D. COLLEGE CORE CURRICULUM

Mathematics

MATH1311:	Finite Mathematics for Students of Business
MATH1312:	Calculus for Students of Business
MATH1313:	Statistical Methods
MATH1321:	Pre Calculus Mathematics
MATH1422:	Calculus I
MATH1423:	Calculus II
MATH1324:	Calculus III
MATH2332:	Linear Algebra
MATH2332:	Ordinary Differential Equations

Course Title: MATH 1311: Finite Mathematics for Students of Business

Semester Credit Hours: 3 (3,0)

I. Course Overview

Finite Mathematics for Students of Business covers topics from mathematics of finance that should be familiar to all students seeking careers in the business world. These include mathematics related to supply, demand and cost analysis; interest, annuity and investments; probability and decision making; and Markov processes. Students should acquire the necessary mathematical basis for further study in economics and finance. The prerequisite for MATH 1311 is the algebraic manipulation skill commensurate with that gained in the Preparation Year Program.

II. PMU Competencies and Learning Outcomes

Students of MATH 1311 will begin to understand the quantitative tools that contribute to the professional competence needed to make rational business decisions about the future, as well as to find practical solutions to problems in the present. The students will begin to learn how to use these tools to communicate their ideas and solutions to others. Students will be introduced to the use of "real-world" data obtained from sources such as the Internet. Students will become adept at using the Web-based course supplement to access course materials and communicate with fellow classmates and the instructor. They enhance their teamwork and leadership skills by working in groups to achieve the solutions to designated exercises.

III. Detailed Course Description

The course begins with a discussion of functions modeling concepts related to cost (fixed and variable), revenue, profit, and supply and demand. The course then proceeds to topics involving interest, future, and present values of an annuity. This includes sinking funds and amortization. The course next covers topics from discrete probability and counting, considering odds and expected value of a random variable. It concludes with a discussion of Markov Chains and their use in making long-term projections. In all cases the emphasis of the course should be on concepts and applications to business and finance. Emphasis on memorization of formula and algorithms should be minimal.

IV. Requirements Fulfilled

MATH 1311 satisfies three hours of the College Core mathematics requirements. It is the prerequisite for MATH 1312, Calculus for Students of Business, and is required of all students pursuing degrees from the College of Business Administration. MATH 1311 should be taken the first semester after completion of the Preparation Year Program.

V. Required Prerequisites

The prerequisite for MATH 1311 is the algebraic manipulation skill commensurate with that gained in the Preparation Year Program.

VI. Learning Outcomes

A. To learn basic tools from finite mathematics that can be applied to business related endeavors.

B. To begin to learn how to use tools from mathematics to make good business decisions.

C. To begin to develop an understanding of how long-term investments produce profits.

D. To learn how one can make long-term predictions with respect to market share and demographics.

E. To develop improved collaborative skills.

VII. Assessment Strategy

For purpose of final course grades (summative assessment), students should be assessed via their performance on in-class quizzes and exams which focus on the applications of the mathematics to business and finance.

- Weekly 15-minute, in-class quizzes over assigned homework to motivate students to do the work and receive credit accordingly.
- Three class-length, in-class exams to assess students' accumulative mastery of content covered prior to time of exam.
- A comprehensive final exam to assess students' accumulative mastery of course material.

Students' final grades will be based on 15% credit for the quizzes, 50% for the exams, and 35% for the final exam.

Feedback from the instructor (formative assessment) should come via the students' "reflective notebooks."

- At the end of each week the instructor collects the students notebooks. He then reads the students' reflections and chosen problems for that week and enters appropriate written responses into the notebooks.

The final grades and student and instructor observations from the student's "reflective notebook" will be included in the student's portfolio for use in the final assessment capstone course. The intent here is to document the student's maturation as he proceeds through the curriculum.

VIII. Course Format

Primary instruction is to be in a lecture format with the course meeting three times per week for one hour each meeting. At least once per week the students should be allowed to work for at least 30 minutes in class, in groups of two or three, on an application problem chosen from the text by the instructor.

Web supplement. Course homepage (using commercial Web tool, WebCt or BLACKBOARD) should contain the following:

- Course syllabus.
- Course assignments.
- Keys to quizzes and exams (after students have completed them).
- Course calendar (an active utility).
- Course e-mail utility (an active utility).
- Course discussion list (an active utility).
- Student course grades (an active utility).

Classroom Hours (3 hours per week) **Class:** 3
Lab: 0

IX. Topics to be Covered

A. Modeling with elementary functions
   1. Piece-wise linear functions
   2. Cost function - fixed cost + variable cost
   3. Revenue
   4. Profit - revenue-cost
   5. Linear functions representing price-supply and price-demand equilibrium
   6. Quadratic functions representing revenue and profit breakeven analysis
   7. Average cost
   8. Compound interest
   9. Use of Ln to solve for value of the exponent in compound interest formula

B. Math of finance
   1. Simple and compound interest
   2. Future value
   3. Present value
   4. Doubling time
   5. Periodic investments
   6. Sinking funds

C. Probability
   1. Discrete probability and counting
   2. Bayes' Formula
   3. Odds
   4. Expected value of random variable
   5. Empirical Probability

D. Markov Chains
   1. Transition diagram
   2. Transition matrix
   3. Long-term projection
   4. Absorbing chain

X. Laboratory Exercises

This course does not require a separate lab.

XI. Technology Component

All calculations involving real-world data and matrices will be done using the appropriate technology, calculator or computer program.

XII. Special Projects/Activities

The student will be required to keep a "reflective notebook" in which, after each class, they enter their own assessments of what they have learned, and what questions they are left with from the class. The student will select one problem, which the student thinks best reflects the way the mathematical topic will be used in a technical context, from each exercise set. A detailed solution to the problem will be included in the student's reflective notebook.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Barnett/Ziegler/Byleen. *Finite Mathematics*. Ninth Edition.
Upper Saddle River, NJ: Prentice Hall, 2003.
ISBN: 0-13-033840-0

B. Alternative Textbooks

Student supplements as provided by the publisher.

C. Supplemental Print Materials

Materials provided by the publisher.

D. Supplemental Online Materials

Online materials supplied by the publisher.

Course Title: MATH 1312: Calculus for Students of Business

Semester Credit Hours: 3 (3,0)

I. Course Overview

Calculus for Students of Business covers topics from calculus that should be particularly useful for students studying economics and finance. Such topics include regression analysis, mathematical modeling, rate of change, and marginal analysis from differential calculus. Topics covered from integral calculus include optimization and area calculations as they apply to average value, value of continuous income flows, coefficients of inequity, and consumer and producer surplus. Students should acquire the necessary mathematical knowledge and skills for further study in economics and finance.

