



INSTITUTE OF QUANTITATIVE FINANCE (INDIA)

624, Mastermind IV, Royal Palms IT Park, Goregaon (East), Mumbai 400065

Phone: +91-22-28797660 Web: www.iqfindia.com

FRM 2010 TRAINING SYLLABUS

LEVEL I

Introduction to Financial Mathematics

1. Introduction to Financial Calculus
 - a. Variables – Discrete and Continuous
 - b. Univariate and Multivariate Functions – Dependent variable and Independent variable
 - c. Graph of a function
 - d. Linear and Non-Linear functions
 - e. Some functions - Polynomial, Exponential, Logarithmic, Trigonometric
 - f. Limits of a function
 - g. The number e and Natural Logarithm
 - h. Differential Calculus – Differentiation, Interpretation - Slope of a tangent, using derivatives to calculate function values and deltas. Linear functions - 1st order derivative. Non-linear functions – 1st and higher order derivatives, interpretations and usage. Rules of derivatives.
 - i. Functions – Differentiation and Taylor Series Expansion
 - j. Introduction to Partial Derivatives
 - k. Introduction to Integral Calculus
2. Introduction to Bond Mathematics
 - a. Finance and the Time Value of Money
 - b. Concept of Zero Coupon (Discount) Bonds and Coupon Bonds.
 - c. Bond Characteristics
 - d. Bond Types – Fixed Rate, Floating Rate, Inverse Floater Rate, etc.
 - e. Interest Rates – Discrete and Continuous Compounding
 - f. Bond Pricing – using ZCYC or YTMC with discrete compounding or continuous compounding
 - g. Difference between bond coupon rate and bond yield
 - h. Calculating Bond Yield (YTM, CY, MMY, ZCY/Spot, Par Yield, etc.)
 - i. Price Yield Relationship
3. Matrix Algebra
 - a. Vector and Matrix
 - b. Matrix Operations – Transpose, Addition, Multiplication, Inversion

Introduction to Financial Statistics and Econometrics

1. Introduction to Financial Statistics
 - a. Frequency distributions
 - b. Measures of Central Tendency/Location (Mean/Mode/Median)
 - c. Dispersion, Measures of Dispersion (Variance/SD/Quartiles/Percentiles/Ranges) and its relevance to Risk Management
 - d. Correlations



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2. Introduction to Probability Theory
 - a. Random variables
 - b. Probability and its uses
 - c. Probability Rules
 - d. Conditional Probabilities
 - e. Probability Distributions (Single Variable)
 - i. Continuous Time/Discrete Time; Continuous Value/ Discrete Value
 - ii. Probability Mass Function
 - iii. Probability Density Function
 - iv. Cumulative Distribution Function
 - v. Applications and relevance in Risk Management
 - f. Mathematical Expectation
 - g. Moments of Distribution (Mean, Variance, Skewness, Kurtosis), Central Moments, Standardized Moments
3. Introduction to Econometrics
 - a. Introduction to Regression Analysis
 - i. Least Squares Regression
 - ii. Single Variable Linear Regression
 - b. Introduction to Time-series Analysis - Stationary time series models

Quantitative Analysis

1. Discrete Probability Distribution
 - a. Uniform Distribution
 - b. Poisson Distribution
 - c. Binomial Distribution
2. Continuous Probability Distribution
 - a. Uniform Distribution
 - b. Normal/Gaussian Distribution, Standard Normal Distribution
 - c. Log-Normal Distribution
 - d. Student's t Distribution
 - e. F Distribution
 - f. Chi-Square Distribution
 - g. Weibull Distribution
 - h. Bernoulli Distribution
3. Central Limits theorem. Relevance to Risk Management - (Effect on VaR estimation).
4. Chebyshev's Theorem/Inequality
5. Estimating parameters of distributions
 - a. Populations Parameters and Sample Statistics / Estimators
 - b. Biased and Unbiased Estimators
6. Hypothesis Testing and Statistical Inference
 - a. Hypothesis concerning estimators
 - b. Confidence Levels, Confidence intervals, Level of Significance, p-Values
 - c. Type-I and Type-II errors
 - d. 1-Tailed and 2-Tailed Tests
 - e. z-Test and t-Test for Mean
 - f. z-Test and t-Test for difference of Means
 - g. Chi-square test
 - h. F-Test



