

MAT0231 Calculus III

**San Francisco de Quito University
Polytechnic College**

MAT-0231 Calculus III

Name of the Race Coordinator / Department: Eduardo Alba Cabrera

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Mark with an “x” if this course belongs to:

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|------------------------------|---|--|-----------------|
| general training of the race | Formation of specialization of the race | General formation undergraduate (sports, colloquia, English, etc.) | Training remedy |
| | X | | |

Instruction form:

| | | | | |
|---------------------------|-------------|------------|--------------------------------|---------------------------------|
| Chair (classes masterful) | discussions | Laboratory | Supported by classroom in line | Use of classroom in line (only) |
| X | | X | X | |

COURSE DESCRIPTION

This course covers the basic and fundamental topics of Calculus in several variables. we start with vector geometry: vectors, length, polar, cylindrical, spherical coordinates. straight, flat and surfaces. Dot product, cross product. Functions of several variables, graphs, contours, derivatives directional, partial derivatives, second order partial derivatives, the gradient, differentiability, optimization, constrained optimization, integral of functions of several variables, integrals in coordinates cylindrical and spherical, curves and parameterizations, vector fields, line integrals, Theorem of Green, calculus with vector fields, divergence and curl, Green's Theorem, Gauss and Stokes.

We will answer questions such as What is the advantage of going from Single to Multiple Variable Calculus? Which the new technique to develop? Why is it necessary to study further the vector nature of this calculation? What is the importance in physics of the classical vector calculus theorems such as the

Green, Stokes and Gauss theorem? Why is it necessary to introduce vector fields to better understand some physical concepts, like the concept of work for example? etc.

This course is aimed at students of science and engineering at the Polytechnic once they have completed the Calculus 1 and 2

OBJECTIVES

1. Understand the fundamental principles of Calculus in several variables, its history, its evolution and its importance in mathematical methods for physics.
2. Learn to apply the contents of Calculus III to improve the ability to argue in mathematics, solve problems and make decisions technically and creatively.
3. Develop abilities and skills of Calculus in several variables to understand geometry of space from a vectorial perspective.

CONTENTS

1. Three-Dimensional Coordinate Systems
2. Vectors
3. The dot product
4. The cross product
5. Lines and planes in space
6. Cylinders and Quadratic Surfaces
7. Vector Functions
8. Arc length and unit tangent vector
9. Curvature and the unit normal vector N
10. Tangential and normal fields of acceleration
11. Functions of several variables
12. Limits and continuity in higher dimensions
13. Partial Derivatives
14. Chain rule
15. Directional Derivatives and Gradient Vectors
16. Tangent and differential planes
17. Extreme Values and Saddle Points
18. Lagrange multipliers
19. Double integrals
20. Areas, moments and centers of mass
21. Double Integrals in Polar Form

22. Triple integrals in rectangular coordinates
23. Mass and moments in three dimensions
24. Triple Integrals and Cylindrical and Spherical Coordinates
25. Substitution in multiple integrals
26. Line Integrals
27. Vector Fields, Work, Circulation, and Flow
28. Path Independence, Potential Functions, and Conservative Fields
29. Green's theorem in the plane
30. Surface Areas and Surface Integrals
31. Parameterized surfaces
32. Stokes Theorem
33. The Divergence Theorem and a Unified Theory

CLASS ADMINISTRATION FORM

The class will meet three hours each week. The class will be conducted interactively and will require the individual student participation. It is strongly recommended to carry out a previous analytical reading of the corresponding section of the suggested text try to answer the fundamental questions of each section. Write down the doubts and ask them in class.

This class has an additional class of exercises MAT-0231j. Registration for this class is mandatory.

EVALUATION

| Type | Calendar | % Final note |
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| Duties | In the next exercise class after reviewed the corresponding section in class | 5% |
| short tests | Weekly | 10% |
| Projects | Three in the semester spaced by at least 15 days. | fifteen% |
| 1st Ex. Partial | 5th week* | |
| 2nd Ex. Partial | 9th week* | fifty% |
| 3rd Partial Ex. | 13th week* | |
| Final exam | According to registration schedule after completion the skills test. | twenty% |

*The date of the partial exams can receive slight variations of more or less a week in dependence on examinations of other subjects, holidays and unplanned events. Try to avoid them possible and any changes will be notified in time.