II. PMU Competencies and Learning Outcomes

Students of MATH 1312 will continue to develop the quantitative skills needed to be successful in subsequent courses in business and finance and to make rational business decisions about the future, as well as find practical solutions to problems in the present. The students will continue to learn how to use these tools to communicate their ideas and solutions to others. And the students will continue to experience the use of "real-world" data obtained from sources like the Internet. Students will become adept at using the Web-based course supplement to access course materials and communicate with fellow classmates and the instructor. They will enhance their teamwork and leadership skills by working in groups to achieve the solutions to designated exercises.

III. Detailed Course Description

The course begins with a discussion of regression analysis to model real-world phenomena. It proceeds to apply the concept of rate of change to study marginal analysis, elasticity of demand, and management of resources. The course concludes by using integral calculus to study areas as applied to such topics as average value, continuous income flow, coefficient of inequity, and consumer surplus and producer surplus. In all cases the emphasis of the course should be on concepts and applications to business and finance. Emphasis on memorization of formula and algorithms should be minimal.

IV. Requirements Fulfilled

MATH 1312 satisfies three hours of the College Core mathematics requirements. It is required of all students pursuing degrees from the College of Business Administration. The course should be taken immediately after the student completes MATH 1311.

V. Required Prerequisites

MATH 1311: Finite Mathematics for Students of Business.

VI. Learning Outcomes

A. To learn basic tools from calculus that can be of use in subsequent courses in business and finance.

B. To learn to solve problems using the tools of calculus.

C. To learn to communicate the solutions of technical problems to others.

D. To develop improved collaborative skills.

VII. Assessment Strategy

For purpose of final course grades (summative assessment), students should be assessed via their performance on in-class quizzes and exams which focus on the applications of mathematics to business and finance.

- Weekly 15-minute, in-class quizzes over assigned homework to motivate students to do the work and receive credit accordingly.
- Three class-length, in-class exams to assess students' accumulative mastery of content covered prior to time of exam.
- A comprehensive final exam to assess students' accumulative mastery of course material.

Students' final grades will be based on 15% credit for the quizzes, 50% for the exams, and 35% for the final exam.

Feedback from the instructor (formative assessment) should come via the students' "reflective notebooks."

- At the end of each week the instructor collects the students' notebooks. He then reads the students' reflections and chosen problems for that week and enters appropriate written responses into the notebooks.

The final grades and student and instructor observations from the student's "reflective notebook" will be included in the student's portfolio for use in the final assessment capstone course. The intent here is to document the student's maturation as he proceeds through the curriculum.

VIII. Course Format

Instruction: Primary instruction is to be in a lecture format with the course meeting three times per week for one hour each meeting. At least once per week the students should be allowed to work for at least 30 minutes in class, in groups of two or three, on an application problem chosen from the text by the instructor.

Web supplement: Course homepage (using commercial Web tool, WebCt or BLACKBOARD) should contain the following:

- Course syllabus.
- Course assignments.
- Keys to quizzes and exams (after students have completed them).
- Course calendar (an active utility).
- Course e-mail utility (an active utility).
- Course discussion list (an active utility).
- Student course grades (an active utility).

Classroom Hours (3 hours per week) **Class:** 3
Lab: 0

IX. Topics to be Covered

A. Chapter 1
   1. Regression analysis using a calculator
   2. Conceptual understanding of method of least squares
   3. Modeling with linear, quadratic, exponential, and logarithmic functions, and logistic curves

B. Chapter 2
   1. Conceptual understanding of "limit"
   2. Average rate of change
   3. Instantaneous rate of change
   4. Tangent line to approximate graphs
   5. Derivative as a limit of difference quotient

C. Chapter 3
   1. Derivative rules
   2. Marginal analysis
   3. Elasticity of Demand
   4. Management of renewable natural resources

D. Chapter 4
   1. Optimization (skip section 4.4)

E. Chapter 5
   1. Antiderivatives
   2. Power and exponential rules
   3. Distance (left and right sums and error bounds)
   4. Definite integral (average value, continuous income flow)
   5. Areas (Lorentz Curves, Coefficient of inequity, Consumer's surplus, Producer's surplus.)

X. Laboratory Exercises

This course does not require a separate lab.

XI. Technology Component

Calculator or computer program capable of performing regression analysis using real-world data.

XII. Special Projects/Activities

The student will be required to keep a "reflective notebook" in which, after each class, they enter their own assessments of what they have learned, and what questions they are left with from the class. The student will select one problem, which the student thinks best reflects the way the mathematical topic will be used in a technical context, from each exercise set. A detailed solution to the problem will be included in the student's "reflective notebook."

XIII. Textbooks and Teaching Aids

A. Required Textbook

Edmond Tomastik. *Calculus Applications and Technology for Business, Social and Life Sciences*. Forth Edition. Belmont, CA: Brooks/Cole, 2004. ISBN: 0534464963

Turning Point audience response system (a technology supplement to accompany the text)

B. Alternative Textbooks

None

C. Supplemental Print Materials

Materials provided by the publisher.

D. Supplemental Online Materials

Materials provided by the publisher.

Course Title: MATH 1313: Statistical Methods

Semester Credit Hours: 3 (3,0)

I. Course Overview

Statistical Methods covers statistical models and methods of analyzing data. These include estimation, tests of significance, analysis of variance, linear regression, and correlation. Students will acquire the necessary statistical basis for using available information to make rational decisions. The prerequisite for MATH 1313 is the algebraic manipulation skill commensurate with that gained in the Preparation Year Program.

II. PMU Competencies and Learning Outcomes

Students of MATH 1313 will gain the statistical knowledge of data collection and analysis needed to make rational business decisions. The students will begin to learn how to use these tools to communicate their ideas and solutions to other. And the students will be introduced to data obtained from sources available on the Internet and learn how to use professional software to analyze such data. They will enhance their teamwork and leadership skills by working in groups to achieve the solutions to designated exercises.

III. Detailed Course Description

The course begins with a discussion of data needs, types, sources, presentation, and analysis. Such analysis includes measures of central tendency, variation, and coefficient of correlation. Basis probability and probability distributions are discussed. These include covariance, and binomial and normal distribution. The course concludes with sampling distribution and confidence intervals, hypothesis testing, regression analysis, and control charts. Emphasis is on the use of statistics to decision making in the managerial context. Emphasis on memorization of formula and algorithms should be minimal.

