

MATH-2530 Calculus III Spring 2018

Course Information

Course Name: Calculus III

Course Number: MATH-2530

Course Description:

Focus on multivariable Calculus. Apply the concepts learned in the previous two courses to functions of two or more variables. Perform operations on vectors and vector-valued functions. Evaluate partial and directional derivatives, differentials, and discuss some applications. Evaluate multiple integrals. Evaluate line integrals and surface integrals, use vector fields and use Green's, Divergence and Stoke's Theorems as applications of vector calculus.

Class Days and Time: MTWF 11:00-11:50

Classroom: PAH-20

Credit(s): 4

Prerequisite(s): Grade of C- or better in MATH-1520 Calculus II.

Instructor Information

Name: Ana Portilla

Office hours: MWF 12:00-13:00

T 13:00-14:00.

Also by appointment.

Math Office: Padre Arrupe Hall, 1st fl.

Contact: ana.portilla@slu.edu

Biography: Terminal Degree: Ph.D. Mathematics (Universidad Carlos III de Madrid)

Course Objectives

The main objectives of this advanced calculus course are twofold: to appeal to students who have already got a fundamental knowledge of Calculus techniques, and wish to extend their knowledge with a view to possessing a wider basis in preparation for more advanced mathematical and engineering courses; and to develop the ability to use of the techniques, but also to give an awareness of the underlying theory behind them. This course is appropriate for students majoring in engineering.

Mathematics Program Objectives

1. (BA/BS) Demonstrate the ability to solve a variety of mathematical problems
2. (BA/BS) Demonstrate the ability to recall important mathematical definitions and results (for example, theorems)
3. (BA/BS) Demonstrate the ability to apply mathematical reasoning, including formulating definitions
4. (BA/BS) Demonstrate the ability to apply the methods of direct and indirect proof

5. (BA/BS) Demonstrate the ability to communicate mathematical ideas and concepts in clearly written problem solutions
6. (BS) Demonstrate an ability to perform statistical analyses
7. (BS) Demonstrate an ability to write computer programs to analyze data and perform calculations

Student Learning Outcomes

Program Objectives	Student Learning Outcomes	Assessment Method
A	<p>A.1 Apply vector operations in two and three dimensions and use vector methods to analyze plane and space curves, and curvilinear motion.</p> <p>A.2 Demonstrate the ability to analyze and visualize curves, surfaces, and regions in 2 and 3 dimensions, in Cartesian, polar, cylindrical, and spherical coordinate systems.</p> <p>A.3 Perform calculus operations on functions of several variables and vector-valued functions including limits, partial derivatives, directional derivatives, curvature, and multiple integrals.</p> <p>A.4 Apply standard techniques of multivariable calculus, both differential and integral, to solve selected applied problems.</p> <p>A.5 Find and classify extrema and tangent planes of functions of two variables. Optimization problems.</p> <p>A.6 Apply standard techniques of vector analysis to analyze and solve problems involving vector fields and (line, surface, or flux) integrals.</p> <p>A.7 Apply the computational and conceptual principles of calculus to the solutions of various scientific applications.</p>	Midterms, class discussions, quizzes, group work, final exam.
B	<p>B.1 Recall basic definitions of single variable Calculus</p> <p>B.2 Recall various important theorems of Vector Calculus (Fundamental theorem of line integrals, Green’s Theorem, Divergence Theorem, etc.)</p>	Midterms, class discussions, quizzes, group work, final exam.

C	C.1. Apply Mathematical reasoning to translate basic definitions of single variable Calculus to multivariable Calculus.	Class exercises, quizzes.
E	E.1 Students will be able to communicate mathematical ideas effectively in both written and oral context. To this end, they will resort to the appropriate Mathematical results to justify their answers.	Midterms, class discussions, quizzes, group work, final exam.

Required and recommended reading

Required reading: Calculus - Multivariable, Anton, Bivens, Davis. Wiley, 9th edition, 2005.

Recommended: The Calculus of Functions of Several Variables, by Dan Sloughter, Furman University, <http://synechism.org/drupal/cfsv/> (<http://creativecommons.org/licenses/by-nc-sa/1.0/>)

Required work

One in-class exam, two midterms and one comprehensive final exam will be given. They will emphasize the material presented in class but will also cover the reading assignments.

Homework will be assigned for every topic covered. The homework will not be graded, but solutions will be provided and students are expected to check their exercises and come to office hours with any difficulties encountered.

Late work:

Make up exams are not given. If an exam is missed due to an excused absence (see paragraph below), a make up exam will be given the same day of the final exam. Exams that are missed illegitimately result in a score of 0 in the final grade. Missing more than one exam results in an F grade for the entire course.

Excused Absences:

Legitimate conflicts and excuses require written documentation and are limited to death or near death instances in the immediate family, a student's illness that requires immediate doctor's care (with the corresponding doctor's note), a University sponsored event (not club sports) and regularly scheduled religious obligations. The documentation must be presented on the day the student returns to the university. Excuses that will NOT be considered include personal travel arrangements, non-University sponsored events, a conflicting appointment, or an illness that does not prevent you from coming to the exam.