Grades

A: Obtain a final percentage greater than or equal to 90%

B: Obtain a final percentage greater than or equal to 80% and less than 90%

C: Obtain a final percentage greater than or equal to 70% and less than 80%

D: Obtain a final percentage greater than or equal to 60% and less than 70%

SPECIFICATIONS FOR TASKS

- Duties. Set of exercises at the end of each studied section of the main text. exercises of complexity similar to those that may (not necessarily) be presented in tests and exams. The list Complete set of exercises for each task is posted on your D2L account.

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| 12.1 Three-Dimensional Coordinate Systems | 9,11,16,24,27,28,41,47,53 |
| 12.2 Vectors | 7,11,45,21,24,29,41,45,53 |
| 12.3 The dot product | 5,13,15,19,21,24,25,31,33,46,53 |
| 12.4 The cross product | 17,24,27,29,31,41 |
| 12.5 Lines and planes in space | 6,19,27,35,47,59,61,67,69 |
| 12.6 Cylinders and Quadric Surfaces | 55,61,69,78,79,83 |
| 13.1 Vector Functions | 7,25,30,37 |
| 13.3 Arc length and unit tangent vector | 5,8,9,13,18 |
| 13.4 Curvature and the unit normal vector N | 3,5,6,13,15,21 |
| 13.5 Tangential and normal fields of acceleration | 7,13,16,23,26, |
| 14.1 Functions of several variables | 3, 5, 6, 13, 15, 21, 31 to 36,49,52,65,67 |
| 14.2 Limits and continuity in higher dimensions | 9, 10, 19, 20, 26, 31, 39, 41, 46, 53 |
| 14.3 Partial Derivatives | 13,15, 17, 39, 54, 57, 63 |
| 14.4 Chain rule | 5, 9, 12, 31, 35, 42, 46 |
| 14.5 Directional Derivatives and Gradient Vectors | 13, 21, 25, 29, 31 |
| 14.6 Tangent and differential planes | 7, 15, 19, 27, 41, 51 |
| 14.7 Extreme Values and Saddle Points | 19, 23, 25, 33, 39, 44, 50, 53 |

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| 14.8 Lagrange multipliers | 7, 11, 21, 25, 31, 37, 39 |
| 15.1 Double Integrals | 5, 13, 19, 33, 37, 43 |
| 15.2 Areas, moments and centers of mass | 8, 11, 15, 21, 29, 45 |

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| 15.3 Double Integrals in Polar Form | 9,13, 18, 21, 27, 43 |
| 15.4 Triple integrals in rectangular coordinates | 13, 21, 27, 28, 42, 46 |
| 15.5 Mass and moments in three dimensions | 13, 14, 16, 17 |
| 15.6 Triple Integrals and Cylindrical and Spherical Coordinates | |
| 15.7 Substitution in multiple integrals | 5, 7, 13, 14, 20 |
| 16.1 Line Integrals | 3, 6, 12, 15, 16, 21, 25 |
| 16.2 Vector Fields, Work, Circulation, and Flow | 10, 13, 14, 21, 27, 29, 44 |
| 16.3 Independence of trajectory, potential functions and conservative fields | 10, 11, 15, 22, 29, 33a) |
| 16.4 Green's theorem in the plane | 3, 6, 8, 9, 16, 19, 23, 29, 34 |
| 16.5 Surface Areas and Surface Integrals | 5, 11, 15, 17, 19, 25, 29 |
| 16.6 Parameterized surfaces | |
| 16.7 Stokes Theorem | |
| 16.8 The Divergence Theorem and a Unified Theory | |

They must be delivered in the corresponding class of exercises according to what is established by the professor of said class. Each duty (corresponding to a different order number) must be delivered stapled correctly identified with a header that includes: duty number, text section and page, student name and no. of code, name of the main teacher and name of the exercise teacher. No it is strictly necessary to put the statement of the exercises but they must be well referenced. must put all the solution procedure. Do not neglect order and cleanliness. The answers without procedures are useless. It is suggested to use Scientific Notebook or Lyx for editing.

- **Projects:** These are lengthy works that aim to involve students in research tasks and development that give the feeling of a significant achievement when completed. There are application projects, use of computational techniques, discovery of properties and concepts. Up to two will be assigned projects during this course. Projects must be carried out in groups of no less than two or no more than three students, and using Scientific Notebook or some other scientific text editor such as LyX or LaTeX. The Scientific Notebook program is installed in the USFQ laboratories. The themes of the projects will be posted to your D2L account.
- **Partial tests.** They are common tests (for all the parallels of the course) that cover between 7 and 10 sections studied in the course. They have between 7 and 10 questions and an approximate duration of 2 or more hours (taken outside class hours). They will be administered on Saturdays during daytime hours published in D2L. The tentative schedule is the 5th, 9th and 13th week of the course. The sections it covers are those studied up to a week before the exam. . Up to three partial exams will be administered.
- **Final exam.** It is a cumulative departmental exam with an emphasis on topics not tested in the partial exams. It has a format similar to that of the Partial Exams. will be administered according to registration calendar.

