The new ACI Diploma

Unit 4
Advanced Derivatives
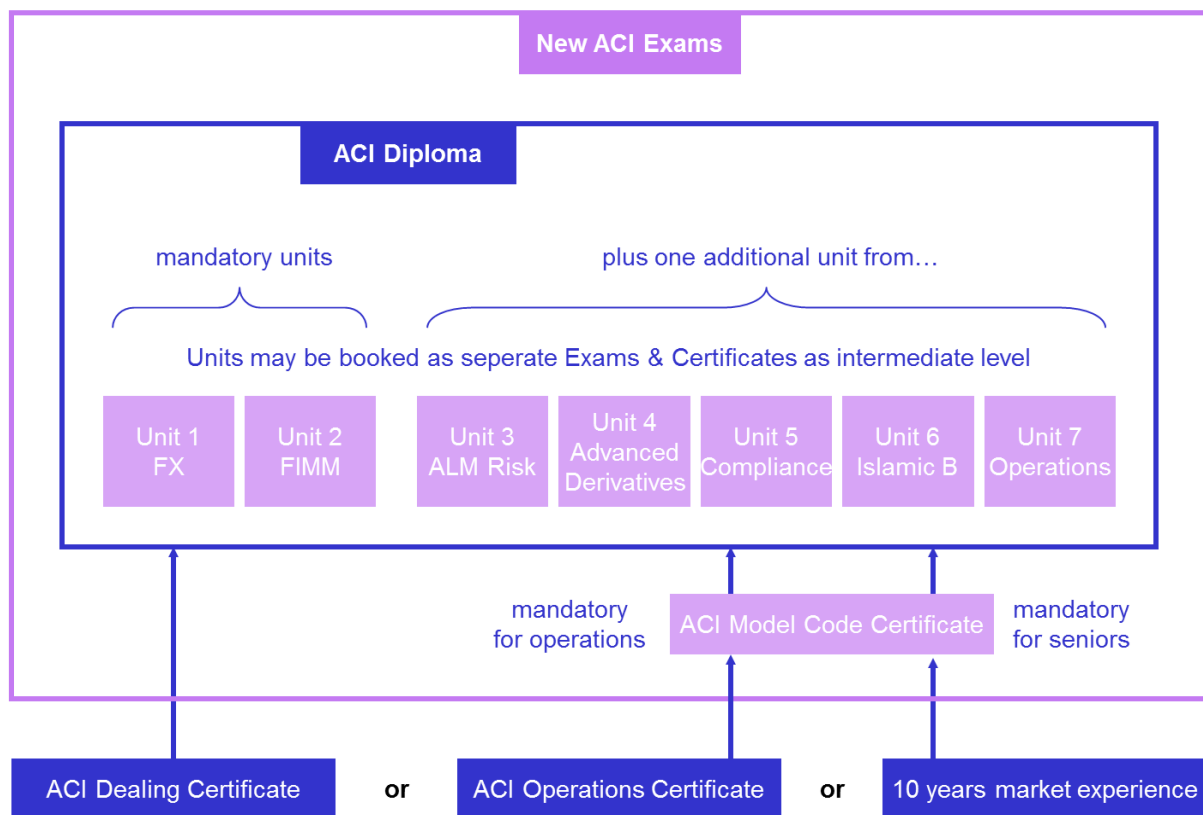
Effective October 2014

"Setting the benchmark in certifying the financial industry globally"

The new ACI Diploma

Objective of the new ACI Diploma

The new ACI Diploma builds on the ACI Dealing Certificate and the ACI Operations Certificate and is designed to ensure that candidates acquire a superior theoretical and practical knowledge of the foreign exchange and money markets, their related instruments, and the linkages that exist between those markets and the practice of risk management. Candidates are expected to have acquired a solid grounding in the core subject areas and have the requisite skills in financial mathematics prior to matriculating for the Diploma.

The course is designed for the following groups:
- Senior foreign exchange and money market dealers
- Corporate and bank treasurers
- Senior operations staff

Eligibility

In order to become eligible for the new ACI Diploma examination you either need to be:

- holder of the ACI Dealing Certificate or
- holder of both the ACI Operations Certificate and the ACI Model Code Certificate examination or
- a senior practitioner with a ten years' work experience in financial markets and you need to pass the ACI Model Code Certificate examination. In this case you have to submit your CV to the ACI Board of Education which will decide on your eligibility.

