compound Statements

Chapter 2
Sections 2.1 - 2.4
The Logic of Quantified Statements

Chapter 3
Sections 3.1-3.4, 3.6
Elementary Number Theory and Methods of Proof

Chapter 4
Sections 4.1 - 4.2
Sequences and Mathematical Induction

Chapter 5
Sections 5.1 - 5.3
Set Theory

Chapter 7
Sections 7.1 - 7.4
Functions

Chapter 10
Sections 10.1-10.3, 10.5
Relations

Chapter 11
Sections 11.1, 11.2, 11.5, 11.6
Graphs and trees

If time permits, one could cover Section 10.4 (Cryptography), Chapter 12, or the omitted sections in Chapter 11. This material is optional.

As a result of completing the course Discrete Mathematics, MATH 2420, students will be able to:

1. Identify logical form, form compound statements using the connectives and, or and not, determine truth tables of more general compound statements, determine whether two statement forms are logically equivalent or nonequivalent, apply De Morgan's laws to form negations of and and or, determine whether a statement is a tautology or a contradiction, and use logical equivalences to simplify statement forms.

2. Determine truth tables for compound statements containing conditional and biconditional connectives, represent if-then as or, and then use this representation to negate an if-then statement, determine the negation, contrapositive, converse and inverse of a conditional statement, rewrite a conditional statement as an "only if" statement, and as sufficient and necessary conditions.

3. Determine whether and argument is valid or invalid, use valid argument forms such as modus ponens, modus tollens, etc. to do complex deductions, and illustrate a proof by contradiction using the knights and knaves example.

4. Give the input/output table for the following gates: OR, AND and NOT, find a Boolean expression (input/output table, respectively) of a circuit, find a circuit corresponding to a Boolean circuit (input/output table, respectively) by finding the disjunctive-normal or sum-of-products form, determine whether two logical circuits are equivalent, and simplify a combinatorial circuit.

5. Represent a binary (hexadecimal, octal) number as a decimal number, represent a decimal (hexadecimal, octal) number in binary notation, represent a binary number in hexadecimal (octal) notation, and add and subtract binary numbers.

6. Determine the domain and the truth set of a predicate variable, identify universal and existential statements, be able to write these statements in formal and informal language, and identify universal conditional statements, negate universal and existential statements, as well as statements containing both universal and existential statements.

7. Define an even (odd) integer, prove an existential statement using an example, use a direct proof to prove universal statements such as "The sum of an even integer and an odd integer is odd", "If the difference of any two integers is odd, then so is their sum", etc., disprove a universal statement by an example, follow the directions for writing proofs of universal statements, and identify common mistakes in proving statements.

8. Use direct proofs or counterexamples to prove or disprove statements involving the rational numbers.

9. Use direct proofs or counterexamples to prove or disprove statements involving the divisibility of integers, and use the quotient-remainder theorem to illustrate a proof by division into cases.

10. Use methods of proofs by contradiction and contraposition to prove various statements.

11. Find the explicit formula for a sequence, and be able to do calculations involving factorial, summation and product notations.

12. Be able to prove statements using mathematical induction.

13. Determine whether one set is a subset of another, whether two sets are equal, whether an element is in a set or not, be able to determine the union, intersection, difference and complement of sets, illustrate sets using Venn diagrams, determine the Cartesian product of two or more sets, prove set identities, use set identities to derive new set properties from old set properties, use Venn diagrams to prove set identities, determine whether sets form a partition of a given set, and determine the power set of a set.

14. Determine whether a relationship is a function or not, determine the domain, co-domain, range of a function, and the inverse image of x, prove or disprove whether a function is one-to-one or not, determine whether a function is onto or not, determine the inverse of a one-to-one correspondence, determine the composition of two functions, and show that if two functions are one-to-one (onto) so too is their composition.

15. Determine the arrow diagram of a relation, whether a relation is a function or not, determine the inverse of a relation, whether a relation is reflexive, symmetric or transitive, determine the transitive closure of a relation, show that the binary relation induced by a partition is an equivalence relation, and show that the set of equivalence classes of an equivalence relation on A forms a partition of A.

16. Identify loops, parallel edges, etc. in a graph, draw the complete graph on n vertices, and the complete bipartite graph on (m,n) vertices, determine whether a graph is bipartite or not, list all the subgraphs of a given graph, determine the degree of a vertex in a graph, prove that the sum of the degrees of the vertices is equal to twice the number of edges, show that in any graph there is an even number of vertices of odd degree, apply these results, and determine the complement of a simple graph.

17. Determine whether a walk is a path, simple path, closed walk, circuit or a simple circuit, determine whether a graph is connected or not, prove that a graph has an Euler circuit if and only if the graph is connected and every vertex of the graph has even degree, determine whether a given graph has an Euler circuit and, if so, indicate one, prove that a graph has an Euler path if and only if the graph is connected and has exactly two vertices of odd degree, determine whether a given graph has an Euler path and, if so, indicate one, and determine whether a graph has a Hamiltonian circuit and, if so, indicate one.

18. Determine whether a graph is a tree or not, show that any tree with more than one vertex has two leaves, show that any tree with n vertices has n-1 edges, show that if G is an connected graph with n vertices and n-1 edges, then G is a tree, determine in a rooted tree, the root, level of a given vertex, height of the tree, children, parent, siblings, ancestors and descendants of a vertex, determine whether a given tree is a binary or full binary tree, and prove results regarding binary trees.

