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Course Outline for MATH 2

CALCULUS II

Effective: Fall 2012

I. CATALOG DESCRIPTION:
MATH 2 — CALCULUS II — 5.00 units

Continuation of single-variable differential and integral calculus. Topics covered include: inverse and hyperbolic functions; techniques of integration; parametric equations; polar coordinates; sequences, series, power series and Taylor series. Introduction to Cartesian coordinates in three dimensions and operations with vectors. Primarily for mathematics, physical science and engineering majors.

5.00 Units Lecture

Prerequisite
MATH 1 - Calculus I
with a minimum grade of C

Grading Methods:
Letter Grade

Discipline:

	MIN
Lecture Hours:	90.00
No Unit Value Lab	18.00
Total Hours:	108.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

Before entering the course a student should be able to:

A. MATH1
1. Evaluate the limit of a function at a real number;
2. Determine whether a function is continuous at a point or an interval;
3. Find and interpret average and instantaneous rates of change;
4. State the definition of the derivative as the limit of a difference quotient and use the definition to find the derivative of a function;
5. Interpret the derivative as the slope of a tangent line and find the equation of a tangent line to a function;
6. Explain the definitions of velocity and acceleration and use the derivative to find the velocity and acceleration of an object in motion, given the position function for the object;
7. State and apply the rules for differentiating algebraic, trigonometric, inverse, exponential and logarithmic functions;
8. Utilize the chain rule when differentiating functions;
9. Work with differentials and their applications;
10. Use calculus-based methods to analyze functional behavior;
11. Sketch the graphs of algebraic, rational and transcendental functions using the methods of calculus;
12. Find all maxima, minima and points of inflection of a function;
13. Use implicit differentiation;
14. Evaluate the limit of a function at infinity;
15. Apply differentiation to solve related rate and optimization problems;
16. Apply the Mean Value Theorem;
17. Utilize Newton's Method;
18. Evaluate a definite integral as the limit of a Riemann sum;
19. Apply the Fundamental Theorem of Integral Calculus;
20. Evaluate integrals by the method of substitution;
21. Find areas between curves and volumes of solids of revolution;
22. Use logarithmic differentiation.

IV. MEASURABLE OBJECTIVES:

Upon completion of this course, the student should be able to:

A. Graph and differentiate inverse trigonometric functions;
B. Evaluate limits by applying L'Hospital's rule and techniques appropriate to limits of indeterminate forms;
C. Evaluate definite and indefinite integrals by a variety of integration techniques;

D. Apply numerical methods to approximate definite integrals;
E. Evaluate improper integrals;
F. Find arc length and the surface area of a solid of revolution;
G. Solve separable first order differential equations;
H. Solve exponential growth and decay problems;
I. Sketch curves defined by parametric equations;
J. Apply the techniques of calculus to parametric curves;
K. Sketch curves defined by polar equations;
L. Apply the techniques of calculus to polar curves;
M. Determine convergence or divergence of an infinite sequence;
N. Determine convergence of divergence of an infinite series, alternating or non-alternating, by applying tests for convergence;
O. Estimate the sum of a convergent series;
P. Determine convergence or divergence of a power series;
Q. Find the radius and interval of convergence;
R. Apply theorems for differentiation and integration of a power series;
S. Find Taylor and Maclaurin series for a given function;
T. Use the binomial series to find a power series of a function;
U. Perform basic vector algebra in two-space and three-space and interpret the results geometrically;
V. Find dot product and cross product of vectors.

