Laurea / B.A.
in Global Governance

Syllabus
Calculus
CFU: 12
Prof. Alessio Porretta

Course Description

One of the things we learned from 20th century is that complex phenomena arising from social and life sciences can not be deeply analyzed and understood unless we make use of the universal language of mathematics. This goes back to Galileo's intuition that universe be written in mathematical symbols, a principle nowadays applied to human sciences as well as to natural ones. The purpose of this course is to introduce students to those basic notions in mathematics which are essential to describe, understand and analyze possibly different models of quantitative phenomena. Main concepts and tools of differential and integral calculus are taught in order that students become familiar with functions of real variables, notions of growth, limits, rate of change, optimization, time evolution, all of them being necessary to approach mathematical models in applied sciences as well as to pursue further studies in probability and statistics. Students are expected to learn the main concepts, to practice with basic tools of calculus and to understand the use of mathematical language in applied models of real life.

Teaching Method

The course is essentially taught in the traditional way through room lessons; this is necessary since the mathematical language needs to be presented in action on the blackboard, where theory and practice become intrinsically linked. Tutorials specifically devoted to practice repetition will be added to standard lessons, so that students may be called to interact and test their level of comprehension.

Schedule of Topics

Topic 1	Real numbers, elementary functions and graphs
Topic 2	Sequences and limits
Topic 3	Recurrence, discrete time models: exponentials and logarithms, log scales
Topic 4	Derivatives: rules and applications, rate of change in applied models
Topic 5	Optimization: maxima and minima, convexity, curve sketching
Topic 6	Integration: areas, antiderivatives, Fundamental Theorem of Calculus
Topic 7	Differential equations and growth models: equilibrium points, stability
Topic 8	Multivariable calculus: partial derivatives, optimization, integration

Textbook and Materials:

Laurence D. Hoffmann, Gerald L. Bradley, Dave Sobecki, Michael Price:
Applied Calculus for Business, Economics, and the Social and Life Sciences, Expanded Edition, ***ed. Mc Graw-Hill.***

The above textbook is recommended. Please note that there also exists a brief edition of the same textbook:
Laurence D. Hoffmann, Gerald L. Bradley, Dave Sobecki, Michael Price:
Applied Calculus for Business, Economics, and the Social and Life Sciences, Brief Edition, ed. Mc Graw-Hill.

The expanded edition is recommended. For those who happen to buy the brief edition, please contact the teacher to have details on the extra chapters which are missing.

Further readings:

1. Notes given by the teacher

2. Claudia Neheauser: Calculus for biology and medecine, 3rd ed. Pearson International
(especially devoted to models in biology and life sciences, discrete and continuous time growth models)

Assessment
The exam consists of written examinations. All written examinations require students to solve exercises through a detailed written explanation containing all the necessary steps and computations.
Two mid-term examinations are given, roughly corresponding to Topics 1-5 and 6-7 respectively, although variations could happen according to the up-to-date program of lessons. Each mid-term examination may count up to 30% of the final grade, provided the exam is passed in the winter session. At the end of the lessons period, a final written examination is given. Attendance to the final examination is compulsory in order to pass the exam. Students who fail mid-term examinations have the opportunity to give the final examination where they may be required to solve additional exercises. Students who fail, or do not attend, the final examination will need to give a new complete examination in different sessions of the year.

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