19. Apply Kruskal's algorithm or Prim's algorithm to determine a minimal spanning tree for a given graph.

MATH 3030 Mathematical Models for Computer Science

Departmental Outline for MATH 3030

Mathematical Models for Computer Science

Description: Elements of mathematical modeling including: probability, distributions of random variables, sampling statistical inference, transforms, operators, vector analysis, elements of linear algebra.

Prerequisites: Grade of C or higher in MATH 2420 Discrete Mathematics and MATH 2215 Multivariable Calculus.

Calculators: Students may have a scientific or programmable calculator. It is up to each instructor as to how much the students can use a calculator on tests.

Texts: (Required) Advanced Engineering Mathematics by Kreyszig, 8th Ed, Wiley, ISBN 0471154962.

Syllabus

Chapters 6, 7, 18, 22, 23, and 10

Chapter 6
Linear Algebra: Matrices, Vectors, Determinants, Linear Systems of Equations

Chapter 7
Linear Algebra: Matrix Eigenvalue Problems

Chapter 18
Numerical Methods in Linear Algebra

Chapter 22
Data Analysis: Probability Theory

Chapter 23
Mathematical Statistics

Chapter 10
Fourier Series, Integrals, and Transforms

MATH 3435 Introductory Linear Algebra

Departmental Outline for MATH 3435

Introductory Linear Algebra Syllabus

Text: Linear Algebra and Its Applications, 3rd edition, by David Lay, Addison-Wesley, ISBN 0201709708.

Prerequisite: Grade of C or higher in Math 2215 (Multivariable Calculus)

Corequisite: Math 3000 (Bridge to Higher Mathematics).

Material covered: Sections 1.1-1.8 Linear Equations and Matrices

Sections 2.1-2.3 Invertible Matrices

Sections 3.1-3.2 Determinants

Sections 4.1-4.7 Vector Spaces

Sections 5.1-5.5 Eigenvalues and Eigenvectors

Sections 6.1-6.2 Inner Product and Orthogonality

Math 3435: Introductory Linear Algebra

Catalog course description: Prerequisites: Math 2215 and Math 3000.

Theory and applications of matrix algebra and linear transformations. Topics include linear equations, vector spaces, matrices, subspaces, and bases.

Goals

To provide students with a solid background in linear algebra and basic matrix theory, including applications.

Course Content Standards

The following standards are offered as guidelines for assessing student progress, judging the effectiveness of instructional programs, and developing curricular units.

The subject matter outlined in these standards represents the minimum knowledge in which a student should demonstrate proficiency at the successful completion of the course.

• Students will be able to identify a system of linear equations and form the augmented matrix for the system.

• Students will be able to identify when a matrix is in row echelon form or reduced row echelon form.

• Students will be able to identify when an augmented matrix in row echelon form corresponds to an inconsistent system, a system with a single solution, or a system with multiple solutions.

• Students will be able to use elementary row operations to reduce an augmented matrix to row echelon form and to use the form, together with back-substitution, to solve the corresponding system.

• Students will be able to perform algebraic operations on vectors in n-dimensional space.

• Students will be able to interpret the geometric properties of vectors in Rn and of algebraic operations on vectors in Rn.

• Students will know the definitions of a linear combination and of the span of a set of vectors and the geometric significance of a vector being in the span of a set of vectors.

• Students will be able to represent a set of linear equations as a combination of the columns of the system matrix A and also as the matrix-vector product Ax.

• Students will recognize consistent systems as those in which the right hand side is a combination of the columns of the system matrix A.

• Students will be able to computationally determine if a given set of vectors is linearly independent and determine if a given vector is in the span of a set of vectors.

• Students will know the definition of a linear transformation and will be able to represent linear transformations as matrices.

• Students will be able to identify one to one and onto linear transformations.

• Students will be able to apply the theory of linear systems to simple applied problems.

• Students will be able to apply basic matrix operations, including products, sums and transposes.

• Students will be able to determine if two matrices are inverses of each other.

• The student will be able to deduce the uniqueness of solutions from invertibility.

• Students will be able to compute the inverse matrix using elementary row operations.

• Students will be able to apply the equivalent conditions of the invertible matrix theorem to determine if matrices are invertible.

• Students will be able to apply the definition of the determinant to compute the determinant of a matrix.

• The student will know the effect of elementary row operations on the determinant.

• Students will be able to compute determinants using elimination.

• Students will know the properties and definition of a vector space and be able to apply these properties in computations involving vectors.

• Students will be able to tell if a given set is a subspace.

• Students will be able to find the null space and column space of a matrix and be able to relate them to kernel and range of a linear transformation.

• Students will be able to apply the definition of linear independence and to recognize linearly independent and linearly dependent sets of vectors.

- Students will be able to recognize a basis for a subspace and be able to construct a basis for the span of a set of vectors.
- Students will be able to define a coordinate system with a basis and be able to find the coordinates of a vector with respect to a given basis.
- Students will be able to change a basis and represent the basis change as a matrix.
- Students will be able to determine the dimension of a subspace.
- Students will be able to compute the rank of a matrix and to relate the rank to the dimension of the null and column spaces of a matrix.
- Students will be able to describe a Markov chain using its probability transition matrix.
- Students will be able to find the steady state of a Markov chain.