

Syllabus for Math 1470.01: Calculus II Fall 2013

ENGR 1.262 MWF 09:45-10:35

EDC 1.534 R 09:10-10:00

Contact information

Instructor: Dr. Eleftherios Gkioulekas, Department of Mathematics

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Office hours: M 11:00-12:00 TR 15:00-16:00

Office location: MAGC 3.214

Course information

Prerequisites: MATH 1460 with a grade of C or better, or appropriate high school background and placement scores.

Corequisites: None.

Course Description: Topics include derivatives and integrals of transcendental functions, methods of integration, parameterized curves, integration in polar coordinates, and infinite sequences and series.

References

- (1) J. Stewart, "Essential Calculus" (early transcendentals), 2nd edition, Cengage, 2012
- (2) E. Gkioulekas (2009): "Lecture Notes on Calculus 2", in preparation

Outline of Topics

- **Integration by parts**

General remarks

Forms 1-6

Miscellaneous integrals

Evaluating integrals by recursion

- **Integrals of rational functions**

General Remarks

Case 1: Denominator with linear factors

Case 2: Denominator with linear and repeated factors

Case 3: Denominator with linear factors and an irreducible quadratic

Case 4: method of undetermined coefficients

Case 5 : Functions requiring long division

Integrals that reduce to rational function integrals

- **Trigonometric Integrals**

Forms $f(\sin x)\cos x$ and $f(\cos x)\sin x$

Forms $f(\tan x)/\cos^2 x$ and $f(\cot x)/\sin^2 x$

Forms $\tan^a x/\cos^b x$ and $\cot^a x/\sin^b x$

Form: Products of trig functions

Form: Squares of trig functions

Method of desperation

- **Rationalizing substitutions**

Form $\sqrt{a^2 - b^2x^2}$

Form $\sqrt{a^2x^2 \pm b^2}$

Form $\sqrt{a^2x^2 + bx + c}$ with $a > 0$

Form $\sqrt{a^2x^2 + bx + c}$ with $a < 0$

- **Improper Integrals**

Improper Integrals of the first kind

Improper Integrals of the second kind

Convergence criteria for improper integrals

- **Sequences**

Convergent sequences

Divergent sequences

Bounded sequences

Recursive sequences and monotonicity

Convergence and order

- **Series**

Series convergence

Integral test

Comparison test

Limit comparison test

Ratio test

Root test

Alternating series test

Absolute convergence test

Conditional convergence

- **Series approximation of functions**

Power series

Representing functions as a power series
 Representing functions as a power series
 Taylor and Maclaurin series

Areas
 Volumes
 Arclengths

- **Applications of integrals**

Pedagogical objectives and expectations

The fundamental pedagogical objectives that students should strive for in every Mathematics course are:

- (1) To understand, learn, and remember the formal and rigorous mathematical *definition* for every concept covered in the course.
- (2) To understand, learn, and remember all the *theorems* and *propositions* that are applicable to previously defined concepts.
- (3) To understand, learn, and practice the *methods* for applying theorems in the solution of routine problems, and to be able to creatively synthesize techniques to solve problems that are non-routine and may require creative thinking.
- (4) To master *rigorous mathematical writing*, understand and use *logic and quantifier notation*, and realize and appreciate that every mathematical argument, from basic arithmetic, to advanced mathematics, with almost no exceptions, is a mathematical proof.
- (5) To master the course material to a level of excellence that will ensure sustained success in more advanced mathematics courses.

To be successful in this course, it is expected that you should:

- (1) Spend about 12 hours each week working homework problems, reviewing lecture notes, reading the text-book and online lecture notes, studying for exams, and seeking help from the tutors and instructor;
- (2) Complete all homework problems, check the correctness of your work, and understand the methods and principles they illustrate;
- (3) Master the designed course topics before each quiz and test, and if necessary, complete additional problems beyond those assigned and consult other sources if you find the assigned problems and text are insufficient;
- (4) Recognize that mastery of the solution to a problem is not demonstrated by simply obtaining the correct numerical answer, but only by a clear, systematic, and detailed solution that traces the given information to the final numerical answer and that employs knowledge developed in this and previous courses;
- (5) When you experience difficulty in the course, seek help from the tutors and instructor immediately;
- (6) Attend class meetings regularly, pay attention, and do not hesitate to ask questions; and
- (7) Write your solutions to homework, test, and quiz problems in an organized and legible way.

