

MAT 221 Topics Outline

Course Description.

MAT 221 Calculus II
(Fall and spring)

4cr.

An introduction to the integral calculus of real-valued functions of one real variable. Topics include integrals and their applications in a context that includes polynomial, rational, trigonometric, exponential, and logarithmic functions. Also, infinite sequences and series of real numbers. Offered each semester. Four lecture hours per week. Required of all mathematics majors. **Prerequisite:** MAT 220.

I. The Definite Integral

Week 1	<ul style="list-style-type: none">• The area problem, approximation of area under a curve using a Riemann Sum• Sigma notation• Construction and calculation of left and right endpoint approximations
Week 2	<ul style="list-style-type: none">• Definition of the definite integral• Basic properties of definite integrals, linearity, order, etc.
Week 3	<ul style="list-style-type: none">• Fundamental Theorem of Calculus• Evaluating definite integrals using antiderivatives, including integration by substitution• Area between curves

II. Applications of Integrals.

Week 4	<ul style="list-style-type: none">• Volumes of solids of revolution
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III. The calculus of logarithms and exponentials.

Week 5	<ul style="list-style-type: none">• $\ln(x)$ defined as an integral.• Review of the calculus of exponentials and logarithms.• Review of exponential growth models.
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III. Techniques of Integration.

Week 6	<ul style="list-style-type: none">• Review of basic techniques. Integration by parts
Week 7	<ul style="list-style-type: none">• Numerical integration: The Trapezoidal Rule and Simpson's Rule and error bounds• Improper Integrals

IV. Sequences and Series.

Week 8	<ul style="list-style-type: none">• Infinite sequences. Numerical, algebraic, and graphical analyses• Definition of convergence of infinite series• Geometric series
Week 9	<ul style="list-style-type: none">• Linear combinations of series• Divergence Test and the harmonic series• The Integral Test• The Comparison and Limit Comparison Tests
Week 10	<ul style="list-style-type: none">• The Ratio Test and The Root Test• Alternating series; absolute and conditional convergence
Week 11	<ul style="list-style-type: none">• Power series• Taylor and Maclaurin series
Week 12	<ul style="list-style-type: none">• Error estimates for Taylor series

Instructor Options:

1. Other applications of integration, e.g. calculating work, arc length, surface area, fluid pressure, etc.
2. Other exponential growth models, e.g., logistic models, Newton's Law of Cooling, etc.
3. Hyperbolic functions.
4. Other techniques of integration, e.g. partial fractions, trigonometric substitutions, tables, etc.