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CLASS POLICIES

The use of any type of calculator or form will not be allowed in the exam. In most exercises as usual in the exercises of the text, the calculations will be simple, otherwise they can be left raised. If strictly necessary, a formula will be provided in the exam if it is not part of it. of the course program. It is essential that in all the exams all the procedures for each of the exercises. Answers without procedures are worthless. It is highly recommended Maintain order and cleanliness in exams. There is no possibility of advancing or retarding an exam individually. If it is more than one absence, it would be recommended to withdraw from the class, in case of be possible.

Projects must be delivered at the beginning of the class corresponding to the delivery date. Any delay of up to 24 hours will be penalized with 20% of the grade. Projects are not received after 24 hours of the delivery date. In group work, the following should be taken into account:

- Ensure that each member of the group is collaborating in the realization.
- All members must master all the content of the project.
- It is the responsibility of EVERYONE for any act of plagiarism and/or copying

If there is any doubt about their performance, they could be called to an oral defense of the project.

Class attendance is not mandatory but will be taken into account above all to provide timely help.

There is no possibility of rounding the grade other than under the policies established in this syllabus. This implies the impossibility of carrying out "extra work" in a particular way.

The university's withdrawal policy will be strictly applied, there is no possibility of application of exceptions that are not contemplated in said policy.

Punctual attendance to class is recommended, repeated tardiness will be interpreted as irresponsibility and disrespect to the class, in addition to causing the loss of the introduction to the class, fundamental for the correct understanding of the contents that will be exposed in it.

USFQ Mission

USFQ trains, educates, researches and serves the community within the philosophy of Liberal Arts, integrating all sectors of society.

Vision of USFQ

USFQ will be a model university for education in Liberal Arts, entrepreneurship, scientific development, technological and cultural for Latin America, recognized for the quality and leadership of its graduates.

the liberal arts

An educational philosophy in which all disciplines of knowledge have equal importance, and which seeks to form free individuals, aware of their environment, enterprising, self-confident, creative and without conditions.

College Mission

The USFQ College of Sciences and Engineering trains professionals with excellent levels of preparation science and technology in their area of specialization, and with a solid humanistic background in arts liberals; professionals who are people of integrity, with solid ethical and moral principles, of acute critical thinking, who know how to make decisions and solve problems creatively; professionals with

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objective knowledge of Ecuador and the world, sensitive to the problems of our society and deeply committed to their professional and personal improvement.

USFQ CODE OF HONOR

It is the responsibility of all USFQ members to obey and enforce the following code:

- I. Conduct myself in a way that does not undermine in any way the opportunities for personal fulfillment and professional of other people within the University Community. Among other actions, I will prevent the slander, lies, greed, envy, and I will promote kindness, recognition, happiness, friendship, solidarity and truth.
- II. Be honest: do not copy, plagiarize, lie or steal in any way. Sign all academic work as proof of compliance with the Code of Honor, that I have not received help or copied from sources not allowed. Keep tests, examinations and all confidential information confidential, without divulge it.
- III. Respect all members of the university community and take care of the campus, its infrastructure and equipment.
- IV. Do not defame.
- V. Report to the Dean of Students any action of disrespect to the Honor Code by any member. Cooperate with the Court of Honor to clarify any investigation and violation of this Code.

Any violation of this code by a member of the USFQ Community will be sanctioned by the corresponding authority in accordance with the respective procedure. For more information, go to Dean of Students.

ACADEMIC HONESTY AND PLAGIARISM

The honor code is taken very seriously in this class. Plagiarism or copying in the projects and/or exams is dishonest. You will get an "F" grade on your job and may receive other punishments discipline in accordance with University regulations.

MAIN TEXT

Calculus Several Variables, George Thomas, Twelfth Edition, Pearson, 2010.

BIBLIOGRAPHY

Vector Calculus of Marsden and Tromba.

Vector Calculus by Claudio Pita Ruiz.

Calculus in several Stewart variables.