

Calculus II, MA 126, Section CT

INSTRUCTOR

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OFFICE LOCATION

University Hall 4029

COURSE OVERVIEW

Calculus II builds on the fundamentals of Calculus I. In the first unit, we will delve deeper into integration techniques and learn integration, including area, volume (disc method, washer method and shell method), and problems involving the concept of Work, computed with integration on the applied force function. In Unit 2 we learn about infinite sequences and series, first learning methods to identify convergent sequences and series and culminating with the study of power series and specifically, Taylor series. Finally, in Unit 3, we vectors, and operations on vectors including the dot product and cross product.

REQUIRED TEXT

Stewart, James. *Essential Calculus*, Cengage Learning. 2nd edition (2013). E-Book Comes with UAB Opt-In Through Webassign (you do not need the hard copy)

REQUIRED MATERIALS

Computer with strong internet access.

Printer with ink (or tablet). PDF's of the notes must be either printed or downloaded and completed, then turned in on our e-learning website.

Tablet or smart device for PollEverywhere access.

EXAM SCHEDULE

| DATE(S) | SUBJECT |
|---------|---|
| SEP 25 | Exam 1 Multiple Choice Portion (Lectures 1-11) – 45 minutes |
| SEP 26 | Exam 1 Free Response Portion (Lectures 1-11) – 45 minutes |
| OCT 30 | Exam 2 Multiple Choice Portion (Lectures 12-23) – 45 minutes |
| OCT 31 | Exam 2 Free Response Portion (Lectures 12-23) – 45 minutes |
| DEC 4 | Exam 3 Multiple Choice Portion (Lectures 24-32) – 45 minutes |
| DEC 5 | Exam 3 Free Response Portion (Lectures 24-32) – 45 minutes |
| DEC 11 | Final Exam (Lectures 1-32) – 2 hours 30 minutes, Location TBD |

GRADING SCHEME

This is an approximation of the points breakdown for the course. There will be 100 available points altogether in the course (not including any extra credit), though this number may change if circumstance requires the deletion of any assignments.

| ASSIGNMENT TYPE | TOTAL POINTS | DESCRIPTION |
|-----------------------|--------------|---|
| Midterm Exams (Three) | 36 | 3 midterm exams, 12 points each, see exam schedule above. |
| Final Exam | 24 | Comprehensive final exam, see schedule above |
| Weekly Quizzes | 20 | Given weekly, usually on Thursdays |
| Webassign Homework | 10 | 32 Webassign Homework Assignments |
| Participation | 10 | Mix of attendance, PollEverywhere, and classwork |

GRADING SCALE

| | | | | |
|-------------------|--------------|--------------|--------------|------------------|
| A: 88% and higher | B: 75% - 87% | C: 62% - 74% | D: 50% - 61% | F: 49% and lower |
|-------------------|--------------|--------------|--------------|------------------|

WEBASSIGN HOMEWORK

There is one webassign homework corresponding to each section of the notes. The assignment is designed to take between 1-2 hours to complete altogether. Please TRY THE PROBLEM YOURSELF before seeking help. See this link for more information on UAB First Day Access: <https://www.uab.edu/elearning/academic-technologies/first-day-access>

WEEKLY QUIZZES

Starting in Week 2, there will be a quiz nearly each week covering the material from the previous week. The quiz will take a maximum of 30 minutes.

MIDTERM EXAMS

There will be 3 midterm exams throughout the semester (each exam will be part multiple-choice and part free-response), one at the end of each unit (see course schedule for dates). The final exam will be cumulative. Each midterm exam is worth 12% and the final exam is worth 24%. You may use any calculator without internet connection on the exam..

TEST CORRECTIONS/EXTRA CREDIT

There will be NO test corrections on the exams, however on Midterm Exams 1-3, there will be a long extra credit Webassign review which you can complete for up to a week past the exam date in order to add a maximum of 10% to your exam grade. (The Webassign assignment will say it is out of 120 points, whatever you earn on it, multiply that amount by 0.01 and that will be added to your exam score, note a max of 1.2 points may be added to your exam). **If you miss an exam or do not think you**

earned a score that reflects your understanding, you have a chance to replace a bad test score with the final exam score.