Grading Policies

- **Grading:** There will be 4 major exams, and a comprehensive final exam. The time and location of exams will be announced in class. Exams count for 80% and final exam for 20%. Combined, you get a numerical grade on a scale 0-20. Each exam question is graded on a 0-4 scale with $4 = A$, $3 = B$, $2 = C$, $1 = D$, $0 = F$. Combining all exams, as explained above, gives a weighted average score on a 0-20 scale. This score is then mapped to a letter grade as follows: A: 16-20; B: 12-16; C:10-12; D; 7-10; F: 0-7. If there is a downcurve, I will announce it in class and on the course website.
- **Homework:** Homework will be assigned, but will not be collected or graded. Nevertheless, it is crucial to do the homework as part of your preparation for the exams. To keep up, I recommend that **after every lecture you should solve the homework problems corresponding to the material covered on that day's lecture. Thus you need to work on a continuous basis!** Maintain a well-organized written record of your homework solutions by **writing the statement of each problem** (so that your document is stand-alone and can be read by itself), followed by your detailed solution, and clearly indicate the problem, section, and chapter number of the question. Most homework problems require more than simply writing the answer, and so you must write all steps of your solution and provide appropriate justification, as illustrated by the instructor's solved examples, as you would on a test or quiz. Write neatly and legibly, using rigorous

mathematical notation. While you are encouraged to discuss homework problems with other students, tutors, your instructor, and other faculty, the write-up of your solutions must be your own work and not simply copied from another student or another source. Use a ring binder to collect your homework, and write with a black pen, as that will help you to later scan the ring binder as a PDF file, for possible future use, and as a form of backup. This will provide you with a readily available resource to prepare for tests and quizzes, as well as providing documentation of the homework problems should you have a question about a problem and seek help from the instructor or a tutor.

- **Attendance Policy:** Attendance will be taken during most class meetings. **The instructor has the prerogative to drop any student with five (5) or more unexcused absences.** Two (2) tardies will count as one (1) unexcused absence. A tardy is defined as entering the class late or leaving the class early. **If you miss any major exam (e.g. any 50min or longer in-class exam), you will be dropped from the course.**
- **How to Excuse an Absence:** To excuse an absence, you must submit **in writing** the "Notification of a Scheduled Excused Absence form" stapled **with documentation**, before the date you will be absent, or no more than **three (3)** business days after the date. The form should be submitted in person in class, during office hours, or via the Mathematics Department secretary. The form can be downloaded from the course web page. If a major exam is missed during an excused absence, your score for that exam will be replaced with your final exam score.
- **Make-ups:** There are no make-up exams. In the case of **excused** absences the final exam will be used as a make-up exam. **Each student MUST take the final exam at the scheduled date and time.** There will be no make-ups for the final exam, after the official final exam date!
- **Regrading policy:** If you believe that a mistake in grading has been made you may request that your paper be regraded. Such request must be submitted **in writing** within one week from the day the graded test has been returned in class, and must be accompanied by the original (unaltered) paper. If you make any changes to the paper your request will be denied. Please note that if you request regrading, all problems are subject to review. Thus, your overall grade may be increased or decreased.

Explanation of grades

Your exams are graded question by question on a 0-4 scale per question. The meaning of the grades is as follows:

4: The question was solved correctly with reasonable writing. Please check with the posted exam solution though, as oftentimes, there can be further improvement in your writing style.

3: The question was approached with correct methodology but your solution contains minor errors of carelessness. Please check with the posted exam solution, and make a conscious effort to avoid similar errors in the future. It can take many years of experience before you can produce almost error-free work. In the meantime, always proofread your work multiple times.

