The University of Texas – Rio Grande Valley
Syllabus for Math 2415.01: Calculus III Summer I 2018
ECOBE 111 MTWRF 09:10–11:10

Contact information

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Course information

Prerequisites: MATH 2414 (or MATH 2488) with a grade of 'C' or better.
Corequisites: None.
Course Description: Topics include functions of several variables, partial derivatives, multiple integrals, Lagrange multipliers, and vector calculus including the Divergence Theorem and Stoke's Theorem.

References

(1) J. Stewart, "Essential Calculus" (early transcendentals), 2nd edition, Thomson Brooks/Cole, 2013
(2) E. Gkioulekas: "Lecture Notes on Calculus 3", *Online Lecture Notes on Mathematics*, Edinburg, University of Texas Pan American (2011), 366 pp.
(3) E. Gkioulekas: "Zero-bounded limits as a special case of the squeeze theorem for evaluating single-variable and multivariable limits", *International Journal of Mathematical Education in Science and Technology* **44** (2013), 595-609
(4) Z. Hannan: "wxMaxima for Calculus I", Solano Community College (2015), 158pp
(5) Z. Hannan: "wxMaxima for Calculus II", Solano Community College (2015), 176pp
(6) R.P. Feynman, R.B. Leighton, and M. Sands: "Differential Calculus of Vector Fields" in *"The Feynman Lectures on Physics, Volume II"* (1964), http://www.feynmanlectures.caltech.edu/
(7) R.P. Feynman, R.B. Leighton, and M. Sands: "Vector Integral Calculus" in *"The Feynman Lectures on Physics, Volume II"* (1964), http://www.feynmanlectures.caltech.edu/

Outline of Topics

- **Vectors in $\mathbb{R}^3$**
  Cartesian coordinates
  Vector addition and scalar multiplication
  Vector dot product
  Orthogonality condition
  Projections
  Cross Product
  Parallel vectors
  Lines in $\mathbb{R}^3$
  Planes in $\mathbb{R}^3$
  Distances between points, lines, and planes
- **Vector-valued Functions**
  Definitions
  Limit of a vector-valued function
  Derivative of vector-valued functions
  Properties of differentiation
  Tangent line to 3d curves
  Integrals of vector functions
  Arclength
  Curvature
  Tangent, Normal, and Binormal vectors
- **Scalar fields**
  Definitions
  Limits of scalar fields

Continuity
Directional and Partial Derivatives
Differentiable scalar fields
Chain rule
Implicit Differentiation
Level sets and tangent lines/planes

- **Optimization of scalar fields**
  Maximum and minimum values
  Constrained optimization
  Optimization on a bounded set
- **Multiple Integrals**
  Definition of the double integral
  Double integral over a general region
  Change of variables in double integrals
  Definition of the triple integral
  Change of variables in $\mathbb{R}^3$
- **Vector Fields**
  Derivatives of a vector field
  Line Integrals
  Basic properties of line integrals
  Conservative fields and potential functions
  Green's theorem
  Applications of Green's theorem
  Parametric surfaces and surface integrals
  Fundamental product for special surfaces
  Stokes and Gauss theorems

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 textbook 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 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 3 major exams, and a comprehensive final exam. The time and location of exams will be announced in class. Exams count for 75% and final exam for 25% of your grade. 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. There will be no curve and no extra credit.
- **Explanation of grades:** Your exams are graded question by question on a 0-4 scale per question. 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.
- **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. 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. It is important to sign in the sign-up sheet if you are present. **The instructor has the prerogative to drop any student with four (4) or more unexcused absenses.** Two (2) tardies will count as one (1) unexcused absense. A tardy is defined as entering the class late or leaving the class early. **If you miss any major exam, you will be dropped from the course.**
- **How to Excuse an Absense:** To excuse an absense, you must submit **in writing** the "Notification of a Scheduled Excused Absense form" stapled **with documentation**, before the date you will be absent, or no more than **three (3)** bussiness 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 absense, your score for that exam will be replaced with your final exam score. UTRGV's attendance policy excuses students from attending class if they are participating in officially sponsored university activities, such as athletics; for observance of religious holy days; or for military service.
- **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.

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.utrgv.edu/eleftherios.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.
- **Calendar of Activities:** Information regarding important dates, such as, first day of classes, holidays, last day to drop a class before it appears on the transcript (the census date), last day to drop or withdraw with a DR grade, and final exam schedule are available at `http://my.utrgv.edu`, at the bottom of the screen, prior to login. Please be advised of these important dates, and feel free to inquire with the instructor about any questions you may have with regard to the academic calendar.
- **Calculators:** 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 your UTRGV account (http://my.utrgv.edu); you will be contacted through email with further instructions. Students who complete their evaluations will have priority access to their grades.
- **Disability Access Statement:** If you have a documented disability (physical, psychological, learning, or other disability which affects your academic performance) and would like to receive academic accommodations, please inform your instructor and contact Student Accessibility Services to schedule an appointment to initiate services. It is recommended that you schedule an appointment with Student Accessibility Services before classes start. However, accommodations can be provided at any time. **Brownsville Campus:** Student Accessibility Services is located in Cortez Hall Room 129 and can be contacted by phone at (956) 882-7374 (Voice) or via email at

ability@utrgv.edu. **Edinburg Campus:** Student Accessibility Services is located in 108 University Center and can be contacted by phone at (956) 665-7005 (Voice), (956) 665-3840 (Fax), or via email at ability@utrgv.edu.

- **Academic integrity:** As members of a community dedicated to Honesty, Integrity and Respect, students are reminded that those who engage in scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and expulsion from the University. Scholastic dishonesty includes but is not limited to: cheating, plagiarism, and collusion; submission for credit of any work or materials that are attributable in whole or in part to another person; taking an examination for another person; any act designed to give unfair advantage to a student; or the attempt to commit such acts. Since scholastic dishonesty harms the individual, all students and the integrity of the University, policies on scholastic dishonesty will be strictly enforced (Board of Regents Rules and Regulations and UTRGV Academic Integrity Guidelines). All scholastic dishonesty incidents will be reported to the Dean of Students.
- **Sexual harassment, discrimination, and violence**: In accordance with UT System regulations, your instructor is a "responsible employee" for reporting purposes under Title IX regulations and so must report any instance, occurring during a student's time in college, of sexual assault, stalking, dating violence, domestic violence, or sexual harassment about which she/he becomes aware during this course through writing, discussion, or personal disclosure. More information can be found at www.utrgv.edu/equity, including confidential resources available on campus. The faculty and staff of UTRGV actively strive to provide a learning, working, and living environment that promotes personal integrity, civility, and mutual respect that is free from sexual misconduct and discrimination.

Student Learning Outcomes

After completing this course students will:

(1) Understand vectors in Euclidean space, operations involving vectors, and their application to analytical geometry.
(2) Understand vector-valued functions, operations with them (including differentiation and integration), and their application to arclength and curvature calculations.
(3) Understand scalar fields (maps from Euclidean space to the real number line), operations with them (limits, differentiation, and integration), optimization problems involving scalar fields.
(4) Compute multiple integrals, in two or three dimensions, over box domains, simple domains, and via a smooth change of variables.
(5) Understand vector fields (mappings of vector to vector), the gradient, divergence, and curl of vector fields, use tensor notation to derive differentiation rules for vector fields, line integrals of vector fields. Green's theorem, surface integrals of scalar and vector fields, the Stokes and Gauss theorems.

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.