Learning Objectives

- **Know:** Candidates should be able to recall what they have learned
- **Understand:** Candidates should be able to demonstrate comprehension on what they have learned
- **Apply:** Candidates should be able to use what they have learned to achieve an accurate result
- **Analyse:** Candidates should be able to review content and make an informed decision and draw conclusions
- **Evaluate:** Candidates should be able to extract meaning from what they have learned

Objective of Unit 4
Advanced Derivatives

Candidates should learn how to deal with advanced derivatives across asset classes in terms of pricing, hedging, risk management and documentation. They should recognize products, trading strategies, develop an understanding how to decompose complex structures into simple building blocks, and know when such decomposition is not possible. Candidates should know the relevance of pricing models, how they are used and what their limitations are. Key to dealing advanced derivatives is evaluating the volatility smile surface and classifying different sources of risk. Additionally, candidates will learn which market data is relevant for pricing a pre-specified transaction.

Topic Basket 1
Volatility Surfaces & Smile Construction

The candidate should:

- Understand the principles and show solid working knowledge in the context of volatility surfaces
    - Evaluate volatility cones from historic data of implied volatilities;
    - Apply volatility cones to derive investment strategies;
    - Analyse the difference between a two-volatility-strangle and a one-volatility-strangle;
    - Know how to interpret quoted volatilities of caps, floors, and swaptions;
    - Know how to construct IR volatility surfaces.
- Understand the principles and show solid working knowledge in the context of smile construction
    - Apply FX smile construction for a fixed maturity from at-the-money volatility, risk reversals and butterflies;
    - Analyse the advantages and disadvantages of interpolation and extrapolation across the volatility smile surface using the different approaches SABR, vanna-volga, parabolic, polynomial, cubic splines and non-parametric;
    - Evaluate parabolic interpolation and extrapolation across the volatility smile curve on the delta space;
    - Apply interpolation and extrapolation across time on the smile surface;
    - Evaluate the strike from the delta with smile;
    - Apply no-arbitrage condition checks to the smile surface.

Topic Basket 2
First Generation Exotics: Products, Pricing & Hedging

The candidate should:

- Understand the functionality of first generation exotics and show solid working knowledge in pricing and hedging
    - Apply pricing of digital options with smile;
    - Apply the correct quote of the forward price to valuation of digital options;
    - Understand which derivatives contracts have significant directional exposure;
    - Understand the relevance of forward skew risk;
    - Analyse the hedge of a regular knock-out option with a risk reversal;

- Analyse which elements of risk are not hedged by semi-static replication of a regular knock-out option with a risk reversal;
- Analyse generally between static, semi-static and dynamic hedging;
- Evaluate forward volatility risk;
- Know derivatives with significant forward volatility risk and forward skew risk;
- Know the pedigree of barrier and touch options;
- Evaluate the solution of the total value of a structure for zero cost given a pre-specified sales margin;
- Apply smile adjustment in first generation exotics;
- Evaluate bid-ask spreads of first generation exotics;
- Understand the life cycle of a derivative contract;
- Understand the difference between pre-trade and post-trade valuation;
- Apply valuation of a derivative contract in case of a counterparty defaulting;
- Know the procedures of derivatives documentation;
- Analyse a termsheet and a deal confirmation;
- Know the functionality of credit default swaptions;
- Analyse backwardation and contango of commodity forward contracts.

- Understand the structuring of first generation exotics
  - Evaluate the construction of the universe of barrier and touch options from key building blocks, which are vanilla and one-touch;
  - Analyse how to replicate a reverse-knock-out barrier option with a portfolio of regular-knock-out barrier options and touch products;
  - Analyse how to replicate a European style barrier option using a portfolio of vanilla and digital options;
  - Analyse how to replicate a knock-in-knock-out (KIKO) using a portfolio of single barrier options and double barrier options;
  - Analyse how to replicate a transatlantic barrier option with a portfolio of standard barrier options;
  - Apply building structures from building blocks; such structures include wedding-cakes, forward extras, dual currency deposits, reverse convertible bonds, discount certificates, bonus certificates;
  - Apply the replication of interest rate derivatives (specifically caps and floors) using bond options;
  - Understand the approximation of swaptions using bond options.
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- Understand the market principles
  - Understand the importance of master agreements, definitions and other legal matters;
  - Understand the impact and relevance of the associations ISDA, EMA, FXC on FX derivatives trading.

