

Annexure 12

**Courses of advanced
quantitative and
algorithmic trading**

A) CPFE® Program | Financial Engineering Course Highlights

- **World Class Faculty:** Learn from highly acclaimed Quant practitioners and academics in Quantitative Finance who have worked with topmost global investment banks and firms in New York, London, Singapore, Sydney and more, with academic background from some of the world's top universities like Stanford (USA), Columbia (USA), IIM, IIT, ISI.

Module No.	Module Name	Details	Type
Module No.:Primer 1	Module Name: Introduction to Investment Finance	Details: Introduction to Finance and Financial Institutions Introduction to Capital Markets Introduction to Debt Markets Introduction to Derivatives Markets	Type: Optional
Module No.: Primer 2	Module Name: Introduction to Financial Mathematics	Details: Introduction to Linear Algebra Introduction to Differential Calculus Introduction to Integral Calculus Introduction to Ordinary Differential Equations	Type: Optional
Module No.: Primer 3	Module Name: Introduction to Probability & Statistics	Details: Introduction to Probability Probability Distributions Descriptive and Inferential Statistics	Type: Optional
Module No.: Primer 4	Module Name: Introduction to Programming	Details: Programming in Python	Type: Optional
Module No.: Module 101	Module Name: Introduction to Financial Engineering	Details: Introduction to Financial Economics Introduction to Bond Mathematics Options Fundamentals Introduction to Exotic Options	Type: Compulsory
Module No.: Module 102	Module Name: Financial Mathematics	Details: Probability Theory Basic Stochastic Processes Brownian Motion	Type: Compulsory
Module No.: Module 103	Module Name: Financial Mathematics II	Details: Stochastic Calculus Black-Scholes-Merton Models	Type: Compulsory
Module No.: Module 104	Module Name: Machine Learning for Quantitative Finance	Details: Regression Models Time Series Models Volatility Forecasting	Type: Compulsory
Module No.: Module 105	Module Name: Numerical Methods	Monte Carlo Simulation Methods Numerical Methods for Partial Differential Equations	Type: Compulsory
Module No.: Module 106	Module Name: Derivatives Valuations 1	Equity Derivatives Currency Derivatives	Type: Compulsory

Module No.: Module 107	Module Name: Derivatives Valuations 2	Interest Rate Derivatives Credit Derivatives Operational and Compliance Risk	Type: Compulsory
Module No.: Module 108	Module Name: Risk Analytics	Introduction to Financial Risk Market Risk Credit Risk Operational and Compliance Risk	Type: Compulsory

- **Industry focused curriculum: Advanced curriculum designed by Quant practitioners from top Wall Street Investment Banks and financial institutions and industry experts to prepare job-ready professionals who are highly sought after by International Banks, Hedge Funds, Consulting Firms and other Financial Institutions.**
- **Rigorous Practical Implementation: Learn how to combine theory and computational methods with strong emphasis on practical implementation in Python of the real-world application areas of these skills.**

CPFE® Structure

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prepare students for technically sophisticated jobs with financial institutions, financial service providers, financial consulting services and financial software companies. The program is intended for students seeking comprehensive technical knowledge of vanilla and exotic derivatives pricing, hedging, trading and investment strategies and portfolio management in equity, currency, interest rates, credit and mortgages.

CPFE is a short-term course that requires seven months of study for the core modules, which makes it attractive to students with strong quantitative skills who are willing to make a quick head start in the investment finance industry. The applied nature of the program implies the fact that there is great emphasis in it to impart the practical implementation skills and techniques that are actually used by practitioners in top financial institutions in the industry, so a considerable part of the course time is devoted to teaching implementation skills along with rigorous theoretical discourse.

As an applied discipline, financial institutions look for the following skill sets in the candidates for positions in their Quant teams :

- Strong quantitative background**
- Sound knowledge of the underlying financial theories**
- Very good implementation skills**

This Financial Engineering course is designed specifically to meet these exact needs. This is a course on modelling and applications of mathematics, statistics and econometrics in investment finance. The program covers all the technical and quantitative aspects of investment finance used in top financial institutions.