Attendance and punctuality:

Although not mandatory, I strongly urge you to attend all classes. On the other hand, you will be responsible for any announcements, information, problems or course changes that are made in all lectures. Students are expected to arrive on time to the lectures. Repeated lateness will not be tolerated.

If a class is not attended, it is the student's responsibility to find out what was covered in class and to secure notes from another student. During office hours, and after the student has read and worked on the notes on his own, only specific questions regarding the material missed will be answered.

Grading system

The final grade will be obtained as follows:

- 15% in-class exam
- 55% first and second midterm
- 30% final exam

Evaluation:

- In-class: 50 minute exam consisting of some problems related to the material covered in class.
- Midterms: up to 2:30 hour exams consisting of some problems related to the material covered in class.
- Quizzes: Some quizzes will be given throughout the course about homework assignments.
- Final exam: The final exam is cumulative. It will cover the entire semester's material, will be an up to 3 hour exam, and will be similar in form to the midterm exams.
- A positive evolution in grades might have a positive impact in the overall grade.
- Active participation during the lectures by asking interesting questions will have a positive impact on the final grade, bringing up borderline grades.
- You are going to be evaluated not only on your knowledge of facts beyond the surface level, but also on your creative and critical thinking, your ability to draw conclusions and make connections, and to communicate information in a reasoning and organized way.

Remark: No complaints about the grade of an exam will be accepted two weeks after the results have been announced to the class.

Important Dates:

- **January:**
 - 10 Wed: First day of classes.
 - 21 Sun: Last day to DROP a class without a grade of "W" and/or add a class. Last day to choose audit (AU), or Pass/No Pass (P/NP) Options.
 - 26 Fri: No class. Application Deadline for Spring Semester Degree Candidates.
- **February:**
 - 9 Fri: First midterm exam (14:00-16:30).
 - 14 Wed: Registration for Summer 18 sessions begins.

- 22-23 Th-Fri: No classes (Winter break).
- **March:**
 - 9 Fri: Last day to drop a class and receive a "W".
 - 13 Tue: In-class exam (classtime).
 - 15 Th: Last day to submit Transfer Application for fall semester.
 - 26-30 Mon-Fri: Semana Santa (University closed).
- **April:**
 - 4 Wed: Registration for Fall 2018 semester begins.
 - 13 Fri: Second midterm exam (14:00-16:30).
- **May:**
 - 1 Tue: Holiday (University closed).
 - 2 Wed: Holiday (University closed).
 - 3 Th: Final day of classes.
 - 8 Tue: Final exam (8:30-11:30).

For other important dates, visit

<http://www.slu.edu/madrid/academics/registrar/academic-calendar/spring-2018>

Course outline

- Part 1: Geometry of \mathbb{R}^2 and \mathbb{R}^3
Introduction to \mathbb{R}^n (Ch 11.1, 11.2); Angles and the dot product (Ch 11.3); The cross product (Ch 11.4); Lines, planes, and hyperplanes (Ch 11.5, 11.6); Linear and affine functions (class notes); Operations with matrices (class notes)
- Part 2: Functions from \mathbb{R} to \mathbb{R}^n
Curves (Ch 12.1, 12.2); Best affine approximations (Ch 12.2, 12.3, 12.4); Motion along a curve (Ch 12.6, 12.5)
- Part 3: Functions from \mathbb{R}^n to \mathbb{R}
Geometry, limits, and continuity (Ch 13.1, 13.7, 13.2); Directional derivatives and the gradient (Ch 13.3, 13.6); Best affine approximations (Ch 13.4, 13.5, 13.7); Second-order approximations (class notes); Extreme values (Ch 13.8, 13.9); Definite integrals (Ch 14.1, 14.2, 14.5); Change of variables in integrals (Ch 11.8, 14.8, 14.3, 14.7)
- Part 4: Functions from \mathbb{R}^m to \mathbb{R}^n
Geometry, limits, and continuity (Ch 14.4, 15.1); Line integrals (Ch 15.2, 15.3); Green's Theorem (Ch 15.4); Surface integrals (Ch 15.5); Divergence Theorem (Ch 15.7); Stokes' Theorem (Ch 15.8)

Things that you should do in order to get a good grade in this class:

- Don't miss classes, but if you ever have to miss one, ask one of your classmates (not me) for the notes as soon as possible and go over them before the next lecture.
- Do ALL the solved exercises recommended from the textbook. I can't emphasize this enough. All math classes require a lot of practice and this is not an exception.

- Work every week, and if possible, every day. If you don't have an assignment or exercises to practice (that would be very rarely), review your class notes and go over the problems we have solved in class on your own one more time.
- Feel free to pass by my office to ask me if something is not clear from the lecture before the next lecture, you will probably have trouble understanding it otherwise.
- Form study groups and make sure that all members participate and learn from each other. Experience shows that math is more effectively learned when you work in groups.
- Write your homework and exams neatly and in an organized way. Remember that you are going to be evaluated **not only** on your knowledge of facts beyond the surface level, **but also** on your creative and critical thinking, your ability to draw conclusions and make connections, and to communicate information in a reasoning and organized way.