MAKE UP WORK

- Anything from Unit 1 must be made up on or before TBD. No credit will be given for Unit 1 material after this point.
- Anything from Unit 2 must be made up on or before TBD. No credit will be given for Unit 2 material after this point.
- Anything from Unit 3 must be made up on or before TBD. No credit will be given for Unit 3 material after this point.
- The last day to turn in any late assignments for this class will be TBD, anything after that point will not be accepted for any credit.
- If you miss a quiz, you must contact your instructor right away and if it is a valid reason (including documented illness, death of a family member, jury duty, etc.), then your instructor will create a make up quiz for you and you will come to office hours and complete it within a week of the missed quiz.
- **IF YOU MISS AN EXAM OR DO NOT THINK YOU EARNED A SCORE THAT REFLECTS YOUR UNDERSTANDING, YOU HAVE A CHANCE TO REPLACE A BAD TEST SCORE WITH THE FINAL EXAM SCORE.**

FINAL EXAM

The final exam will be cumulative and will draw questions from the three midterm exams. It will have 15 Multiple Choice Questions and 6 Free Response Questions (5 MC and 2 FR from Each Midterm). The Exam will take 2.5 hours and will be held on Wednesday DEC 11, TBD, 1:30-4:00 pm in a location that will be announced later.

ACCOMODATIONS FOR STUDENTS WITH DISABILITIES

If you are a student with learning needs that require special accommodation: Register with UAB's Disability Support Services (<https://www.uab.edu/students/disability/>) by providing appropriate documentation. Then: Email your instructor (lwickman@uab.edu) your accommodation letter, along with any additional information. Finally, register for the exams through the DSS (if you get extended time) to ensure testing accommodations are met.

This should be done as early as possible in the semester. However, you can submit your accommodation letter to the instructor at any point in the semester.

ACADMEIC INTEGRITY

UAB students are bound by the Academic Integrity Code, which can be found here: <https://www.uab.edu/one-stop/images/documents/academic-integrity.pdf>. Instances of cheating will be dealt with according to the code.

CAMPUS RESOURCES

There are many counseling and wellness programs available to you as a UAB student. If you or a friend is in distress, please visit <https://www.uab.edu/students/counseling/resources/campus-resources> for a list of available resources and reach out for help.

EXTRA HELP

There are many opportunities available for extra help. One of the most useful is the Math Learning Lab. You can attend without an appointment and get help with any math class (up to Calculus 2). Learning Lab information can be found at this link:

<https://www.uab.edu/cas/mathematics/student-resources/math-learning-lab>

LEARNING OUTCOMES

By the end of the course, students will be able to:

1. Apply integration techniques to compute a number of antiderivatives, namely:
 - a. U-substitution
 - b. Applying trigonometric identities
 - c. Trigonometric substitution
 - d. Expressions that are the derivatives of inverse tangent functions, inverse sine functions, and inverse cosine functions
 - e. Integration by parts
 - f. Integration by partial fraction decomposition
2. Apply L'Hôpital's Rule
3. Rewrite expressions so that their indeterminate forms are $\frac{\infty}{\infty}$ or $\frac{0}{0}$
4. Evaluate Improper Integrals
5. Use integration to compute area between two curves
6. Use integration to compute volume with the disk method
7. Use integration to compute volume with the washer method
8. Use integration to compute volume with the shell method
9. Use integration to compute work done on one-dimensional motion
10. Write a rule for the n^{th} term of a sequence
11. Evaluate the limit of a sequence (sometimes requiring L'Hôpital's Rule)
12. Evaluate the partial sum of a series
13. Use the **test for divergence** to determine if a series diverges
14. Prove the conditions of the **integral test** apply and then apply the integral test to determine if a qualifying series converges or diverges.
15. Apply the **(direct) comparison test** to a series (i.e. prove the the terms of a series are less than those of a convergent series or greater than those of a divergent series).
16. Apply the **limit comparison test** to a series (i.e. prove that a series behaves the same as a convergent series or a divergent series and make a conclusion).
17. Prove the conditions of the **alternating series test** apply and then apply the alternating series test to prove an alternating series converges.
18. Determine if a series converges absolutely, converges conditionally, or diverges.
19. Apply the **ratio test** to a series to determine if it converges absolutely.
20. Apply the **root test** to a series to determine if it converges absolutely.
21. Find the interval of convergence of a power series.
22. Use algebraic manipulation to write a function as a power series.
23. Find the Maclurin series for a function.
24. Find the Taylor series for a function.

