Course title: Numerical Methods for Finance

Course Basic Information	
Academic Unit: (University/Department)	ETH Zürich, Department of Mathematics
Course title:	Numerical Methods for Finance
Level:	Master of Science UZH ETH in Quantitative Finance
Course Status:	Core MF
Year of Study:	**Spring Semester**
Number of Classes per Week:	2h (lectures) + 1h(exercises)
ECTS Credits:	**6 ECTS**
Time /Location:	|According to the timetable in ETH course catalogue
Lecturer:	Prof. Dr. Christoph Schwab
Content	
Content of the course	1. Review of option pricing. Wiener and Levy price process models. Deterministic, local and stochastic volatility models. 2. Finite Difference Methods for option pricing. Relation to bi- and multinomial trees. 3. Finite Difference methods for Asian, American and Barrier type contracts. 4. Finite element methods for European and American style contracts. 5. Pricing under local and stochastic volatility in Black-Scholes Markets. 6. Finite Element Methods for option pricing under Levy processes. Treatment of integrodifferential operators. 7. Stochastic volatility models for Levy processes. 8. Techniques for multidimensional problems. Baskets in a Black-Scholes setting and stochastic volatility models in Black Scholes and Levy markets. 9. Introduction to sparse grid option pricing techniques.
Course's objectives:	Introduce the main methods for efficient numerical valuation of derivative contracts in a Black Scholes as well as in incomplete markets due Levy processes or due to stochastic volatility models. Develop implementation of pricing methods in MATLAB and Python. Finite-Difference/ Finite Element based methods for the solution of the pricing integrodifferential equation.
The expected outcomes:	On successful completion of this module, students should be able to: • Identify suitable numerical methods for PDEs to valuate financial derivatives under different market models, such as Black-Scholes, Lévy and stochastic volatility models. • Apply their theoretical knowledge to implement algorithms for option pricing problems in Python/MATLAB. • Assess the accuracy of the implemented valuation routine based on a-priori error estimates for finite difference and finite element methods.