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7. Probability Distributions (Multi-Variate)
 - a. Joint Distribution
 - b. Marginal Distribution
8. Regression Analysis – Multi-variate, Linear & Non-linear
 - a. 2-Variable Linear Regression
 - b. Multi-variate/Multiple Linear Regression
 - c. Hypothesis Testing
 - i. t-Test
 - ii. F-Test
 - d. Modeling Issues
 - i. Missing Variables
 - ii. Multi-Collinearity
 - iii. Heteroscedasticity
 - iv. Autocorrelation
 - e. OLS/GLS
9. Processes – Stochastic & Deterministic
10. Continuous-time Stochastic Processes
 - a. Markov Process, Markov Chains
 - b. Weiner Process / Brownian Motion
 - c. Generalized Weiner Process
 - d. Brownian motion (ABM/GBM)
 - e. Ito Process
11. Introduction to Simulation Techniques
 - a. Discreet/Continuous time systems
 - b. Numerical and Analytical Simulation
 - c. Historical Simulation
 - d. Monte Carlo Simulations
 - e. Partial/Quasi Monte Carlo
12. Random Number Theory, RNG, Quasi RNG.
13. Correlated Random numbers generation - Cholesky Decomposition
14. Statistical properties and forecasting of correlation, covariance and volatility
15. Forecasting Volatility
 - a. UWMA
 - b. EWMA
 - c. ARCH
 - d. GARCH
16. Maximum Likelihood Estimation (MLE)
17. Volatility term structures

Financial Markets and Products

1. Capital structure of companies
2. Concept of Primary Market and Secondary Market
3. Types of Financial Instruments and Financial Markets
 - a. Equity/Capital/Stock Market
 - b. Fixed Income / Debt Market (Government Borrowings, Corporate Borrowings, etc.)
 - c. Money Market (Repo, Reverse Repo, CBLO, etc.)
 - d. Derivatives Market (Forwards, Futures, Options, Swaps, etc.)



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4. Introduction to Financial Derivatives
 - a. Fixed-Income and Interest Rate Derivatives - IRS & FRA
 - b. Equity and Equity Index Derivatives - Forward, Futures and Options
 - c. Commodities Derivatives
 - d. Currency / Foreign Exchange (FOREX) Derivatives - Swaps, Forwards, Futures and Options
5. American options, effects of dividends, early exercise
6. Financial/Securities Market Operations – Stock and other Exchanges, OTC markets, Intermediaries, Clearing House mechanisms / Clearing Corporation, Structural Hubs
7. Netting, collateral and downgrade triggers
8. Functioning of Regulatory bodies
9. Concept of Financial Returns – Relative and Absolute returns, Continuous and Discrete returns
10. Corporate Actions and their effects on return calculations for risk modeling.
11. Speculation, Hedging and Arbitrage
12. Trading strategies with derivatives
13. Minimum variance hedge ratio
14. Cheapest to deliver bond, conversion factors
15. Commodity derivatives, cost of carry, lease rate, convenience yield
16. Basis risk
17. Foreign exchange risk
18. Risk-free Rate of Interest
19. Corporate bonds
20. Credit Spreads – Risk Premium
21. Debt equity swaps, loan sales, Brady bonds
22. Measuring portfolio exposures
23. Construction of Stock Indices (Methods - Free Float and Market Capitalization)

Foundations of Risk Management

1. The random behaviour of asset prices
2. Log Normal property of Returns, Skewness & Kurtosis
3. Types of Financial Market Returns
 - a. Fixed Income & Money Market returns – Coupon Rate, Current Yield, Yield-To-Maturity, Discount Yield, Bond-equivalent Yield, Yield-To-Call/Yield-To-Put
 - b. Stock Market Returns: Dividend Yield, Price Return
4. Concept of Risk – Business Risk, Non-Business Risk - Strategic Risk, Financial Risk
5. Portfolio Effect of Risk
6. Diversification
7. Market efficiency, equilibrium and the Capital Asset Pricing Model (CAPM)
8. Single-Index Model
9. Systematic/Market/Non-Diversifiable Risk and Non-Systematic/Residual/Diversifiable Risk
10. Efficient Frontier
11. Performance Measurement and Performance Attribution
12. Sharpe ratio and information ratio
13. Tracking Error
14. Factor models and Arbitrage Pricing Theory



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15. Creating value with risk management
16. Risk management failures
17. Case studies
18. Ethics

