COURSE PRESENTATION FORM – ACADEMIC YEAR 2010/2011

COURSE NAME	**Analysis**
COURSE CODE	75001 (BSc 270) / 70135 (BSc 509) / 70007 (BSc Old)
LECTURER	Prof. Ricardo Alberto MARQUES PEREIRA
TEACHING ASSISTANTS	Valeria Leggieri – English Ilenia Fronza – Italian Helmuth Thaler - German
TEACHING LANGUAGE	English
CREDIT POINTS	12 (BSc 270) / 8 (BSc 509) / 6 (BSc old study plan)
LECTURE HOURS	72
EXERCISE HOURS	36
TIME SPAN	30.09.2010 - 11.06.2011
TIME TABLE	See Timetable Page
OFFICE HOURS LECTURER	Faculty of Computer Science, Piazza Domenicani 3, second floor, office 2.10, Thursday 14:40 – 16:00 and Friday 14:40 – 16:00.
OFFICE HOURS TEACHING ASSISTANT	Faculty of Computer Science, Piazza Domenicani 3, first floor.
PREREQUISITES	Elementary notions of set theory, propositional logic, algebra (linear and quadratic equations and inequalities), elementary functions (powers and radicals, exponentials and logarithms), and Cartesian geometry (points, lines, and parabolas).
OBJECTIVES	Introduction to the theory of functions of a single real variable: domain and graph of elementary functions, limits, continuity, differentiation, polynomial approximations (Taylor's formula), optimization (maxima and minima), convexity and concavity, graphs of functions, integration, techniques of integration, sequences and series, linear differential equations. Moreover, introduction to the fundamental methods and structures of abstract and linear algebra.
SYLLABUS	• Foundations: sets, maps, logic. • The basic numerical sets N, Z, Q, and R. • The real line R: intervals, metric, and topology. • Real variable functions: positive/negative domains, graphs. • Linear and quadratic functions and their graphs. • Elementary functions and their graphs.

- Limits at a point and limits at infinity.
- Continuity and theorems on continuity.
- Differentiation: derivatives, rules of differentiation.
- Theorems on differentiation.
- Polynomial approximations and Taylor's formula.
- Limits revisited: indeterminate forms and l'Hospital's rule.
- Optimization in one variable, local minima and maxima.
- Convex and concave functions, global minima and maxima.
- Sketching the graph of functions, types of asymptotes.
- Integration: definite and indefinite integrals, rules of integration.
- Theorems on integration, the fundamental theorem of calculus.
- Integration by substitution and integration by parts.
- Generalized integrals, convergence and divergence.
- Sequences and convergence.
- Series and convergence.
- Taylor and Maclaurin series.
- First order linear differential equations.
- Second order linear differential equations.

The traditional 8 credits Analysis exam regards all subjects in this group. The old 6 credits Analysis exam regards all subjects in this group except: 1st and 2nd order linear differential equations, and sequences and series.

- Binary relations: properties, partial and total orders and preorders, equivalence relations.
- Abstract algebraic structures, homomorphisms and isomorphisms.
- Groups: cyclic and permutation groups, the group of residue classes module m.
- Rings: types of rings, characteristic, zero divisors.
- Matrices: matrix algebra, determinants, inverse matrix, elementary transformations, canonical form.
- Linear systems of equations: Rouché-Capelli's theorem, Gauss-Jordan elimination, Cramer's rule.
- Vector spaces: subspaces, linear dependence and independence, bases and dimension.
- Linear transformations and the associated algebra, eigenvalues and eigenvectors.
- Quadratic forms: definition and sign, classification in terms of the associated matrix.

The traditional 4 credits Algebra exam regards all subjects in this group except: eigenvalues and eigenvectors, and quadratic forms.

TEACHING FORMAT Classical classroom lectures for both theory and exercise classes.

ASSESSMENT The assessment is based on three midterm exams and one final exam which can be taken in June/July, September, or January/February. All exams are written exams. The assessment scheme is as follows: exams are marked

from 0 to 30 and as usual the 'sufficiency' level (minimum pass mark) is 18. If the midterm mark is sufficient, then the course mark is given by the average between the (overall) midterm mark and the final mark. Otherwise, the course mark is simply the final mark.

READING LIST

The following textbooks are suggested (more recent editions might exist):

- Robert A. Adams: Single variable calculus (3rd ed. ISBN 978-0-201-82826-9), Addison Wesley 1995.
- Robert A. Adams: Calculus, a complete course (3rd ed. ISBN 978-0-201-82823-8), Addison Wesley 1994.
- Robert A. Adams: Calculus, a complete course (6th ed. ISBN 978-0-321-27000-9), Prentice Hall 2006.
- Fred Safier: Precalculus, Shaum's outline series (2nd ed. ISBN 978-0-07-150864-3), McGraw Hill 2008.
- Frank Ayres and Elliott Mendelson: Calculus, Shaum's outline series (5th ed. ISBN 978-0-07-150861-2), McGraw Hill 2008.
- Frank Ayres: Modern Abstract Algebra, Shaum's outline series (1st ed. ISBN 978-0-07-002655-1), McGraw Hill 1965.
- Seymour Lipschutz and Marc Lipson: Linear Algebra, Shaum's outline series (4th ed. ISBN 978-0-07-154352-1), McGraw Hill 2008.

In any case, the students should primarily refer to their notes (carefully) taken in class.

SOFTWARE USED

None.

LEARNING OUTCOME

Basic concepts and techniques of single variable differential calculus: limits, derivatives, integrals, sequences, series, 1st and 2nd order linear differential equations. Plus the basic notions and methods of abstract and linear algebra: groups and rings, homomorphisms, matrices and determinants, linear systems, vector spaces, linear transformations, and quadratic forms.

COURSE PAGE

No material is available online: students are supposed to refer primarily to their notes (carefully) taken in class (lectures and exercise classes) and consult the suggested textbooks.