Laurea / B.A.
in Global Governance

Academic Year 2017-2018
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 cannot 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 classroom lectures; this is necessary since the mathematical language needs to be presented in action on the blackboard, where theory and practice become intrinsically linked. Additional tutorials will be devoted to those students who need extra practice as well as specific care because they lack of background. At the beginning of the year, this group of students is identified from an evaluation test at the end of the Math precourses. During the semester, as the program goes further, periodic evaluations are scheduled to monitorize the group of students who need to follow the additional tutorials.

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, 2012-2013.

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, 2012.
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 on differential equations
(available at http://axp.mat.uniroma2.it/~porretta/notes-porretta2.pdf)
2. Not mandatory - Claudia Neheauser: Calculus for biology and medicine, 3rd ed. Pearson International, 2011.
(especially devoted to models in biology and life sciences, it may complement the main textbook on topics like discrete and continuous time growth models, differential equations)

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 25% of the final grade, provided the exam is passed in the winter session.
In between the beginning of the course and the first mid-term, as well between the first and the second mid-term, two short partial evaluation tests are given, which count each up to 5% of the final grade.
According to those tests, as well as to the results of mid-term exams, students may be required to follow the additional tutorials which support the standard lessons.
At the end of the lecture period, a final written examination on topics 1 to 8 is given and is worth 40% if the exam is passed in the winter session. Attendance to the final examination is compulsory in order to pass the exam.
Students who fail or do not attend mid-term examinations have the opportunity to give the final examination where they may be required to solve additional exercises. Students who fail the final examination will need to give a new complete examination in different exam dates of the year and forego their previous mid-term results. Students who do not attend the first final examination can redo it without forgoing the mid-results in the second exam of the winter session. Students who retake the exam in the September session have to forego any result of the winter session and do a new complete examination.

Office hours
By appointment, every thursday h 16.00

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