

**Course Title:** Calculus II (IAI Code: MTH 902)

**Course Description:** *IAI Description:* Topics include (but are not limited to) the following: limits and continuity; definition of derivative: rate of change, slope; derivatives of polynomial and rational functions; the chain rule; implicit differentials; approximation by differentials; higher order derivatives; Rolle's Theorem: mean value theorem; applications of the derivative; anti-derivative; the definite integral; the fundamental theorem of calculus; area, volume, other applications of the integral; the calculus of the trigonometric functions; logarithmic and exponential functions; techniques of integration, including numerical methods; indeterminate forms: L'Hospital's rule; improper integrals; sequences and series, convergence tests, Taylor series; functions of more than one variable, partial derivatives; the differential, directional derivatives, gradients; double and triple integrals: evaluation and applications.

**Semester Credit Hours:** 3-5

**Prerequisite:** Successful Completion of Calculus I

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**Course Objectives/Standards:**

*based on the Illinois Mathematics Standards (IMS) for Teachers*

Upon completion of this course a student should be able to:

***Knowledge Objectives***

- Apply techniques of integration, including numerical methods, to integrate algebraic and transcendental functions. (IMS 2A, 3A, 4B, 8B3)
- Recognize need for and apply integration by parts, trigonometric substitution, partial fractions, and other integration techniques. (IMS 2A, 4B, 8B3)
- Use the definite integral to find areas, volumes, lengths of curves, growth and decay, work, surface area, computation of moments, centers of mass, etc. (IMS 2A, 3A, 4B, 5A, 7A6)
- Solve differential equations, including separable equations and work with these equations in the context of exponential growth and decay. (IMS 2A, 3A, 4B, 5A, 7A6)
- Explain and represent a series as a sequence of partial sums. (IMS 3A)

- Use the integral and comparison tests for convergence on positive series. (IMS 2A)
- Test alternating series for both absolute and conditional convergence. (IMS 3A)
- Use Taylor series to represent functions. (IMS 2A, 5A)
- Use series in applications. (IMS 2A, 4B, 5A)

### ***Performance Objectives***

- Explain the connection between a function and its antiderivative/indefinite integral. (IMS 3B, 8C1, 8C2, 8C5, 8C6)
- Explain the connection between the indefinite integral & the definite integral [i.e. the Fundamental Theorem of Calculus]. (IMS 3B, 6D1, 7C8, 8C2, 8C5)
- Apply techniques of integration, including numerical methods, to integrate algebraic and transcendental functions. (IMS 2C, 3B, 6D1, 6D3, 7C8, 8C5, 8C6)
- Recognize need for and apply integration by parts, trigonometric substitution, partial fractions, and other integration techniques. (IMS 2C, 3B, 6D1, 8C5, 8C6)
- Use the definite integral to find areas, volumes, lengths of curves, growth and decay, work, surface area, computation of moments, centers of mass, etc. (IMS 2C, 3B, 6C1, 6C2, 6D1, 6D3, 7B6, 7C8, 8C5, 8C6)
- Solve differential equations, including separable equations and work with these equations in the context of exponential growth and decay. (IMS 2C, 3B, 6C1, 6C2, 6D1, 7B6, 7C8, 8C5, 8C6)
- Explain and evaluate improper integrals. (IMS 2C, 3B, 6C1, 6D1, 7C8, 8C2, 8C4, 8C5, 8C6)
- Explain and represent a series as a sequence of partial sums. (IMS 3B, 6D3, 8C1, 8C4, 8C6)
- Use the integral and comparison tests for convergence on positive series. (IMS 2C, 3B, 6C1, 6C2, 6D1, 6D3, 8C4, 8C6)
- Test alternating series for both absolute and conditional convergence. (IMS 3B, 6C2, 6D1, 6D3, 7C8, 8C4, 8C6)
- Use Taylor series to represent functions. (IMS 2C, 3B, 6D1, 6D3, 7B6, 8C1, 8C4, 8C6)
- Use series in applications. (IMS 2C, 3B, 6C1, 6D1, 7C8, 8C2, 8C4, 8C6)