The combination of skills imparted through this program viz. understanding of complex financial theories, rigorous exposure to the underlying mathematical and statistical theories, practical financial modelling ability and computer implementation proficiency, is in high demand in the industry, and which the employers do not generally find in graduates of standard MBA or financial engineering programs.

B) CPMLF Program - Machine Learning for Finance Course Highlights

Course Structure

CERTIFICATE PROGRAM IN

Machine Learning for Finance (CPMLF)

- **Preparatory Primers**

- ML Programming Preliminaries
- ML Mathematical Preliminaries
- ML Probability & Statistical Preliminaries

- **Module I**

Machine Learning Overview, Framework & Finance Applications

- **Module II**

Machine Learning Supervised Learning Algorithms

- **Module III**

Machine Learning Unsupervised Learning Algorithms

- **Module IV**

Machine Learning Speech and Language Processing

- **Module V**

Machine Learning Model Evaluation Metrics and Model Validation

C) CPQFRM® Program | Quantitative Finance and Risk Management Course Highlights

- **World Class Faculty:** Learn from highly acclaimed Quant practitioners and Risk Management experts who have worked with topmost global investment banks and firms in New York, London, Singapore, Sydney and more, with academic background from some of the world's top universities like Stanford (USA), Columbia (USA), IIM, IIT, ISI.
- **Industry focused curriculum:** Advanced curriculum designed by Quant and Risk Management practitioners from top Wall Street Investment Banks and financial institutions and industry experts to prepare job-ready professionals who are highly sought after by MNC Investment Banks, Commercial Banks, Asset Management Companies, Consulting Firms and other Financial Institutions.
- **Rigorous Practical Implementation:** Strong emphasis on practical implementation in Python and knowledge of the real-world application areas.

CPQFRM® Structure

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Module No.	Module Name	Details
Module No.:Primer 1	Module Name: Introduction to Programming	Programming in Python
Module No.: Module 201	Module Name: Introduction to Investment Finance	Details: Financial Markets and Products Financial Economics Fundamentals of Fixed Income Instruments Fixed Income Mathematics Derivatives Products and Strategies Financial Institutions
Module No.: Module 202	Module Name: Introduction to Financial Mathematics	Details: Linear Algebra Calculus Review
Module No.:Module 203	Module Name: Introduction to Probability & Statistics	Details: Probability Theory Probability Distributions

		Descriptive and Inferential Statistics
Module No.:Module 204	Module Name: Machine Learning for Quantitative Finance	Details: Introduction to Machine Learning Supervised Learning <ul style="list-style-type: none"> • Regression Models • Time Series Models • Volatility Forecasting Unsupervised Learning
Module No.: Module 205	Module Name: Stochastic Processes	Details: Basic Stochastic Processes

D) PGPAT Program - Algorithmic Trading Course Highlights

- **Highly qualified industry practitioner faculty**
- **Advanced Curriculum**
- **Thoroughly hands-on training in programming algorithmic trading strategies in Python**
- **Training on industry leading algorithmic trading platforms**
- **Training in Simulation Lab**
- **Live Trading experience in real market**