V. CONTENT:

A. Inverse trigonometric functions
    1. Domain and range
    2. Graphs
    3. Differentiation
    4. Antiderivatives and integration formulas
B. Hyperbolic functions
    1. Definitions and graphs
    2. Identities
    3. Differentiation
    4. Antiderivatives and integration formulas
    5. Inverse hyperbolic functions
    6. Differentiation
    7. Antiderivatives and integration formulas
C. Indeterminate forms
    1. Types of indeterminate forms
    2. L'Hospital's rule
    3. Techniques for evaluating limits of indeterminate forms
D. Techniques of integration
    1. Substitution
    2. Inverse trigonometric function integration formulas
    3. Integration by parts
    4. Products of trigonometric functions
    5. Trigonometric substitution
    6. Partial fraction decomposition
    7. Table of Integrals
E. Numerical methods of integration
    1. Midpoint rule
    2. Trapezoidal rule
    3. Simpson's rule
    4. Error analysis
F. Improper integrals
G. Applications of integration
    1. Arc length
    2. Surface area of a solid of revolution
    3. Moments and center of mass
H. Separable first order differential equations
I. Exponential growth and decay
J. Parametric curves and equations;
    1. Curve sketching and direction of motion
    2. Elimination of a parameter
    3. Calculus with parametric curves
        a. Slope of a tangent line
        b. Area
        c. Arc length
K. Polar curves and equations;
    1. Polar coordinates
    2. Curve sketching
    3. Calculus with polar curves
        a. Slope of tangent line
        b. Area
        c. Arc length
L. Infinite sequences
    1. Definition
    2. Geometric sequence
    3. Convergence
    4. Divergence
M. Infinite series
    1. Geometric series
    2. Telescoping series
    3. p-series
    4. Alternating series
    5. Tests for convergence or divergence
        a. nth term divergence test
        b. Integral test
        c. p-series test
        d. Comparison tests
        e. Alternating series test
        f. Ratio and root tests

6. Sum of a convergent series

N. Power series
   1. Definition
   2. Power series representation of a function
   3. Tests for convergence
   4. Radius and interval of convergence
   5. Applications
   6. Binomial series

O. Taylor and Maclaurin series
   1. Definition
   2. Finding the Taylor or Maclaurin series representation of a function
   3. Taylor's inequality

P. Three-dimensional coordinate
   1. Regions in space
   2. Equation of a sphere

Q. Vectors
   1. Operations with vectors
   2. Dot product
   3. Angle between vectors and orthogonal vectors
   4. Scalar and vector projection
   5. Cross product

VI. METHODS OF INSTRUCTION:

A. **Discussion** -
B. **Lecture** -
C. Web- or CD-Rom-based tutorials
D. Student presentations
E. **Lab** - Assignments
F. Collaborative learning

VII. TYPICAL ASSIGNMENTS:

A. Homework
   1. Homework should be assigned from the text and should include a sufficient number and variety of problems to develop both skill and conceptual understanding. Problems should range in level of difficulty from introductory level to challenging. A typical assignment should take an average student 1 to 2 hours for each hour in class.

B. Collaborative learning
   1. Collaborative learning, done in small groups of 2-4 students, can be used to introduce new concepts, build skills, or teach problem solving. Students may be asked to present their results on the board.
   2. Example collaborative learning assignment: Have each group solve a curve-sketching problem and then present their work to the rest of the class, explaining the process they used and their results.

C. Laboratory assignments
   1. Lab assignments can be used to reinforce fundamental concepts and skills or to explore certain concepts in more depth than is possible in-class. They may be designated for individual or group work. Lab assignments are completed in the Open Math Lab where students have access to assistance with the assignments.
   2. Example lab assignment: Sketch a family of curves and comment on how changes in the constant coefficients affect (a) locations of extrema and points of inflection and (3) intervals on which the function is increasing/decreasing, concave upward/downward.

VIII. EVALUATION:

A. **Methods**

   1. Exams/Tests
   2. Quizzes
   3. Projects
   4. Group Projects
   5. Home Work
   6. Lab Activities
   7. Other:

B. **Frequency**

   1. Recommend minimum of four exams plus the final
   2. Homework should be assigned for each section covered
   3. Recommend minimum of eight laboratory assignments over the semester
   4. Number of quizzes and collaborative activities are at the discretion of the instructor

IX. TYPICAL TEXTS:

1. Stewart, James (2012). *Calculus* (7th ed.). Belmont, CA: Brooks/Cole – Thompson Learning.
2. Anton Howard, Irl Bivens and Stephen Davis (2012). *Calculus: Early Transcendentals, Single and Multivariable* (10th ed.). New York, NY: John Wiley & Sons, Inc.
3. Briggs, W. L., and Cochran, L. (2011). *Calculus* (1st ed.). Boston, MA: Pearon-Addison Wesley.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

A. Graphing calculator