IV. Requirements Fulfilled

MATH 1313 satisfies three hours of the College Core mathematics requirements. MATH 1313 is a recommended elective for all students and required of all students entering the College of Business Administration or the Interior Design program in the College of Engineering.

V. Required Prerequisites

The prerequisite for MATH 1313 is the algebraic manipulation skill commensurate with that gained in the Preparation Year Program.

VI. Learning Outcomes

A. To learn to use statistical analysis in decision making.

B. To develop an understanding of the appropriate and inappropriate use of statistical data to make inferences.

C. To learn how to use professional software in statistical analysis.

VII. Assessment Strategy

For the purpose of final course grades (summative assessment), students should be assessed via their performance on in-class quizzes and exams which focus on the applications of the mathematics to business and finance.

- Weekly 15-minute, in-class quizzes over assigned homework to motivate students to do the work and award credit accordingly.
- Three class-length, in-class exams to assess students' accumulative mastery of content covered prior to time of exam.
- A comprehensive final exam to assess students' accumulative mastery of course material.

Students' final grades will be based on 15% credit for the quizzes, 50% for the exams, and 35% for the final.

Feedback from the instructor (formative assessment) should come via the students' "reflective notebooks." (See "Special Projects.")

- At the end of each week the instructor collects the students notebooks. He then reads the students' reflections and chosen problems for that week and enters appropriate written responses into the notebooks.

The final grades and student and instructor observations from the student's "reflective notebook" will be included in the student's portfolio for use in the final assessment capstone course. The intent here is to document the student's maturation as he proceeds through the curriculum.

VIII. Course Format

Instruction: Primary instruction is to be in a lecture format with the course meeting three times per week for one hour each meeting. At least once per week the students should be allowed to work for at least 30 minutes in class, in groups of two or three, on an application problem chosen from the text by the instructor.

Web supplement: The course homepage (using commercial Web tool, WebCt or BLACKBOARD) should contain the following:

- Course syllabus.
- Course assignments.
- Keys to quizzes and exams (after students have completed them).
- Course calendar (an active utility).
- Course e-mail utility (an active utility).
- Course discussion list (an active utility).
- Student course grades (an active utility).

Classroom Hours (3 hours per week) **Class:** 3
Lab: 0

IX. Topics to be Covered

A. Introduction to data analysis
   1. Need for data
   2. Types of data
   3. Sources of data
   4. Design of survey research
   5. Types of sampling methods
   6. Evaluating survey worthiness

B. Presenting data
   1. Tables and charts for numerical data
   2. Bivariate data
   3. Tables and carts for categorical data
   4. Bivariate categorical data

C. Numerical descriptive data
   1. Measure of central tendency
   2. Variation
   3. Descriptive summary statistics
   4. Coefficient of correlation
   5. Pitfalls and ethical issues

D. Basic probability
   1. Basis probability
   2. Conditional probability
   3. Ethical issues

E. Probability distributions
   1. Discrete random variable
   2. Covariance and application to finance
   3. Binomial distribution
   4. Normal distribution

F. Sampling distribution and confidence intervals
   1. Confidence intervals
   2. Estimation of the mean
   3. Estimation of proportion
   4. Sampling size
   5. Ethical issues

G. Hypothesis testing
   1. Z test
   2. t test
   3. Proportions
   4. Pitfalls and ethical issues
   5. Inference for comparing two means
   6. Inference for comparing two proportions

H. Simple linear regression
   1. Models
   2. Variation
   3. Residual analysis

I. Multiple regression
   Developing a model

J. Applications of quality and productivity
   Control charts

X. Laboratory Exercises

This course does not require a separate lab.

XI. Technology Component

A. Microsoft Excel 5.0 or higher with the Phstat2 add-on (furnished with text). The students will gain experience with this professional software as they use it to complete the exercises in the text.

B. Either BLACKBOARD, or WebCt , see "Course Format." In the modern world, it is imperative have as much opportunity as possible to actively interact with the Internet.

XII. Special Projects/Activities

The student will be required to keep a "reflective notebook" in which, after each class, they enter their own assessments of what they learned, and what questions they are left with from the class. The student will select one problem, which the student thinks best reflects the way the mathematical topic will be used in a technical context, from each exercise set. A detailed solution to the problem will be included in the student's reflective notebook.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Levine, David, Timothy Krehbiel, and Mark Berenson. *Business Statistics: A First Course*. Third Edition. Upper Saddle River, NJ: Prentice Hall, 2003.
ISBN: 0-13-034827

B. Alternative Textbooks

None

C. Supplemental Print Materials

As available from publisher.

D. Supplemental Online Materials

As available from publisher.

Course Title: MATH 1321 Pre-Calculus Mathematics

Semester Credit Hours: 3 (3,0)

I. Course Overview

Pre-Calculus Mathematics covers those topics needed for successful completion of Calculus I. Such topics include modeling with functions: linear, quadratic, exponential, and logarithmic. In addition, trigonometric functions with the related laws and identities are covered in some detail. Students should acquire the necessary mathematical knowledge and skills for further studies in calculus and engineering. The prerequisite for MATH 1321 is the algebraic manipulation skill commensurate with that gained in the Preparation Year Program.

II. PMU Competencies and Learning Outcomes

Students of MATH 1321 will begin to develop the quantitative skills needed to be successful in subsequent courses in calculus as well as interior design. These skills will enhance their ability to analyze and solve problems in a technical context and communicate their solutions to other professionals using the language of mathematics. Students will become adept at using the Web-based course supplement to access course materials and communicate with fellow classmates and the instructor. They will enhance their teamwork and leadership skills by working in groups to achieve the solutions to designated exercises.

III. Detailed Course Description

MATH 1321 covers topics normally assumed to be prerequisite knowledge and skills for calculus, as well as applicable to the field of interior design. These topics include modeling with linear, quadratic, exponential, and logarithmic functions. A significant portion of the course is devoted to Trigonometry including properties of sine, cosine, and other trigonometric functions. The laws of sines and cosines are covered along with the sum and difference formulas for each. Compositions, inverses, and combinations of functions are also covered. The emphasis is on concepts and applications to physical science, interior design, and engineering, with minimal emphasis on memorization of formula and algorithms.

IV. Requirements Fulfilled

MATH 1321 satisfies three hours of the university core mathematics requirements. MATH 1321, or skills and knowledge there from, is required for entry into MATH 1422: Calculus I. MATH 1321 should be taken by all students entering the Interior Design program in the College of Engineering.

V. Required Prerequisites

The prerequisite for MATH 1321 is the algebraic manipulation skill commensurate with that gained in the Preparation Year Program.

