



Mathematics 201-BNK-05

Advanced Calculus

Winter 2011

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Ponderation: 3-2-3

Credits: 2 2/3

Prerequisite: Integral Calculus (201-NYB-05) and Vectors & Matrices (201-NYC-05)

Program Objectives

The theoretical basis for the Calculus will be re-examined more carefully. However, the main objective is to furnish you with mathematical tools that have been found essential in dealing with a variety of problems as they arise in the physical world. You should, by the end of this course, have some facility with both the translation of problems into mathematics and the manipulation of the newly acquired tools. Thus the course partially satisfies objective 00UV of the Science Program. More generally, you will learn

- 1) to solve problems systematically;
- 2) to reason logically;
- 3) to communicate in a clear and precise fashion;
- 4) to use previously acquired knowledge when dealing with new situations;
- 5) to use the appropriate information technologies;
- 6) to work autonomously;
- 7) the historical context of the concepts taught;
- 8) appropriate attitudes.

Course Objectives

The calculus courses re-enforce that branch of mathematics called analysis. In this course the student will learn to apply multivariable and vector calculus methods to the study of functions and to problem solving. To meet this objective, the student will learn:

- 1) to define limits and continuity formally and use these definitions in proofs;
- 2) to generalize the techniques of single variable differential and integral calculus to two or more variables;
- 3) to apply multivariable calculus techniques to solve concrete problems;
- 4) to solve first order, first degree differential equations and higher order linear differential equations;
- 5) to use differential equations to solve concrete problems.

Teaching Method

The course is given in an interactive lecture form, with frequent interludes for you to try out the ideas being considered.

Textbook

No textbook is required.

Calculator

Only the Sharp EL531 will be permitted for tests and examinations. It may be purchased at the bookstore.

Course Content

- 1) SINGLE VARIABLE FUNCTIONS: Formal Definition of Limits and Continuity. Formal Definition for the Convergence of Sequences
- 2) VECTOR-VALUED FUNCTIONS: Vector-valued functions, Differentiation and Integration, Velocity and Acceleration, Tangent Vectors and Normal Vectors, Arc Length and Curvature.
- 3) MULTIVARIABLE FUNCTIONS: Functions of Several Variables, Limits and Continuity, Partial Derivatives, Differentials, Chain Rules for Multivariable Functions, Directional Derivatives and Gradients, Tangent Planes and Normal Lines, Optimization of Several Variables, Lagrange Multipliers¹.
- 4) MULTIPLE INTEGRALS: Iterated Integrals and Area in the Plane, Double Integrals and Volume, Change of Variables: Polar Coordinates, Center of Mass and Moments of Inertia, Surface Area, Triple Integrals, Triple Integrals in Cylindrical and Spherical Coordinates, Change of Variables: Jacobians¹.
- 5) VECTOR ANALYSIS: Vector Fields¹, Line Integrals¹, Conservative Vector Fields and Independence of Path¹, Green's Theorem¹, Parametric Surfaces¹, Surface Integrals¹, Divergence Theorem¹, Stokes's Theorem¹.
- 6) DIFFERENTIAL EQUATIONS: Separable and Homogeneous Equations, First-Order Linear Equations, Exact Equations, Integrating Factors, Second-Order Linear Equations¹, Non-Homogeneous Linear Equations¹, Applications¹, Series Solutions¹.

¹ These topics will only be covered if time allows.

Evaluation

The evaluation in this course will verify that you have learned:

- 1) to use the appropriate concepts;
- 2) to represent curves in \mathbb{R}^2 and curves and surfaces in \mathbb{R}^3 ;
- 3) to choose and apply the correct rules and differentiation and integration techniques;
- 4) to solve differential equations;
- 5) to manipulate algebraic expressions correctly;
- 6) to arrive at exact answers
- 7) to arrive at correct interpretations of results;
- 8) to justify the steps you have taken in problem solving;
- 9) to use the appropriate terminology and notation.

There will be four term tests, four assignments and a final evaluation consisting of a final exam examination.

The midterm and final grade will be calculated as follows:

	<u>Midterm grade</u>	<u>Final Grade</u>
Tests	2 at 40% each	4 at 12% each
Assignments	2 at 10% each	4 at 3% each
Final Exam	-	40%

If a student is absent for a test due to a College-authorized reason (see the *Institutional Policy on the Evaluation of Student Achievement (IPESA)*, section 2.7 on the SLC web site <http://www.slc.qc.ca/>), then a make up evaluation will be given, otherwise a student will be given zero (0). Late assignments will be severely penalised (10% taken off per day), and will not be accepted once I have given back the graded assignments.

Tests and assignments (including the final examination) will be graded on the proper use of English and Mathematics. That means that written passages must be grammatically correct and that proper mathematical style and notation will be required. Improper use may result in a loss of up to 15% of the grade.

Absences

Attendance is mandatory and a maximum of 5 absences will be tolerated (explained and/or unexplained). More than the 5 absences may mean failure in the course (see section 5.2 of the IPESA).

Rules & Regulations

St. Lawrence has definite regulations concerning cheating and plagiarism. Any student caught cheating or plagiarizing on an assignment or a test will automatically receive a zero for that assignment or test. If a student is caught a second time, automatic failure in the course will result and disciplinary action may be taken. For more information, the student can consult section 5.5 of the IPESA where these rules are clearly indicated.