2: Your solution is either incomplete or contains major errors. Please check with the posted exam solution, and practice similar problems from the homework. You should form or join a study group with other students, and seek out tutoring.

1 or 0: Your solution is completely wrong, or no attempt was made to solve the problem. Make sure to study the theory, methodology, and solved examples in the question's area, in addition to consulting the posted exam solution practicing similar problems from the homework. You should form or join a study group with other students, and seek out tutoring.

Overall, if you are planning to take future Mathematics or STEM courses, I would like to see you score 3 or 4 on all questions on all major examinations. If you score less than that on any questions, it indicates weaknesses in understanding the material. You should be proactive about addressing these weaknesses. Your overall grade is obtained via a simple numerical average of your major examinations and your final examination.

Other Policies

- **Course web page:** A course web page will be used to distribute the syllabus, assigned homework, solutions to exams, a copy of my lecture notes, and any other relevant material. A link to that page will be available from my main page at <http://faculty.utpa.edu/gkioulekas/>
- **Exam pick-up:** If you do not pick up your test paper within 1 week from the test date, I will throw away your paper and keep record of your test score.
- **Extra Help:** You can get additional help during my office hours or from the following locations:
 - (1) The *LSAMP Math Lab* is located in room MAGC 3.510 of the Math building. All undergraduate math courses are tutored.
 - (2) *The Math Learning Center* is located in the LEAC building (the old Math building), room 114. Courses tutored are: MATH 1300; MATH 1334; MATH 1340; MATH 1341; MATH 1342; MATH 1450; MATH 1460; MATH 1470.
- **Departmental Calculator Policy:** A calculator capable of performing basic scientific computations (arithmetic, trigonometric functions, logarithmic and exponential functions) is required for this course. Graphing calculators, calculators that can store formulas or strings, or calculators capable of performing symbolic calculations will not be allowed in quizzes/tests/exams. Electronic equipments such as pocket organizers, handheld or laptop computers, electronic writing pads or pen-input devices, and cell phones will not be permitted during quizzes and exams. Graphing calculators will be permitted for solving homework problems.
- **More about Calculator Usage:** The problems you will encounter in my exams will not require a calculator, and you are better served in the long-term by minimizing your dependence on calculators. Don't use the calculator to approximate roots, exponentials, logarithms, etc. Mathematical problems require **exact** answers. Approximations are reasonable **only** on application problems where the numbers given may be approximate themselves, and thus the best answer that can be deduced is unavoidably approximate.
- **Classroom Conduct:** Common courtesy requires that students arrive in class on time, and stay the entire class period. Turn your cellphones and pagers off. You are required to treat your classmate and instructor with respect and courtesy. Use of any electronic devices, except for calculators, is not allowed in class, and I reserve the option to remove you from the classroom without warning for any behaviour that I deem as disrespectful or disruptive. You agree to indemnify and hold harmless the professor with respect to all actions undertaken by the professor to enforce classroom conduct or to properly proctor exams. Taking my course implies your consent to this policy.
- **Revisions:** This syllabus may be revised at any time. The syllabus posted on the professor's course web site is the only copy guaranteed to incorporate all revisions that may be made under this policy and will thus supersede any other versions posted on other university websites.
- **Mandatory Course Evaluations:** Students are required to complete an ONLINE evaluation of this course, accessed through ASSIST via your UTPA account (<https://my.utpa.edu/>); you will be contacted through email and ASSIST on November 13 with further instructions. The evaluation window closes at 11:59pm on December 4, the last day of classes. Students who complete their evaluations by August 13th will have priority access to their grades.
- **Disability Access Statement:** Students with disabilities are encouraged to contact the Disability Services Office for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Texas-Pan American to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Disability Services office (DS), University Center # UC 108 (on the first floor), 665-7005, disabilityservices@utpa.edu. The Director of Disabilities is Christine Stuart-Carruthers, 665-5375, caruthers@utpa.edu.