25. Use the power series expansion for one function to find the power series of another function, either through algebraic manipulation, differentiation, or integration.
26. Plot points in 3D
27. Write an equation for the xy -plane, xz -plane, and yz -plane
28. Find the (Euclidean) distance between two points in 3D-space
29. Find the equation of a sphere in 3D-space
30. Add vectors in 2D coordinates and 3D coordinates.
31. Write the component form of a vector.
32. Write a vector in terms of the standard basis vectors \mathbf{i} , \mathbf{j} , and \mathbf{k}
33. Find the magnitude of a vector
34. Find a unit vector in the direction of a given vector
35. Find the dot product of two vectors
36. Find the angle between two vectors
37. Find the scalar and vector projection of a vector \mathbf{b} onto another vector \mathbf{a}
38. Compute work done on a system in two and three-dimensions using dot products
39. Find the cross product of two vectors
40. Find a vector that is orthogonal to two given vectors
41. Find the area of a parallelogram whose sides are given by two vectors \mathbf{a} and \mathbf{b}
42. Find the area of a triangle whose sides are given by two vectors \mathbf{a} and \mathbf{b}
43. Find the volume of a sphere whose sides are given by three vectors \mathbf{a} , \mathbf{b} and \mathbf{c}
44. Graph a vector function
45. Find the parametric, symmetric, and vector equation of a line in 3D space
46. Graph space curves, including lines and cylindrical spirals
47. Find a tangent vector
48. Integrate a vector function
49. Find arc length of a parametrically defined function
50. Find the normal vector to a plane
51. Find the equation of a plane in space
52. Find the distance between parallel planes in space
53. Find the intersection of two planes in spaces
54. Find the intersection of a line and plane in space
55. Find the angle between planes in space

LECTURE BREAKDOWN

| Lecture Number | Lecture Subject | Corresponding Textbook Section(s) |
|---------------------------------------|-------------------|-----------------------------------|
| Exam 1 – Lectures 1-11 (SEPT 25 & 26) | | |
| 1 | Substitution Rule | 4.5, 5.2, 5.3 |

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| 2 | Trig Integrals and Substitution | 6.2 |
| 3 | Inverse Trig Functions – Differentiation | 5.6 |
| 4 | Inverse Trig Functions – Integration | 5.6 |
| 5 | Integration by Parts | 6.1 |
| 6 | Partial Fraction Decomposition | 6.3 |
| 7 | L'Hopital's Rule | 5.8 |
| 8 | Improper Integrals | 6.6 |
| 9 | Applications of Integration – Work (1-Dimensional) | 7.6 |
| 10 | Area between Curves | 7.1 |
| 11 | Arc Length (2-Dimensional) | 7.4 |
| Exam 2 – Lectures 12-23 (OCT 30 & 31) | | |
| 12 | Volume – Washer & Disk Method | 7.2 |
| 13 | Volume – Shell Method | 7.3 |
| 14 | Sequences | 8.1 |
| 15 | Series – Test for Divergence & Partial Sums | 8.2 |
| 16 | Series – Geometric & Telescoping | 8.2 |
| 17 | Integral Test | 8.3 |

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|--|---|------|
| 18 | Comparison & Limit Comparison Test | 8.3 |
| 19 | Alternating Series & Absolute Convergence | 8.4 |
| 20 | Ratio Test and Root Test | 8.4 |
| 21 | Power Series | 8.5 |
| 22 | Writing Functions as Power Series | 8.6 |
| 23 | Taylor & Maclaurin Series | 8.7 |
| Exam 3 – Lectures 24-32 (DEC 4 & 5) | | |
| 24 | 3-D Coordinate System | 10.1 |
| 25 | Vectors | 10.2 |
| 26 | Dot Products | 10.3 |
| 27 | Projections & Work (2 & 3-Dimensional) | 10.3 |
| 28 | Determinants (for 2x2 and 3x3 matrices) | 10.4 |
| 29 | Cross Products | 10.4 |
| 30 | Vector Functions | 10.7 |
| 31 | Lines and Planes in Space | 10.5 |
| 32 | Arc Length (2 & 3-Dimensional) | 10.8 |