UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Mathematics For Marketing - 1

2021-2-E1801M048-T1

Learning objectives

This class aims to give the student a solid foundation for the mastering of the fundamental concepts related to Numerical Series, Integrals, Linear Algebra and Financial Mathematics.

At completion, the student will be able 1) to study numerical series, compute integrals and use the fundamental notions of linear algebra, manipulate matrices and solve linear systems, and 2) to apply mathematical techniques to a broad class of financial models and linear programming.

Contents

This class introduces the student to the fundamental notions related to Numerical Series, Integrals and Linear Algebra (Matrices and Linear Systems). In the second part there is an extensive introduction to the fundamental concepts of Financial Mathematics and Linear Programming.

Detailed program

Series. Definition of numerical Series and its sum. Telescoping Series. Geometric series. Necessary Condition for Convergence of a Series. Series with terms with eventually constant signs. Generalized Harmonic Series. The Ratio Test, the Comparison Test, the Asymptotic Test, and the Root Test. Absolute and Simple Convergence of Series.

Integrals. Definition of the Riemann Integral. Sufficient Conditions for Integrability. Main Properties of the Integral. Lagrange Theorem. The Fundamental Theorem of Calculus. Definition of Antiderivative and its use in the computation of the Riemann Integral. Integration by parts and Integration by change of variable. Improper Integral. Sufficient Conditions for the existence of Improper Integrals.

Linear Algebra. Vector Spaces on **R**. Inner product. Matrices. Operations with Matrices. Determinants and main Properties. Laplace Theorem. Inverse Matrix: Uniqueness of the Inverse Matrix and Necessary and Sufficient Condition for its existence. Linear Systems. Cramer's Theorem. Rank of a Matrix. Rouche-Capelli Theorem.

Financial Mathematics. Principal, Amount Function, Interest, Simple Interest and Compound Interest. Frequency of compounding. Discount and Discount Factor. Force of Interest. Annuity-immediate and annuity-due. Present and future values of annuities. Perpetuities and deferred annuities. Other accumulation methods. Payment periods and compounding periods. Loans and Costs of Borrowing. Amortization schedule. Different. Amortizations and theirs computation. Analysis of real Investments. Net Present values. Internal rate of return. Payback period. Fixed-Income securities and valuation. Bonds. Yield of bonds. Spot Rates and Forward Rates. No Arbitrage Principle. Duration. Volatility. Basic Notions of Dynamic programming

Prerequisites

Matematica Generale (General Mathematics)

Teaching methods

There will be lectures and practice sessions as well as tutorials and they will all be delivered in Lecture theatres. The class is taught in Italian.

The lectures aim to present the theoretical results related to the class's material. In the lectures we will focus on presenting the theorems and mathematical results listed above. In addition, the lectures will also cover and discuss problems and exercises to illustrate the theoretical results.

In the practice sessions the focus is on helping the student in solving problems. Therefore the focus will be only on presenting the solutions of exercises and problems. Moreover, several financial mathematics problems will be solved and discussed.

Finally, there will be a tutor who will assist the students.

Assessment methods

A written exam.

The student can substitute the final exam with two mid-term exams.

The aim of the written exams is to establish if the student has developed a reasonable level of problem solving ability. Therefore there will be exercises similar to the ones presented in the suggested textbooks.

In the case the students opt to take the mid-term exams then the final grade will be the average of the two grades

Textbooks and Reading Materials

1. Angelo Guerraggio MATEMATICA (Seconda Edizione) Pearson Education Italia

2. Stefani, Torriero, Zambruno Elementi di Matematica Finanziaria con cenni di Programmazione Lineare GIAPPICHELLI

3. Bolamperti e Ceccarossi Elementi di Matematica Finanziaria con cenni di Programmazione Lineare ESERCIZI (II edizione) Giappichelli.

Semester

Second Semester

Teaching language

Italian