VI. Learning Outcomes

A. To learn the basic tools required for the study of calculus.

B. To develop the ability to employ functions to model real-world phenomenon.

C. To learn to solve problems using the tools of mathematical modeling.

D. To learn to communicate the solutions of technical problems to others.

E. To develop improved collaborative skills.

VII. Assessment Strategy

For the purpose of final course grades (summative assessment), students should be assessed via their performance on in-class quizzes and exams which focus on the applications of the mathematics to business and finance.

- Weekly 15-minute, in-class quizzes over assigned homework to motivate students to do the work and award credit accordingly.
- Three class-length, in-class exams to assess students' accumulative mastery of content covered prior to time of exam.
- A comprehensive final exam to assess students' accumulative mastery of course material.

Students' final grades will be based on 15% credit for the quizzes, 50% for the exams, and 35% for the final.

Feedback from the instructor (formative assessment) should come via the students' "reflective notebooks."

- At the end of each week the instructor collects the students notebooks. He then reads the students' reflections and chosen problems for that week and enters appropriate written responses into the notebooks.

The final grades and student and instructor observations from the student's "reflective notebook" will be included in the student's portfolio for use in the final assessment capstone course. The intent here is to document the student's maturation as he proceeds through the curriculum.

VIII. Course Format

Instruction: Primary instruction is to be in a lecture format with the course meeting three times per week for one hour each meeting. At least once per week the students should be allowed to work for at least 30 minutes in class, in groups of two or three, on an application problem chosen from the text by the instructor.

Web Supplement: Course homepage (using commercial Web tool, WebCt or BLACKBOARD) should contain the following:

- Course syllabus.
- Course assignments.
- Keys to quizzes and exams (after students have completed them).
- Course calendar (an active utility).

- Course e-mail utility (an active utility).
- Course discussion list (an active utility).
- Student course grades (an active utility).

Classroom Hours (3 hours per week) **Class:** 3
Lab: 0

IX. Topics to be Covered

A. Functions, lines, and change
   1. Notation
   2. Rate of change
   3. Linear functions
   4. Fitting linear functions to data

B. Functions, quadratics, and concavity
   1. Input/Output
   2. Domain/Range
   3. Piecewise defined functions
   4. Inverse functions
   5. Concavity
   6. Quadratics

C. Exponential functions
   1. Family of exponential functions
   2. Comparison of exponential with linear functions
   3. Graphs of exponential functions
   4. Continuous growth and the number e

D. Logarithmic functions
   1. Logarithms and their properties
   2. Logarithms and exponential models
   3. The logarithm function
   4. Logarithmic scales

E. Graphs of functions
   1. Shifts
   2. Reflections and symmetry
   3. Stretches and compression
   4. Families of quadratic functions

F. Trigonometric functions
   1. Periodic functions
   2. Sine and cosine functions
   3. Radians
   4. Graphs
   5. Sinusoidal functions
   6. Other trigonometric functions
   7. Inverse trigonometric functions
   8. Laws of sines and cosines
   9. Identities
   10. Sum and difference formula
   11. Trigonometric models
   12. Polar coordinates
   13. Complex numbers and polar coordinates

G. Compositions, inverses, and combinations of functions
   1. Composition
   2. Inverse
   3. Combination

H. Polynomial and rational functions
   1. Power functions
   2. Polynomials
   3. Short-run behavior of polynomials
   4. Rational functions
   5. Sort-run behavior of rational functions
   6. Comparison of power, exponential, and log functions
   7. Fitting exponentials and polynomials to data

X. Laboratory Exercises

This course does not require a separate lab.

XI. Technology Component

Calculator or computer program capable of performing regression analysis using real-world data. Students should have access to a computer algebra system (MAPLE recommended). Students should be given minimal instruction in the use of these technologies and urged to use them to compare graphs of functions and their first and second derivatives.

XII. Special Projects/Activities

Students will be required to keep a "reflective notebook" in which, after each class, they enter their own assessments of what they learned, and what questions they are left with from the class. The student will select one problem, which the student thinks best reflects the way the mathematical topic will be used in a technical context, from each exercise set. A detailed solution to the problem will be included in the student's reflective notebook.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Connally, Eric, Deborah Hughes-Hallett, and Andrew Gleason, et al. *Functions Modeling Change*, Second Edition. Hoboken, NJ: John Wiley and Sons, Inc, 2004.

ISBN: 0471-45653-5

B. Alternative Textbooks

None

C. Supplemental Print Materials

As provided by publisher

D. Supplemental Online Materials

As provided by publisher

Course Title: MATH 1422: Calculus I

Semester Credit Hours: 4 (3,1)

I. Course Overview

Calculus I covers topics from differential calculus with an introduction to integration. Topics include limits of functions, concept of differentiation of one variable with rules for differentiation, and applications of derivatives involving related rates, optimization, and curve sketching. Integration is introduced and the Fundamental Theorem of Calculus is covered. Students should acquire the necessary mathematical knowledge and skills for further study in calculus and engineering. The prerequisite for MATH 1422 is MATH 1321: Pre-Calculus Mathematics, or knowledge and skills therein. The course will be taught in the lecture format, one hour per class, three hours per week, with an additional one-hour problem-solving recitation.

II. PMU Competencies and Learning Outcomes

Students of MATH 1422 will continue to develop the quantitative skills needed to be successful in subsequent courses in calculus and ultimately in their courses in engineering. These skills will enhance their ability to analyze and solve problems in a technical context and communicate their solutions to other professionals using the language of mathematics. Students will become adept at using the Web-based course supplement to access course materials and communicate with fellow classmates and the instructor. They will enhance their teamwork and leadership skills by working in groups to achieve the solutions to designated exercises.

III. Detailed Course Description

MATH 1422 is a mainstream course in Differential Calculus. It covers both the mechanics of computing derivatives and their applications to problems arising in the physical sciences and engineering. Such topics include limits of functions, concept of differentiation of one variable with rules for differentiation, and applications of derivatives involving related rates, optimization, and curve sketching. In addition the indefinite and definite integral are introduced. In all cases the emphasis of the course is on concepts and applications to physical science and engineering. Emphasis on memorization of formula and algorithms should be minimal.

IV. Requirements Fulfilled

MATH 1422 satisfies four hours of the College Core mathematics requirements. It is required of all students pursuing degrees from the College of Engineering (except Interior Design). It should be taken as soon as possible after the preparation year.

V. Required Prerequisites

MATH 1321: Pre-Calculus, or skills and knowledge thereof.

VI. Learning Outcomes

A. Learn to compute and apply derivatives

B. To develop an understanding of how differentiation is used to solve problems arising in the physical sciences and engineering.

