IIQF

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2010 FRM EXAM TRAINING SYLLABUS

PART 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. Physical representation of a function
    d. Linear and Non-Linear functions
    e. Limits of a function
    f. The number e and Natural Logarithm
    g. 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.
    h. Functions – Differentiation and Taylor Series Expansion
    i. Introduction to Partial Derivatives
    j. 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

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

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/Discreet Time; Continuous Value/ Discreet 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

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
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
      iii. Missing Variables
      iv. Multi-Collinearity
      v. Heteroscedasticity
      vi. Autocorrelation
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)
11. Introduction to Simulation Techniques
   a. Discreet/Continuous time systems
   b. Numerical and Analytical Simulation
   c. Historical Simulation
   d. Monte Carlo Simulations
12. Correlated Random numbers generation - Cholesky Decomposition
13. Statistical properties and forecasting of correlation, covariance and volatility
14. Forecasting Volatility
   a. EWMA
   b. ARCH
   c. GARCH
15. Maximum Likelihood Estimation (MLE)
16. Volatility term structures

Financial Markets and Products

1. Financial/Securities Market Operations – Stock and other Exchanges, OTC markets, Intermediaries, Clearing House mechanisms / Clearing Corporation, Structural Hubs
2. Netting, collateral and downgrade triggers
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.)
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. Measuring portfolio exposures
6. American options, effects of dividends, early exercise
7. Trading strategies with derivatives
8. Minimum variance hedge ratio

9. Cheapest to deliver bond, conversion factors
10. Commodity derivatives, cost of carry, lease rate, convenience yield
11. Basis risk
12. Foreign exchange risk
13. Corporate bonds
14. Debt equity swaps, loan sales, Brady bonds

Foundations of Risk Management

1. Creating value with Risk Management
2. Market efficiency, equilibrium and the Capital Asset Pricing Model (CAPM)
3. Single-Index Model
4. Systematic/Market/Non-Diversifiable Risk and Non-Systematic/Residual/Diversifiable Risk
5. Efficient Frontier
6. Performance Measurement and Performance Attribution
7. Sharpe ratio and information ratio
8. Tracking Error
9. Factor models and Arbitrage Pricing Theory
10. Risk management failures
11. Case studies
12. Ethics

Valuation and Risk Modeling

1. Fixed Income Mathematics – Yields (YTM, Current, etc), Bond Pricing, Durations, Convexity, DV01, Duration Based Hedging
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. Discount factors, arbitrage, yield curves
6. Value-at-Risk (VaR)
    a. Definition
    b. Measurement methods – Full Valuation, Delta-Normal, Historical Simulation, Monte-Carlo Simulation.
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. Credit rating agencies, credit ratings
11. Credit transition matrices
12. Sovereign risk and country risk evaluation
13. Derivatives
    a. Options Pricing
        i. Numerical Methods (Binomial Tree, Monte-Carlo Simulation)
        ii. Analytical Models (Black-Scholes-Merton)
    b. Estimating Greeks
14. Limitations of VaR and Alternatives – Tail VaR / CVaR, Stress Testing, Scenario Analysis.

PART II

Market Risk Measurement and Management

1. Volatility Skews, Volatility Smiles/Frowns, Volatility Term Structures, Volatility Surface
2. Exotic Options
3. Duration and Convexity of fixed income securities
4. Term structure models
5. Backtesting VaR
6. Mapping financial instruments to risk factors
7. Expected shortfall and coherent risk measures
8. Extreme Value Theory
9. Copulas and tail dependence
10. 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. Credit derivatives, Credit Default Swaps (CDS) and Credit-Linked Notes (CLN)
4. Structured finance, securitization, tranching and subordination
5. Collateralized Debt Obligations (CDO) – pricing and risk management
6. Probability of Default (PD), Loss Given Default (LGD) and Recovery Rate.
7. Credit Scoring
8. Credit Spreads
9. Expected and Unexpected loss
10. Contingent claim approach and the KMV Model
11. Default and default-time correlations
12. Portfolio credit risk
13. Credit risk management models
14. Risk mitigation techniques (including netting agreement, rating triggers and collateral)

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
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