Module No.	Module Name	Details
Part 1		
Module 101	Introduction to Algorithmic and Quantitative Trading	<ul style="list-style-type: none"> • What is “Algorithmic” Trading? • Market Structures • Evolution: Algorithmic Trading trends and their impact on the markets • Types of Algorithmic Trading Strategies • Lifecycle of Algorithmic Trading • Market Microstructure and Concepts <ul style="list-style-type: none"> ○ Order Book Dynamics ○ Bid-Ask Spread ○ Bid-Ask Bounce • Latency • Introduction to jupyter notebook • Introduction to IntelliJ IDE <ul style="list-style-type: none"> ○ Installing intelliJ ○ Basics of IntelliJ ○ Read stock data with IntelliJ and basic functionality
Module 102	Technical Trading Strategies	<ul style="list-style-type: none"> • 1. Overview of Systematic Trading indicators in Technical Analysis • 2. Trend following Strategies • 3. Momentum based Strategies • 4. Exploring strategies on stock price data • 5. Exploring such strategies on bitcoin data
Module 103	Strategy Development and Back-testing	<ul style="list-style-type: none"> • 1. Ideation and Strategy Creation • 2. Architecture of a back-testing System • 3. Common Pitfalls (Look-ahead bias, survivorship bias etc.) • 4. Implementing a back-tester • 5. Strategy Module • 6. Performance Measurement Statistics • 7. Parameter Optimization • 8. Transaction Cost Analysis
Module 104	Money Management and Risk Management	<ul style="list-style-type: none"> • 1. Optimal Capital Allocation • 2. Risk Management
Module 105	Algorithm Trading Infrastructure Setup	<ul style="list-style-type: none"> • 1. Algorithm Trading Mechanics • 2. Architectural design • 3. Basic platform design and architectural setup • 4. Operational considerations and pitfalls
Module 106	Algorithmic System Design and Implementation	<ul style="list-style-type: none"> • 1. Implementing Strategies • 2. Order Management • 3. Risk Management • 4. Error Handling • 5. API Integration
Part 2		
Module 107	Options Trading Strategies	<ul style="list-style-type: none"> • 1. Options Pricing • 2. Options Greeks • 3. Options Trading Strategies <ul style="list-style-type: none"> ○ a. Market Neutral Strategies ○ b. Bullish Strategies ○ c. Bearish Strategies ○ d. Arbitrage Strategies <ul style="list-style-type: none"> ▪ i. Cash Future Arbitrage ▪ ii. Conversion Reversal / Put-Call Parity
Module 108	Machine Learning for Quantitative Trading Using Python	<ul style="list-style-type: none"> • 1. Introduction to Machine Learning • 2. Regression Models <ul style="list-style-type: none"> ○ a. Simple Linear Regression

		<ul style="list-style-type: none"> ▪ i. Example with stock data and why linear regression not a good fit ○ ▪ b. Multiple Linear Regression <ul style="list-style-type: none"> ▪ i. Example with stock data ○ c. Logistic Regression ○ d. Decision Tree Regression ○ e. Random Forest Regression
Module 109	Optimization Methods	<ul style="list-style-type: none"> • 3. Classification Models <ul style="list-style-type: none"> ○ a. Decision Tree Classification ○ b. Random Forest Classification • 4. Few examples on what not do fit to stock data
Module 109	Optimization Methods	<ul style="list-style-type: none"> • 1. Analytical vs Numerical Optimization • 2. Cost Functions for Regression • 3. Cost Functions for Classification • 4. Gradient Descent • 5. Stochastic Gradient Descent • 6. Adam Gradient Descent
Module 110	Time Series Analysis Using Python	<ul style="list-style-type: none"> • 1. Auto Regressive Models (AR) • 2. Moving Average Models (MA) • 3. MA as basic model for stock data predictions • 4. Auto Regressive Moving Average Models (ARMA) • 5. Auto Regressive Integrated Moving Average Models (ARIMA) • 6. Exponentially Weighted Moving Average Models (EWMA) • 7. Generalized Auto Regressive Conditional Heteroskedasticity Models (GARCH) • 8. Stock data examples
Module 111	Deep Learning for Quantitative Trading Using Python	<ul style="list-style-type: none"> • 1. Introduction to Deep Learning – Artificial Neural Networks (ANN) <ul style="list-style-type: none"> ○ a. Traditional Machine Learning Vs Deep Learning ○ b. Universal Approximation Theorem ○ c. Perceptron ○ d. Activation Functions ○ e. Cost Functions ○ f. Back Propagation • 2. Feed Forward Neural Network (FFN) • 3. Recurrent Neural Network (RNN) • 4. Long Short Term Memory (LSTM) Network
Module 112	Quantitative Trading Strategies	<ul style="list-style-type: none"> • 1. Introduction to Quantitative Trading • 2. Quantitative Directional Strategies • 3. Statistical Arbitrage Strategies <ul style="list-style-type: none"> ○ a. Pairs Trading Strategies • 4. Arbitrage Strategies <ul style="list-style-type: none"> ○ a. Index Arbitrage ○ b. Spread Arbitrage • 5. Gamma Scalping • 6. Volatility Trading <ul style="list-style-type: none"> ○ a. Risk Reversal / Volatility Skew Trading ○ b. Dispersion Trading • 7. Electronic Market Making Strategies
Module 113	Algorithmic Execution Strategies	<ul style="list-style-type: none"> • 1. Execution Algorithms <ul style="list-style-type: none"> ○ a. Percentage of Volume (POV)