C. To learn to compute simple integrals

D. To learn to approximate definite integrals numerically

E. To learn to solve problems using the tools of calculus.

F. To learn to communicate the solutions of technical problems to other.

G. To develop improved collaborative skills.

VII. Assessment Strategy

For the purpose of final course grades (summative assessment), students should be assessed via their performance on in-class quizzes and exams that focus on the applications of linear algebra to physical science and engineering.

- Weekly 15-minute, in-class quizzes over assigned homework to motivate students to do the work and earn credit accordingly.
- Three class-length, in-class exams to assess students' accumulative mastery of content covered prior to time of exam.
- A comprehensive final exam to assess students' accumulative mastery of course material.

Students' final grades will be based on 15% credit for the quizzes, 50% for the in-class exams, and 35% for the final exam.

Feedback from the instructor (formative assessment) should come via the students' reflective notebooks.

- At the end of each week the instructor collects the students' notebooks, reads the students' reflections and chosen problems for that week, and enters appropriate written responses into the notebooks.

Final grades and the student and instructor observations from reflective notebooks will be included in the student's portfolio for use in the final assessment capstone course. The intent is to document the student's maturation has he proceeds through the curriculum.

VIII. Course Format

Instruction: Primary instruction is in a lecture plus recitation format with the course meeting three times per week for a one hour lecture, plus once a week for a one hour problem-solving recitation. During the recitation, students should work in groups of two or three on application problems chosen from the text by the instructor.

Web supplement: Course home page (the university's Web tool, WebCt or BLACKBOARD) should contain the following:

- Course syllabus.
- Course assignments.
- Keys to quizzes and exams (after students have completed them).
- Course calendar (an active utility).
- Course e-mail utility (an active utility).
- Course discussion list (an active utility).
- Student course grades (an active utility).

Classroom Hours (4 hours per week)	**Class:**	3
	Recitation:	1

IX. Topics to be Covered

A. Functions and graphs
   1. Lines
   2. Functions and graphs
   3. Inverse functions (including trigonometric functions)

B. Limits and continuity
   1. Limit of a function
   2. Algebraic computation of limits
   3. Continuity
   4. Exponential and logarithmic functions

C. Differentiation
   1. Tangents
   2. Techniques
   3. Trigonometric, exponential, and logarithmic functions
   4. Rates change
   5. Chain rule
   6. Implicit differentiation
   7. Related rates and applications
   8. Linear approximations

D. Applications
   1. Extreme values of a function
   2. Mean value theorem
   3. Curve sketching
   4. L'Hospital's Rule
   5. Optimization in physical sciences and engineering

E. Integration
   1. Antiderivative
   2. Area as limit of sums
   3. Definite integral
   4. Fundamental theorem of calculus
   5. Integration by substitution
   6. Average value of a function
   7. Numerical integration

X. Laboratory Exercises

This course does not require a separate lab other than the recitation section.

XI. Technology Component

Graphing calculator and Computer Algebra system (MAPLE recommended). Students should be given minimal instruction in the use of these technologies and urged to use them to compare graphs of functions and their first and second derivatives.

XII. Special Projects/Activities

Students will be required to keep a "reflective notebook" in which, after each class, they enter their own assessments of what they learned, and what questions remain from the class. From each exercise set, each student will select one problem, which the student thinks best reflects the way the mathematical topic will be used in a technical context. A detailed solution to the problem will be included in the student's reflective notebook.

XIII. Textbooks and Teaching Aids

A. Required Textbook

   1. Strauss, Monty, Gerold Bradley, and Karl Smith . *Calculus*, Third Edition. Upper Saddle River, RI: Prentice Hall, 2002. ISBN: 0-13-092010-X

B. Alternative Textbooks

   None

C. Supplemental Print Materials

   As provided by the publisher

D. Supplemental Online Materials

   As provide by the publisher

Course Title: MATH 1423: Calculus II

Semester Credit Hours: 4 (3,1)

I. Course Overview

Calculus II is the continuation of MATH 1422: Calculus I. It covers topics from integral calculus of one variable, infinite sequences and series, and vectors. Students continue to acquire the necessary mathematical knowledge and skills for further study in calculus and engineering. The prerequisite for MATH 1423 is MATH 1422. The course will be taught in the lecture format, one hour per class, three hours per week, with an additional one-hour problem-solving recitation.

II. PMU Competencies and Learning Outcomes

Students of MATH 1423 will continue to develop the quantitative skills needed to be successful in subsequent courses in calculus and ultimately in their courses in engineering. These skills will enhance their ability to analyze and solve problems in a technical context and communicate their solutions to other professionals using the language of mathematics. Students will become adept at using the Web-based course supplement to access course materials and communicate with fellow classmates and the instructor. They will enhance their teamwork and leadership skills by working in groups to achieve the solutions to designated exercises.

III. Detailed Course Description

MATH 1423 is the continuation of MATH 1422. It covers both the mechanics of computing integrals and their applications to problems arising in the physical sciences and engineering. Such topics include applications of integration to the computation of areas, volumes, and arc length; as well as work and force. Techniques of integration are also covered. Sequences and comparison tests for series are covered along with power series. In all cases the emphasis of the course should be on concepts and applications to physical science and engineering. Emphasis on memorization of formula and algorithms should be minimal.

IV. Requirements Fulfilled

MATH 1423 satisfies 4 hours of the College Core mathematics requirements. It is required of all students pursuing degrees from the College of Engineering (except Interior Design). It should be taken immediately after completion of MATH 1422: Calculus I.

V. Required Prerequisites

MATH 1422: Calculus I

VI. Learning Outcomes

A. To learn to compute and apply definite and indefinite integrals

B. To develop an understanding of how integration is used to solve problems arising in the physical sciences and engineering.

C. To learn to compute complicated integrals

D. To learn to determine limits of simple sequences and series

E. To learn how to work with vectors in 2-space and 3-space

F. To learn to solve problems using the tools of mathematical modeling.

G. To learn to communicate the solutions of technical problems to other.

H. To develop improved collaborative skills.

VII. Assessment Strategy

For the purpose of final course grades (summative assessment), students should be assessed via their performance on in-class quizzes and exams that focus on the applications of linear algebra to physical science and engineering.

- Weekly 15-minute, in-class quizzes over assigned homework to motivate students to do the work and earn credit accordingly.
- Three class-length, in-class exams to assess students' accumulative mastery of content covered prior to time of exam.
- A comprehensive final exam to assess students' accumulative mastery of course material.

Students' final grades will be based on 15% credit for the quizzes, 50% for the in-class exams, and 35% for the final exam.