Things that you shouldn't do in this class:

- Miss classes... Have I made it clear?
- Be late to the lectures, it is very disruptive to the other students and very disrespectful. Also, you miss the most important part of the lecture, where I say what we are going to do and sometimes do a short review of what we did in the previous class.
- Use your phone during the lectures, whether it is for texting or using internet or, obviously, talking, it is extremely disrespectful. I will not allow it and you will be invited to leave the room.
- Work on something else during classes. Again, you will be invited to leave the room.
- Get up and walk out of the class. It is very disruptive. If you are planning to get out to take care of some urgent issue, let me know in advance.
- Think that by just coming to class, you have all the work done. If you don't practice, you will not learn the material.
- Try to study everything two days before the test. It is impossible to really understand this topic by rushing over the material in a few hours.
- Skip homework.
- Copy the homework from someone else. It is completely useless. The only purpose of the homework is to help you learn.
- Use graphing calculators or any other type of electronic device during tests or exams. It will be considered a violation of the Academic Honesty Code.

Academic Honesty Policy Statement:

Academic integrity is honest, truthful and responsible conduct in all academic endeavors. The mission of Saint Louis University is "the pursuit of truth for the greater glory of God and for the service of humanity." Accordingly, all acts of falsehood demean and compromise the corporate endeavors of teaching, research, health care and community service via which SLU embodies its mission. The University strives to prepare students for lives of personal and professional integrity, and therefore regards all breaches of academic integrity as matters of serious concern.

The governing University-level Academic Integrity Policy can be accessed on the Provost's Office [website](#). Additionally, SLU-Madrid has posted its academic integrity policy online: <http://www.slu.edu/madrid/academics>. As a member of the University community, you are expected to know and abide by these policies, which detail definitions of violations, processes for reporting violations, sanctions and appeals.

The professor will review these matters during the first weeks of the term. Please direct questions about any facet of academic integrity to your faculty, the chair of the department of your academic program, or the Academic Dean of the Madrid Campus.

Only **non-graphic** scientific calculators may be used in tests or in the final examination. Other calculators and devices will be taken from students during the exam and students may not be allowed to continue the exam. Not following this regulation will be considered a violation of the academic honesty code.

Accommodation Statement

In recognition that people learn in a variety of ways and that learning is influenced by multiple factors (e.g., prior experience, study skills, learning disability), resources to support student success are available on campus. Students who think they might benefit from these resources can find out more about:

- Course-level support (e.g., faculty member, departmental resources, etc.) by asking your course instructor.
- University-level support (e.g., tutoring/writing services, Disability Services) by visiting the Academic Dean's Office (San Ignacio Hall) or by going to <https://www.slu.edu/madrid/academics/student-resources>.

Students with a documented disability who wish to request academic accommodations must contact Disability Services to discuss accommodation requests and eligibility requirements. Once successfully registered, the student also must notify the course instructor that they wish to access accommodations in the course. Please contact Disability Services at disabilityservices-madrid@slu.edu or +915 54 58 58, ext. 230 for an appointment. Confidentiality will be observed in all inquiries. Once approved, information about the student's eligibility for academic accommodations will be shared with course instructors via email from Disability Services. For more information about academic accommodations, see "Student Resources" on the SLU-Madrid webpage.

Note: Students who do not have a documented disability but who think they may have one are encouraged to contact Disability Services.

Student Outcome Assessment:

In order to maintain quality academic offerings and to conform to accreditation requirements, SLU-Madrid regularly assesses its teaching, services and programs for evidence of student learning. For this purpose, SLU-Madrid keeps representative examples of student work from all courses and programs on file, including assignments, papers, exams, portfolios and results from student surveys, focus groups and reflective exercises. Copies of your work for this course may be kept on file for institutional research, assessment and accreditation purposes. If you prefer SLU-Madrid not to retain your work for this purpose, you must communicate this decision in writing to your professor.

Title IX

Saint Louis University and its faculty are committed to supporting our students and seeking an environment that is free of bias, discrimination, and harassment. If you have encountered any form of sexual misconduct (e.g. sexual assault, sexual harassment, stalking, domestic or dating violence), we encourage you to report this to the University. If you speak with a faculty member about an incident of misconduct, that faculty member must notify SLU's Title IX deputy coordinator, Marta Maruri, whose office is located on the ground floor of Padre Rubio Hall, Avenida del Valle, 28 (mmaruri@slu.edu; 915-54-5858, ext. 213) and share the basic fact of your experience with her. The Title IX deputy coordinator will then be available to assist you in understanding all of your options and in connecting you with all possible resources on and off campus.

If you wish to speak with a confidential source, you may contact the counselors at the SLU-Madrid's Counseling Services on the third floor of San Ignacio Hall (counselingcenter-madrid@slu.edu; 915-54-5858, ext. 230) or Sinews Multipletherapy Institute, the off-campus provider of counseling services for SLU-Madrid (www.sinews.es; 917-00-1979). To view SLU-Madrid's sexual misconduct policy and for resources, please visit the following web address:
<http://www.slu.edu/Documents/Madrid/campus-life/SLUMadridSexualMisconductPolicy.pdf>.