

BITS Pilani, KK Birla Goa Campus

Wall Street Club in association w/ the **Center for Technical Education**

Introduction to Quantitative Finance

Instructors:

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Mentors:

Quant Wing of the Wall Street Club

Scope:

Introduction:

Quantitative finance is widely dubbed as the “future of finance” with the current growth in artificial intelligence and computational power. Simply put, it is the application of mathematics and computing to effectively model various financial scenarios. This leads to a better way to analyze financial markets by leveraging data, computation and automation with minimal supervision. This area is a rapidly growing career option for engineers, physicists, mathematicians, statisticians and economists alike.

Overview:

The objective of this course is to serve as an introduction to the key mathematical, financial and computational concepts of this field; and as such, the course will broadly be covered into these three phases

- Phase 1: Algorithmic Trading
- Phase 2: Mathematical Finance (Book that will be followed: Paul Wilmott Introduces Quantitative Finance)
- Phase 3: Financial Data Science

The students will be introduced to the various challenges, approaches and models currently used by researchers and industry players alike. This course will focus on using Python, because of its wide popularity, functionality and simplicity.

Structure:

| Sr. No | Week No. | Key Content | Target |
|------------------------------|----------|--|--|
| Introduction / Orientation | | | |
| 1 | Week 1 | What is quantitative finance? What is the motivation? Financial data, simple stock market data and how to manipulate data in Python. | This week will serve as an introduction / orientation for the course. In the hands-on tutorials, the students will be familiarized with Python libraries like numpy, pandas, scikit etc and to the open source platform GitHub. |
| PHASE 1: Algorithmic Trading | | | |
| 2 | Week 2 | <ul style="list-style-type: none">- introducing fundamental and technical analysis- explaining the idea of backtesters and APIs in order to trade on the market | First week of phase 1 - mathematical finance. This week will be aimed at introducing key financial concepts in a quantitative manner. |
| 3 | Week 3 | <ul style="list-style-type: none">- Using API to make algorithms that trade in the live market- Demos of a few trading strategies- How to make backtesters for your own strategies | In week 3, we will dive into creating trading algorithms that trade on the live market using APIs. This will be followed by our own examples of strategies work. |
| 4 | Week 4 | <ul style="list-style-type: none">- Implementation and doubt solving for phase 1- Phase 1 assignment(release) | Discussion of the doubts of the students and an assignment based on backtesting will be released. |

PHASE 2: Mathematical Finance

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|---|--------|--|---|
| 5 | Week 5 | <ul style="list-style-type: none">- Introduction to mathematical finance- Discussion of very elementary mathematical models | Students will be introduced to the concept of derivatives and how they are modelled using maths. First few models of quant finance will be introduced |
| 6 | Week 6 | <ul style="list-style-type: none">- Stochastic Calculus- Everything about black scholes equation and formula | This week will serve as the most important one for phase 2 and extensive discussion |
| 7 | Week 7 | <ul style="list-style-type: none">- Hedging and building complications upon the basic BSE- Phase 2 assignment release | This week will provide a high level overview of BSE and how to build complications on it in order to model it more accurately and realistically Finally we shall release an assignment for this phase |

PHASE 3: Financial Data Science

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|---|--------|---|---|
| 8 | Week 8 | <ul style="list-style-type: none">- Introduction to Time Series data- Traditional methods to model time series | Discussion of time series data and traditional modelling techniques will be discussed. How to code will also be an integral part of the discussion here . |
| 9 | Week 9 | <ul style="list-style-type: none">- Just a gist of modern ML and Deep Learning techniques used to model time series data- Few examples of how it is used in the industry | The final week will give students to study something more by themselves after the course. This mainly includes machine learning and deep learning techniques to model the data. We will give a brief introduction this last week so the students can continue on their own. |



Evaluation:

The evaluation will have three components corresponding to the three phases of the course. The weightage is as follows:

- 40% - Phase 1 assignment submission

- 40% - Phase 2 assignment submission

- 20% - Phase 3 assignment submission

Considerations can be made in deadlines if the student has a good class participation record.