Feedback from the instructor (formative assessment) should come via the students' reflective notebooks.

- At the end of each week the instructor collects the students' notebooks, reads the students' reflections and chosen problems for that week, and enters appropriate written responses into the notebooks.

Final grades and the student and instructor observations from reflective notebooks will be included in the student's portfolio for use in the final assessment capstone course. The intent is to document the student's maturation has he proceeds through the curriculum.

VIII. Course Format

Instruction: Primary instruction is in a lecture plus recitation format with the course meeting three times per week for a one hour lecture, plus once a week for a one hour problem-solving recitation. During the recitation, students should work in groups of two or three on application problems chosen from the text by the instructor.

Web supplement: Course home page (the university's Web tool, WebCt or BLACKBOARD) should contain the following:

- Course syllabus.
- Course assignments.
- Keys to quizzes and exams (after students have completed them).
- Course calendar (an active utility).
- Course e-mail utility (an active utility).
- Course discussion list (an active utility).
- Students course grades (an active utility).

Classroom Hours (4 hours per week)	**Class:**	3
	Recitation:	1

IX. Topics to be Covered

A. Applications of integration
   1. Area between curves
   2. Volume
   3. Polar form and area
   4. Arc length
   5. Applications to work and force

B. Methods of integration
   1. Substitution and tables
   2. Integration by parts
   3. Trigonometric methods
   4. Partial fractions
   5. Improper integrals

C. Infinite series
   1. Sequences
   2. Infinite series (geometric series)
   3. Integral p-Test
   4. Comparison tests
   5. Power series
   6. Taylor and Maclaurin Series

D. Vectors in the plane and in space
   1. Vectors in R2
   2. Vectors in R3
   3. The Dot Product
   4. The Cross Product
   5. Parametric representations of curves
   6. Planes in R3

X. Laboratory Exercises

This course does not require a separate lab other than the recitation section.

XI. Technology Component

Graphing calculator and Computer Algebra system (MAPLE recommended). Students should be given minimal instruction in the use of these technologies and urged to use them to compare graphs of functions and their first and second derivatives.

XII. Special Projects/Activities

Students will be required to keep a "reflective notebook" in which, after each class, they enter their own assessments of what they learned, and what questions remain from the class. From each exercise set, each student will select one problem, which the student thinks best reflects the way the mathematical topic will be used in a technical context. A detailed solution to the problem will be included in the student's reflective notebook.

XIII. Textbooks and Teaching Aids

A. Required Textbook

1. Strauss, Monty, Gerold Bradley, and Karl Smith . *Calculus*, Third Edition. Upper Saddle River, RI: Prentice Hall, 2002. ISBN: 0-13-092010

B. Alternative Textbooks

None

C. Supplemental Print Materials

As available from publisher

D. Supplemental Online Materials

As available from publisher

Course Title: MATH 1324: Calculus III

Semester Credit Hours: 3 (3,0)

I. Course Overview

Calculus III is the continuation of MATH 1423: Calculus II and the final course in the pre-engineering calculus sequence. It covers topics from multivariable calculus including vector-valued functions, multiple integration, and vector analysis. Students complete their acquisition of the necessary mathematical knowledge and skills for further study in engineering. The prerequisite for MATH 1324 is MATH 1423.

II. PMU Competencies and Learning Outcomes

Students of MATH 1324 will develop the quantitative skills needed to be successful in subsequent courses in engineering. These skills will enhance their ability to analyze and solve problems in engineering and communicate their solutions to other engineering professionals using the language of mathematics. Students will become adept at using the Web-based course supplement to access course materials and communicate with fellow classmates and the instructor. They will enhance their teamwork and leadership skills by working in groups to achieve the solutions to designated exercises.

III. Detailed Course Description

MATH 1324 is the continuation of MATH 1423 and the culmination of the three-course calculus series. It covers topics from multivariable calculus including vector-valued functions, multiple integration, and vector analysis. Differentiation and integration of vector valued functions are studied with application of ballistics. Techniques and applications of partial differentiation are covered as well as multiple integration with application to surface areas, mass, and moments. The course ends with a discussion of the multiple variable versions of the Fundamental Theorem of Calculus: Greens Theorem and Stokes Theorem. In all cases the emphasis of the course should be on concepts and applications to physical science and engineering. Emphasis on memorization of formula and algorithms should be minimal.

IV. Requirements Fulfilled

MATH 1324 satisfies three hours of the College Core mathematics requirements. It is required of all students pursuing degrees from the College of Engineering (except Interior Design). It should be taken immediately after completion of MATH 1423.

V. Required Prerequisites

MATH 1423: Calculus II

VI. Learning Outcomes

A. To develop understanding of modeling in three dimensions.

B. To learn to compute and apply partial derivatives.

C. To develop an understanding of how partial differentiation and multiple integration is used to solve problems arising in the physical sciences and engineering..

D. To learn to communicate the solutions of technical problems to other.

E. To develop improved collaborative skills.

VII. Assessment Strategy

For purpose of final course grades (summative assessment), students should be assessed via their performance on in-class quizzes and exams which focus on the applications of the mathematics to physical science and engineering.

- Weekly 15-minute, in-class quizzes over assigned homework to motivate students to do the work and award credit accordingly.
- Three class-length, in-class exams to assess students' accumulative mastery of content covered prior to time of exam.
- A comprehensive final exam to assess students' accumulative mastery of course material.

Students' final grades will be based on 15% credit for the quizzes, 50% for the exams, and 35% for the final.

Feedback from the instructor (formative assessment) should come via the students' "reflective notebooks."

- At the end of each week the instructor collects the students notebooks. He then reads the students' reflections and chosen problems for that week and enters appropriate written responses into the notebooks.

The final grades, and student and instructor observations from the student's "reflective notebook" will be included in the student's portfolio for use in the final assessment capstone course. The intent here is to document the students maturation as he proceeds through the curriculum.

VIII. Course Format

Instruction: Primary instruction is to be in a lecture format with the course meeting three times per week for one hour each meeting. At least once per week the students should be allowed to work for at least 30 minutes in class, in groups of two or three, on an application problem chosen from the text by the instructor.

Web supplement. Course homepage (using commercial Web tool, WebCt or BLACKBOARD) should contain the following:

- Course syllabus.
- Course assignments.
- Keys to quizzes and exams (after students have completed them).

- Course calendar (an active utility).
- Course e-mail utility (an active utility).
- Course discussion list (an active utility).
- Student course grades (an active utility).