Valuation and Risk Modeling

1. Fixed Income Mathematics – Yields (YTM, Current, etc), Bond Pricing, Durations, Convexity, Yield Curves (YTM, ZCYC)
2. Spot Rates and Forward Rates
3. Estimating Forward Rates
4. Term Structure of Interest Rates / Yield Curve (YTMC, ZCYC/Spot, Par Yield Curve, Forward Rate Curve)
5. Duration Based Hedging
6. Value-at-Risk (VaR)
 - a. Definition
 - b. Measurement methods – Full Valuation, Delta-Normal, Delta-Gamma-Normal, Historical Simulation, Monte-Carlo Simulation. Advantages and Disadvantages.
 - c. Implementation and Usage
 - d. Limitations and Alternatives – Tail VaR / CVaR, Stress Testing, Scenario Analysis, Downside semi-variance.
7. Applications of VaR for market, credit and operational risk
8. VaR of Linear and Non-Linear derivatives
9. VaR for fixed income securities with embedded options
10. Structured Monte Carlo Simulation
11. Credit rating agencies, credit ratings
12. Credit transition matrices
13. Sovereign risk and country risk evaluation
14. Derivatives
 - a. Options Pricing – Analytical Models (Black-Scholes-Merton), Numerical Method (Cox-Rubinstein Binomial Tree, Boyle Trinomial Tree, Monte-Carlo Simulation)
 - b. Estimating Greeks



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LEVEL II

Market Risk Measurement and Management

1. Metrics of Market Risk
 - a. Fixed Income – Duration, DV01/PV01/PVBP, Standard Deviation & VaR
 - b. Equities – Beta, Standard Deviation & VaR
 - c. Derivatives – Greeks & VaR.
 - d. FX and FX Derivatives – Standard Deviation, Greeks & VaR
2. Derivatives
 - a. Volatility Skews, Volatility Smiles/Frowns, Volatility Term Structures, Volatility Surface
 - b. Exotic Options
3. Term structure models
4. Mapping financial instruments to risk factors
5. Backtesting VaR
6. Expected shortfall and coherent risk measures
7. Extreme Value Theory
8. Copulas and tail dependence
9. Mortgages and mortgage-backed securities (MBS)
 - a. Underwriting mortgages
 - b. Prepayment models
 - c. Risks in mortgages and mortgage-backed securities
 - d. Valuation of mortgage-backed securities

Credit Risk Measurement and Management

1. Subprime mortgages and subprime securitization
2. Counterparty risk and OTC derivatives
3. Counter-Party Default Risk and Settlement Risk
4. Credit derivatives, Credit Default Swaps (CDS) and Credit-Linked Notes (CLN)
5. Structured finance, securitization, tranching and subordination
6. Collateralized Debt Obligations (CDO) – pricing and risk management
7. Probability of Default (PD), Loss Given Default (LGD) and Recovery Rate.
8. Credit Scoring
9. Credit Spreads
10. Expected and Unexpected loss
11. Contingent claim approach and the KMV Model
12. Default and default-time correlations
13. Portfolio credit risk
14. Credit risk management models
15. Risk mitigation techniques (including netting agreement, ISDA agreement, rating triggers and collateral)



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Operational and Integrated Risk Management

1. Definition of risk capital
2. Allocation of risk capital across the firm
3. Firm-wide risk measurement and management
4. Correlations across market, credit, and operational risk
5. Evaluating the performance of risk management systems
6. Regulation and the Basel II Accord
 - a. Minimum capital requirements
 - b. Credit concentration risk
 - c. Liquidity risk
 - d. Stress testing
7. Implementation and Model Risk
8. Liquidity risk – Asset Liquidity & Cash-flow Liquidity
9. Liquidity Risk measures like MCO, Stress Testing, LD, WBG & MTF
10. Economic capital and risk aggregation
11. Aggregated distributions
 - a. Loss distributions
 - b. Aggregating loss distributions

Risk Management and Investment Management

1. Portfolio construction
2. Risk decomposition and performance attribution
3. Risk budgeting, Active Risk & Tracking error.
4. Setting risk limits
5. Hedge fund risk management
6. Risk-Return metrics specific to hedge funds (Drawdown & Sortino ratio)
7. Risks of specific strategies (fixed-income arbitrage, merger arbitrage, convert arbitrage, equity long/short-market neutral, macro, distressed debt, emerging markets)
8. Asset illiquidity, valuation, and risk measurement
9. The use of leverage and derivatives and the risks they create
10. Measuring exposures to risk factors (dynamic strategies, leverage, derivatives, style drift)
11. Pension fund risk management

Current Issues In Financial Markets

1. Causes and consequences of the current crisis
2. Sub-prime mortgage design
3. Mortgages and securitization, sub-prime CDOs
4. Liquidity crises
5. Use and limitations of VaR
6. Hedge funds and systemic risk

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