### **Sample of Acceptable Course Assignments/Assessments/Artifacts**

*(by Standard and Indicator)*

#### 2A

- Evaluations of homework problems or class discussions or problem/project presentations or quizzes/exams;
- Computer/calculator programming exercise;

## AAT Sample Course Syllabus – September 2003

- Written analysis of videos modeling problem solving;
- Reflective writing on problem solving;
- Writing/analyzing multiple solution strategy problem solving;
- Peer tutoring on problem solving strategies.

### 2C

- Evaluations of homework problems or class discussions or problem/project presentations or quizzes/exams that demonstrate the ability to generalize mathematical properties from specific cases/problems and formulate theorems or discover more general situations where such properties apply.

### 3A

- Evaluations of homework problems or class discussions or problem/project presentations or quizzes/exams;
- Computer/calculator programming exercise;
- Reflective writing on reasoning;
- Completion of proofs;
- Peer tutoring on reasoning.

### 3B

- Evaluations of homework problems or class discussions or problem/project presentations or quizzes/exams;
- Computer/calculator programming exercise;
- Reflective writing on reasoning with technology;
- Completion of proofs;
- Peer tutoring on reasoning with technology.

### 4B

- Evaluations of homework problems or class discussions or problem/project presentations or quizzes/exams;
- Computer/calculator programming exercise;
- Reflective writing on mathematics and how it relates to other disciplines.

### 5A

- Evaluations of appropriate use of technology on homework problems or class discussions or problem/project presentations or quizzes/exams requiring the use of technology: programming language or graphing calculator or mathematics software or internet resources or power point.

6B3

- Evaluations of ability to apply iteration to Newton's Method through homework problems or class discussions or problem/project presentations or quizzes/exams;
- Computer/calculator programming exercise;
- Reflective writing.

6C1 and 6C2

- Use number sense and proportional reasoning in the solving of calculus problems (finding extrema, points of inflections, asymptotes, max/min problems, related rates, Newton's Method) as evaluated by homework problems or class discussions or problem/project presentations or quizzes/exams;
- Computer/calculator programming exercise;
- Reflective writing;
- Peer tutoring on number sense and proportional reasoning.

6D1 and 6D2

- Evaluations of appropriate use of algorithms with or without technology to solve problems as evidenced by homework problems or class discussions or problem/project presentations or quizzes/exams;
- Computer/calculator programming exercise;
- Reflective writing;
- Peer tutoring on use of algorithms with or without technology to solve problems.

6D3

- Evaluations of ability to apply and use numerical integration to approximate results and solve problems as evidenced by homework problems or class discussions or problem/project presentations or quizzes/exams;
- Computer/calculator programming exercise;
- Reflective writing.

7A6 and 7B6

- Evaluations of homework problems or class discussions or problem/project presentations or quizzes/exams on logarithmic scale and finding derivatives and integrals of exponential/logarithmic functions including in application problems.

7C8

- Evaluations of homework problems or class discussions or problem/project presentations or quizzes/exams on modeling areas under curve as summation of rectangles and use of slices and shells to visualize volume.

8B3

- Evaluation of homework problems or class discussions or problem/project presentations or quizzes/exams;
- Computer/calculator programming exercise on finding integrals of relations such as logarithmic, parametric, absolute value and connections of the calculus to the graphs of these relations.

8C1, 8C2, and 8C4

- Evaluations of homework problems or class discussions or problem/project presentations or quizzes/exams;
- Computer/calculator programming exercise;
- Reflective writing;
- Completion of proofs involving limits and how they relate to rates of change, distance, area, and volume.

8C5 and 8C6

- Evaluations of homework problems or class discussions or problem/project presentations or quizzes/exams;
- Computer/calculator programming exercise;
- Reflective writing;
- Completion of proofs on ALL aspects of calculus: derivatives, integrals, continuity, limits, applications.