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- **b. Volume Weighted Average Price (VWAP)**
 - **c. Time Weighted Average Price (TWAP)**

E) CPPPF Program | Python Programming for Finance Course Highlights

- **Learn Python programming in context of finance and development of financial applications**
- **Highly qualified industry practitioner faculty**
- **Thorough hands-on training in programming in Python**
- **Lucid and well-structured Curriculum**

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- **Why python**
 - **• Installing Anaconda**
 - **• Spyder IDE**
 - **• Work with Spyder**
 - **• Jupyter notebook**
 - **• Learning the Syntax**
 - **• Number String**
 - **• Python Basics**
 - **• Operators in Python**
 - **• Control flow**
 - **• Object**
 - **• Collections: List, Tuple, Dictionary, Set**
 - **• Iterable object**
 - **• Iterable comprehension**
 - **• Important library usage: numpy, scipy, pandas**
 - **• Plotting with python**

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- **Class and object-oriented programming with Python**
 - **Monte Carlo Simulation in Python**
 - **Implementing Equity Options Pricing in Python**
 - **Binomial Model**
 - **Black and Sholes Model**
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F) CPDVRA Program | Derivatives Valuation & Risk Analytics Course Highlights

- **World Class Faculty:** Learn from highly acclaimed Quant practitioners and Risk Management experts who have worked with topmost global investment banks and firms in New York, London, Singapore, Sydney and more, with academic background from some of the world's top universities like Stanford (USA), Columbia (USA), IIM, IIT, ISI.
- **Industry focused curriculum:** Advanced curriculum designed by Quant and Risk Management practitioners from top Wall Street Investment Banks and financial institutions and industry experts to prepare job-ready professionals who are highly sought after by MNC financial institutions.
- **Rigorous Practical Implementation:** Strong emphasis on practical implementation and knowledge of the real-world application areas.

About the Course

Finance professionals as well as non-finance professionals (software developers, business analysts, credit analysts, etc.) who want to move into finance often want to learn to develop derivatives valuation and risk analysis models. Even experienced risk management professionals who have the theoretical background of the risk management models, find their skills to be inadequate when it comes to developing and practically implementing the models. For them having the theoretical background is not enough to actually implement these models in practice. Very often these models are now implemented in Python. This is why we have designed this course tailor-made for imparting these skills. This program is designed for people who have prior programming knowledge in any language and want to move into risk management or derivatives valuations field and want learn to develop applications related in these areas.

This is an implementation-oriented course in which practicing Risk Modellers, Investment Bankers and Treasury Professionals teach the latest valuation techniques and risk modeling skills that are used in the industry. This course starts with learning

basic tools and theories related to the field and goes on to learning implementation of valuation models of derivative instruments of various asset classes using the models being used in the industry and then learning to carry out risk analysis and implement various risk models for various asset classes

BUILD YOUR CAREER

BE WISE

BE RICH

THANK YOU

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