Classroom Hours (3 hours per week) **Class:** 3
Lab: 0

IX. Topics to be Covered

A. Vector valued functions
   1. Differentiation and integration
   2. Modeling ballistics
   3. Tangents and normals

B. Partial differentiation
   1. Limits and continuity
   2. Derivatives
   3. Tangent planes
   4. Chain Rule
   5. Directional derivatives and gradient
   6. Extrema

C. Multiple integration
   1. Double integration
   2. Surface area
   3. Triple integrals
   4. Mass and moments
   5. Change of variables

D. Vectors analysis
   1. Divergence and curl
   2. Line integrals
   3. Path independence
   4. Green's Theorem
   5. Surface integrals
   6. Stokes Theorem

X. Laboratory Exercises

This course does not require a separate lab.

XI. Technology Component

Graphing calculator and Computer Algebra system (MAPLE recommended). Students should be given minimal instruction in the use of these technologies and urged to use the technology to draw lots of three-dimensional graphs.

XII. Special Projects/Activities

Students will be required to keep a "reflective notebook" in which, after each class, they enter their own assessments of what they learned, and what questions they are left with from the class. The student will select one problem, which the student thinks best reflects the way the mathematical topic will be used in a technical context, from each exercise set. A detailed solution to the problem will be included in the student's reflective notebook.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Strauss, Monty, Gerold Bradley, and Karl Smith . *Calculus*, Third Edition. Upper Saddle River, RI: Prentice Hall, 2002.
ISBN: 0-13-092010

B. Alternative Textbooks

None

C. Supplemental Print Materials

As available from publisher.

D. Supplemental Online Materials

As available from publisher.

Course Title: MATH 2331: Linear Algebra

Semester Credit Hours: 3 (3,0)

I. Course Overview

Linear Algebra covers topics from linear algebra including vector spaces, linear transformations and matrices, matrix operations, and eigenvectors and eigenvalues. Students acquire mathematical knowledge and skills with matrices, linear systems, and vector spaces necessary for further study in engineering. The prerequisite for MATH 2331 is MATH 1324, Calculus III, or concurrent enrollment therein. The course will be taught in the lecture format, one hour per class, three classes per week.

II. PMU Competencies and Learning Outcomes

Students of MATH 2331 will develop the quantitative skills with matrices and linear systems needed to be successful in subsequent courses in engineering. These skills will enhance their ability to analyze and solve and communicate their solutions to fellow professionals using the language of mathematics. Students will continue to use the Web-based course supplement to access course materials and communicate with classmates and the instructor. They will enhance teamwork and leadership skills by working in groups to achieve the solutions to designated exercises.

III. Detailed Course Description

MATH 2331 covers topics of matrix algebra and linear spaces. Matrix topics include systems of linear equations, row echelon form, matrix algebra, elementary matrices, determinants, and Cramer's Rule. Vector space topics include subspaces, linear dependence and independence, basis and dimension, row and column spaces. Linear transformations are discussed in detail including matrix representations and similarity. The course concludes with a discussion of orthogonality and eigenvalues and eigenvectors. The major emphasis is on applications to problems from the physical sciences and engineering.

IV. Requirements Fulfilled

MATH 2331 satisfies three hours of the College Core mathematics requirements. It is required of all students pursuing degrees from the College of Engineering (except Interior Design). It should be taken immediately after completion of, or concurrent with, MATH 1324.

V. Required Prerequisites

Completion of, or concurrent enrollment in, MATH 1324: Calculus III

VI. Learning Outcomes

A. To develop understanding of vector spaces in three and higher dimensions.

B. Learn to use and manipulate matrices.

C. To develop an understanding of how matrix algebra and vector space concepts are used to solve problems arising in the physical sciences and engineering.

D. To learn to communicate the solutions of technical problems to other.

E. To develop improved collaborative skills.

VII. Assessment Strategy

For the purpose of final course grades (summative assessment), students should be assessed via their performance on in-class quizzes and exams that focus on the applications of linear algebra to physical science and engineering.

- Weekly 15-minute, in-class quizzes over assigned homework to motivate students to do the work and earn credit accordingly.
- Three class-length, in-class exams to assess students' accumulative mastery of content covered prior to time of exam.
- A comprehensive final exam to assess students' accumulative mastery of course material.

Students' final grades will be based on 15% credit for the quizzes, 50% for the in-class exams, and 35% for the final exam.

Feedback from the instructor (formative assessment) should come via the students' reflective notebooks.

- At the end of each week the instructor collects the students' notebooks, reads the students' reflections and chosen problems for that week, and enters appropriate written responses into the notebooks.

Final grades and the student and instructor observations from reflective notebooks will be included in the student's portfolio for use in the final assessment capstone course. The intent is to document the student's maturation has he proceeds through the curriculum.

VIII. Course Format

Instruction: Primary instruction is a lecture format, with the course meeting three times per week for one hour each meeting. At least once per week, the students should be allowed to work in class for at least 30 minutes in groups of two or three on an application problem chosen from the text by the instructor.

Web supplement: Course home page (the university's Web tool, WebCt or BLACKBOARD) should contain the following:

- Course syllabus.
- Course assignments.
- Keys to quizzes and exams (after students have completed them).
- Course calendar (an active utility).
- Course e-mail (an active utility).
- Course discussion list (an active utility).
- Student course grades (an active utility).

Classroom Hours (3 hours per week) **Class:** 3
Lab: 0

IX. Topics to be Covered

A. Matrices and linear systems
   1. Systems of linear equations
   2. Row echelon form
   3. Matrix algebra
   4. Elementary matrices

B. Determinants
   1. Properties of determinants
   2. Cramer's Rule (briefly)

C. Vector spaces
   1. Examples
   2. Subspaces
   3. Linear independence
   4. Basis and dimension
   5. Change of basis
   6. Row and column space

D. Linear transformations
   1. Examples
   2. Matrix representations
   3. Similarity

E. Orthogonality
   1. Scalar product
   2. Orghogonal Subspaces
   3. Least squares problems

F. Eigenvalues
   1. Eigenvalues and eigenvectors
   2. Systems of linear differential equations
   3. Diagonalization

X. Laboratory Exercises

This course does not require a separate lab.

XI. Technology Component

This course has no technology component other than use of students' personal laptop computers as appropriate.