- **Academic integrity:** As members of a community dedicated to honesty, integrity, and mutual respect in all interactions and relationships, the students, faculty and administration of our university pledge to abide by the principles in The Bronc Honor Code. See: <http://www.utpa.edu/dos>

About your Professor

Dr. Gkioulekas was raised in a small mining village, Stratonion, in Greece. He was inspired into a teaching career by the example of his High School Mathematics Teacher, Alexandros Pistofides, and by independently studying all three volumes of the *Feynman Lectures on Physics* during the last 4 years of High School. He graduated with a B.Sc. in Applied Mathematics from the California Institute of Technology in 1997, a M.Sc. in 2000 and a Ph.D in Applied Mathematics in 2006, both from the University of Washington.

Dr. Gkioulekas has conducted original research and published many research papers in national and international refereed research journals in Applied Mathematics and Mathematics Education, with specializations in hydrodynamic and geophysical turbulence, statistical mechanics, and curriculum innovations. He has presented his research in many national and international research conferences, research colloquia and research seminars, including research presentations at the Los Alamos National Laboratory, National Center for Atmospheric Science, and the California Institute of Technology.

He has also authored more than 2000 pages of Online Lecture Notes for many undergraduate and graduate courses that are made freely available to the general public via his faculty web page, and continues to develop notes for new courses and improve the existing notes for current courses, as time allows.

Student Learning Outcomes

- (1) Correctly apply the standard methods of integration, including substitution, integration by parts, trigonometric identities, trigonometric substitution, and partial fraction decomposition.
- (2) Approximate definite integrals using the Riemann sums, trapezoid rule, Simpson's rule, and series techniques.
- (3) Properly define and evaluate improper integrals and apply the Comparison Test to determine whether they converge or diverge.
- (4) Apply integration to compute areas, volumes, work, average values of functions, arc lengths, surface areas, hydrostatic pressures and forces, centers of mass, and moments.
- (5) Define curves parametrically and in polar coordinates, and perform the standard calculus computations on parametric and polar curves, such as derivatives, integrals, areas, arc lengths, and surface areas.
- (6) Understand the concepts of sequence, series, limits of sequences and series, convergence and divergence of sequences and series, and absolute and conditional convergence of series.
- (7) Compute power, Taylor, and Maclaurin polynomials and series for a function, and apply these ideas to problems in mathematics, science, and engineering.

Mathematics Major Student Learning Outcomes

Students completing the B.S. program in Mathematics will:

- (1) Demonstrate in-depth knowledge of Mathematics, its scope, application, history, problems, methods, and usefulness to mankind both as a science and as an intellectual discipline.
- (2) Demonstrate a sound conceptual understanding of Mathematics through the construction of mathematically rigorous and logically correct proofs.
- (3) Identify, formulate, and analyze real world problems with statistical or mathematical techniques.
- (4) Utilize technology as an effective tool in investigating, understanding, and applying mathematics.
- (5) Communicate mathematics effectively to mathematical and non-mathematical audiences in oral, written, and multi-media form.
- (6) Demonstrate an appreciation of and enthusiasm for lifelong scientific inquiry, learning, and creativity.

Core Mathematics Student Learning Outcomes

- (1) To apply arithmetic, algebraic, geometric, higher-order thinking, and statistical methods to modeling and solving real-world situations.
- (2) To represent and evaluate basic mathematical information verbally, numerically, graphically, and symbolically.
- (3) To expand mathematical reasoning skills and formal logic to develop convincing mathematical arguments.
- (4) To use appropriate technology to enhance mathematical thinking and understanding and to solve mathematical problems and judge the reasonableness of the results.
- (5) To interpret mathematical models such as formulas, graphs, tables and schematics, and draw inferences from them.
- (6) To recognize the limitations of mathematical and statistical models.
- (7) To develop the view that mathematics is an evolving discipline, interrelated with human culture, and understand its connections to other disciplines.