Topic Basket 3
Most Relevant Models in Derivative Valuation

The candidate should:

- Understand Greeks and their impact on valuation models
    - Know vanna, volga, rega, sega and other higher order Greeks speed, charm, colour, vanunga and volunga;
    - Understand the relationship between Greeks (including delta) and the pricing model;
    - Analyse the meaning of Greeks displayed in common pricing systems;
    - Understand how higher order derivatives influence the price and lower order Greeks;
    - Understand the impact of Greeks on the hedge error when delta hedging the payoff of a derivative contract.

- Show solid working knowledge in valuation and hedging
    - Apply hedging vega with single options and straddles;
    - Apply hedging vanna with risk reversals;
    - Apply hedging volga with butterflies/strangles;
    - Know and apply vanna volga pricing approaches;
    - Understand how the one-touch price behaves under different pricing models;
    - Apply pricing barrier options with smile;
    - Apply practically hedging barrier options using leverage constraints and its first order approximation: the barrier shift and exponential barrier bending;
    - Apply mixing super-replication and vanna-volga pricing;
    - Apply market data snap-shots for independent valuation;

- Understand the principles of relevant valuation models
    - Understand the conceptual idea of stochastic volatility models;
    - Understand two common stochastic volatility models Heston and SABR in an FX and IR derivatives context;
    - Understand the conceptual idea of a local volatility model;
    - Understand the conceptual idea of stochastic-local volatility models (SLV) and how they are used in risk management systems;
    - Understand model calibration and its relevance for trading in general;
    - Analyse which market instruments to use for model calibration;
    - Evaluate the concepts of how an SLV model is calibrated;
    - Understand the valuation by Monte Carlo simulations conceptually;
    - Analyse the impact of model and implementation choice on the performance of the valuation of a derivatives portfolio;
    - Understand the IFRS level classification;
    - Understand model adjustments (XVA) including CVA, DVA, FVA.

Topic Basket 4
Single Underlying Derivatives Beyond First Generation Exotic Options

The candidate should:

- Understand the functionality of single underlying derivatives and show solid working knowledge in pricing and hedging
  - Understand exotic barrier and touch options beyond the standard barrier and touch options in the sense of the ISDA 2005 barrier option supplement;
  - Analyse the risk the seller of a window barrier option is exposed to;
  - Understand the risk the seller of a discretely monitored barrier option is exposed to in respect of the fixings;
  - Apply a rule-of-thumb to calculate the impact on the price of a barrier option if it is discretely monitored rather than continuously monitored;
  - Understand an accumulative forward or a buy-below-market/sell-above market accumulator;
  - Evaluate an accumulative forward based on a treasurer being either long or short a pre-specified currency;
  - Analyse the product feature and risk of target redemption forwards (TRFs);
  - Know variants of TRFs including pivot TRFs, leveraged TRFs, KIKO TRFs;
  - Analyse the variations how to settle the last cash-flow (no payment, capped payment, full payment);
  - Understand how to hedge a TRF using a rolling strategy of barrier options;
  - Evaluate time options / flexi forwards;
  - Analyse the product feature and risk of a forward volatility agreement;
  - Understand how the strike is fixed in a forward start option;
  - Understand compound and instalment options;
  - Understand the relevance of forward volatility in compound options;
  - Evaluate the price of a compound option using the price of the corresponding vanilla option using a rule of thumb;
  - Analyse scenarios of buy-and-hold vs. early termination in a compound option;
  - Understand in which situation a compound option is more suitable than a vanilla option;
  - Analyse Asian derivatives: options and forwards;
  - Analyse fixed-strike Asian options and floating strike Asian options;
  - Know power options, look back options, chooser options, pay-later options;
  - Understand exotic spot and forward transactions: boosted spot, boosted forward, knock-out forward, extendible forward etc.;
  - Understand the product feature and risk of a variance swap and its variants;
  - Apply the idea of a semi-static hedge of a variance swap with a portfolio of vanilla options;
  - Evaluate the impact of jump-risk on the value of a variance swap;
  - Understand the difference between variance swaps and volatility swaps;
  - Analyse why other than the variance swap the volatility swap cannot statically be hedged with a portfolio of vanilla options;

- Evaluate the impact of changing market data on the price of CMS spread options;
- Understand which model to chose for valuation of different structured IR exotics;
- Understand tradable and non-tradable instruments in the energy markets (gas, oil, electricity);
- Know requirements for energy valuation models;
- Know the tradable products in energy markets: intra-day, day-ahead and forward;
- Understand seasonality in energy markets;
- Know swing contract;
- Understand the different series of iTraxx;
- Understand how to use iTraxx as a proxy to back-out default probabilities;
- Analyse the difference between the major stock indices and their respective futures contracts.