XII. Special Projects/Activities

Students will be required to keep a "reflective notebook" in which, after each class, they enter their own assessments of what they learned, and what questions remain from the class. From each exercise set, each student will select one problem, which the student thinks best reflects the way the mathematical topic will be used in a technical context. A detailed solution to the problem will be included in the student's reflective notebook.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Leon, Steven. Linear *Algebra with Applications*, Sixth Edition. Upper Saddle River, RI: Prentice Hall, 2002.
ISBN: 0-13-033781-1

B. Alternative Textbooks

None

C. Supplemental Print Materials

As available from publisher

D. Supplemental Online Materials

As available from publisher

Course Title: MATH 2332: Ordinary Differential Equations

Semester Credit Hours: 3 (3,0)

I. Course Overview

Ordinary Differential Equations covers topics involving single variable differential equations. These include methods for solving first and second order differential equations, Laplace Transforms, and Fourier Series and Transforms. Students acquire mathematical knowledge and skills to model and solve problems arising form engineering. The prerequisite for MATH 2332 is MATH 2331: Linear Algebra. The course will be taught in the lecture format, one hour per class, three classes per week.

II. PMU Competencies and Learning Outcomes

Students of MATH 2332 will develop the skills needed to model problems arising in the physical sciences and engineering. These skills will enhance their ability to analyze and solve problems in engineering and communicate their solutions to fellow professionals using the language of mathematics. Students will continue to use the Web-based course supplement to access course materials and communicate with classmates and the instructor. They will enhance teamwork and leadership skills by working in groups to achieve the solutions to designated exercises.

III. Detailed Course Description

MATH 2332 develops the basic methods for solving first order differential equations. These include separation of variables, exact differential equations, and integrating factors. Problems arising from the physical science and engineering involving such equations are modeled and solved. Higher order linear differential equations, both homogeneous and non-homogeneous, are discussed using the methods of undetermined coefficients and variation of parameters. Laplace Transforms are covered in some detail including transformations of derivatives and integrals, unit step functions, and Dirac's Delta function. Differentiation and integration of transforms are covered along with convolution and integral equations. These are applied to solutions of differential equations and systems of differential equations. MATH 2332 concludes with a brief discussion of Fourier Series approximations to periodic, even, and odd functions. The major emphasis is on modeling and solving problems arising in the physical sciences and engineering.

IV. Requirements Fulfilled

MATH 2332 satisfies three hours of the College Core mathematics requirements. It is required of all students pursuing degrees from the College of Engineering (except Interior Design). It should be taken immediately after completion of MATH 2331: Linear Algebra.

V. Required Prerequisites

MATH 1324: Calculus III

VI. Learning Outcomes

A. To develop skills in modeling problems arising from the physical sciences and engineering.

B. To learn to use the basic methods from differential equations to solve problems arising from the physical sciences and engineering.

C. To develop an understanding of the use of Laplace Transforms to solve problems arising in the physical sciences and engineering.

D. To develop an understanding of the use of approximation techniques to analyze problems arising in the physical sciences and engineering.

E To learn to communicate the solutions of technical problems to others.

F. To develop improved collaborative skills.

VII. Assessment Strategy

For the purpose of final course grades (summative assessment), students should be assessed via their performance on in-class quizzes and exams that focus on applications to physical science and engineering. Students should be allowed to use the attached flow chart while taking all quizzes and exams.

- Weekly 15-minute, in-class quizzes over assigned homework to motivate students to do the work and earn credit accordingly.
- Three class-length, in-class exams to assess students' accumulative mastery of content covered prior to time of exam.
- A comprehensive final exam to assess students' accumulative mastery of course material.

Students final grades will be based on 15% credit for the quizzes, 50% for in-class exams, and 35% for the final exam.

Feedback from the instructor (formative assessment) should come via the students' reflective notebooks.

- At the end of each week, the instructor collects the students' notebooks, reads the students' reflections and chosen problems for that week, and enters appropriate written responses into the notebooks.

The final grades and the student and instructor observations from the student's reflective notebook will be included in the student's portfolio for use in the final assessment capstone course. The intent is to document the student's maturation has he proceeds through the curriculum.

VIII. Course Format

Instruction: Primary instruction is in a lecture format with the course meeting three times per week for one hour each meeting. At least once per week, the students should be allowed to work in class for at least 30 minutes in groups of two or three on an application problem chosen from the text by the instructor.

Web supplement: Course home page (the university's Web tool, WebCt or BLACKBOARD) should contain the following:

- Course syllabus.
- Course assignments.
- Keys to quizzes and exams (after students have completed them).
- Course calendar (an active utility).
- Course e-mail (an active utility).
- Course discussion list (an active utility).
- Student course grades (an active utility).

Classroom Hours (3 hours per week) **Class:** 3
Lab: 0

IX. Topics to be Covered

A. First order differential equations
   1. Basic concepts
   2. Direction fields
   3. Separable differential equations
   4. Modeling: separable equations
   5. Exact differential equations, integrating factors
   6. Linear differential equations
   7. Modeling: electric circuits

B. Linear second order differential equations
   1. Homogeneous linear equations of second order
   2. Second order homogeneous equations with constant coefficients
   3. Complex exponential function
   4. Euler-Cauchy equation
   5. Non-homogeneous equations
   6. Solution by undetermined coefficients
   7. Solution by variation of parameters
   8. Higher order differential equations
   9. Higher order homogeneous equations with constant coefficients
   10. Higher order non-homogeneous equations

C. Laplace Transforms
   1. Inverse transforms, linearity, and shifting
   2. Transforms of derivatives and integrals
   3. Step functions, second shifting, and Dirac's Delta Function
   4. Differentiation and integration of transforms
   5. Convolution
   6. Partial fractions
   7. General formulas
   8. Table of Laplace Transforms

D. Fourier Series and integrals
   1. Periodic functions and trigonometric series
   2. Fourier series
   3. Functions of Period p=2L
   4. Even and odd functions
   5. Fourier integrals (optional if time permits)
   6. Fourier cosine and sine transforms (optional if time permits)
   7. Fourier transform (optional if time permits)

X. Laboratory Exercises

This course does not require a separate lab.

XI. Technology Component

This course has no technology component other than use of students' personal laptop computers as appropriate.

XII. Special Projects/Activities

Students will be required to keep a "reflective notebook" in which, after each class, they enter their own assessments of what they learned, and what questions remain from the class. From each exercise set, each student will select one problem, which the student thinks best reflects the way the mathematical topic will be used in a technical context. A detailed solution to the problem will be included in the student's reflective notebook.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Kreysizg, Ewin. *Advanced Engineering Mathematics*, Eighth Edition. Indianapolis, IN: Wiley and Sons, INC, 2004.
ISBN: 0-471-15496-2

B. Alternative Textbooks

None

C. Supplemental Print Materials

1. Attached Flow Chart for solving first order differential equations. To be given to students for use on exams and quizzes.
2. As available from publisher

D. Supplemental Online Materials

As available from publisher