- Understand the structuring of single underlying derivatives
    - Analyse the building blocks of faders;
    - Analyse the building blocks of corridors/range-accruals;
    - Apply the structuring and pricing of an accumulative forward with and without smile adjustment;
    - Understand the generic construction of Callable LIBOR Exotics (CLE) including snowball and range features.

Topic Basket 5
Multi Asset Derivatives

The candidate should:

- Understand the functionality of multi asset derivatives
    - Understand the product feature and risk of quanto forwards and options;
    - Understand the product feature and risk of baskets;
    - Know a spread option;
    - Know best-of/worst-of options;
    - Know outside barrier options;
    - Apply worst-of options to generalize a dual-currency deposit to a multi-currency deposit;
    - Know the payoff and functionality of a correlation swap;
    - Understand the functionality of a CDO (Credit Default Obligation).

- Understand pricing and hedging of multi asset derivatives
    - Apply delta hedging a quanto option;
    - Evaluate the limitations of the currency triangle and tetrahedron to the Black-Scholes model;
    - Apply changing several foreign currency amounts to a domestic currency to the payoff of a basket option in several currencies;
    - Understand the pricing of basket options with smile.

- Understand the impact of correlation
  - Apply historic correlation calculation from historic time series;
  - Analyse the process of implying correlations from prices of traded multi-asset exotics;
  - Understand the difference of historic and implied correlation;
  - Evaluate the limitations of implied correlations in the OTC dominated derivatives market;
  - Evaluate correlation risk;
  - Apply implied correlations in a currency triangle;
  - Apply implied correlations in a currency tetrahedron;
  - Analyse hedging correlation risk using vega positions derived from the currency triangle;
  - Analyse correlation geometrically;
  - Understand how the correlation affects the premium of a basket compared to a portfolio of corresponding vanilla options;
  - Analyse the limitations of implied correlation in markets beyond FX.

Topic Basket 6
Long Term Options & Hybrids

The candidate should:

- Understand the functionality of long term options
  - Analyse which source of risk (volatilities or interest rates) dominates for which maturities of derivatives contracts;
  - Analyse the impact of the forward curve on deferred-delivery vanilla options;
  - Understand the product feature and risk of FX-linked long-term bonds, long-term vanilla and power reverse dual convertibles (PRDCs);
  - Analyse the reason and impact of callability and a trigger based termination.

- Understand pricing and hedging of long term options
  - Understand the relevance of basis spreads;
  - Understand the need of complex models for long-term derivatives;
  - Understand the impact of the correlation assumptions between the underlying and interest rates on the value of long-term derivatives contracts.

Examination Procedure

Format: The examination lasts 2.5 hours (150 minutes) and consists of 90 multiple-choice questions.

Calculators: Some questions will require the use of a calculator. A basic one will be provided on the computer screen. You may also use your own hand-held calculator, provided it is neither text programmable nor capable of displaying graphics with a size more than 2 lines.

Score criteria: The overall pass level is 60% (54 correct answers), assuming that the minimum score criteria of 50% for each of the topic baskets is met.

#	Topic basket	Topic weight	Topic basket criteria		
			Number of questions	Minimum score	Correct answers
1	Volatility Surfaces & Smile Construction	13.3%	12	50%	6
2	First Generation Exotics: Products, Pricing & Hedging	26.7%	24	50%	12
3	Most Relevant Models in Derivative Valuation	13.3%	12	50%	6
4	Single Underlying Derivatives Beyond First Generation Exotic Options	22.3%	20	50%	10
5	Multi Asset Derivatives	13.3%	12	50%	6
6	Long Term Options & Hybrids	11.1%	10	50%	5
	Total	**100%**	**90**		

Grades

Pass   60% - 69.99% (54 – 62 correct answers)
Merit   70% - 79.99% (63 – 71 correct answers)
Distinction   80% and above (72 correct answers and more)

Examination Fee

250 EUR, all taxes included. Fee for unit 1 and 2 is 400 EUR if taken in one sitting.