

# ACTUARIAL ASSOCIATION OF EUROPE

## Webinar on the new AAE Core Syllabus

9 May 2019

# Agenda and presenters

## Agenda:

- Moderator's welcome and introduction
- A new Core Syllabus – Guidelines and content
- What has changed?
- Implementation and requirements to comply with the new Core Syllabus
- Q&A

## Presenters:

- Marjon Tjia
- Rafael Moreno Ruiz
- Henning Wergen





# A new Core Syllabus – Guidelines and Content

- Statutes of AAE:
  - Aims (Art. 2):
    - Prescribing educational standards
    - Supporting mutual recognition of actuaries among Member Associations
  - Criteria for Full Membership (Art. 5):
    - Actuarial associations applying for full membership must [...] comply with minimum education standards as set out in the AAE's Core Syllabus for Actuarial Training
  - Mutual Recognition (Art. 6):
    - Full Member Associations must sign the AAE Agreement [...] on a general system for the recognition of higher education diplomas awarded on completion of professional education and training

## A new Core Syllabus – Guidelines and Content

- The current version of the AAE Core Syllabus was accepted in October 2011
- The joint document includes guidelines (explain the use and the structure of the syllabus) and the syllabus (explaining the content) itself
- Commitment to keep the AAE Core Syllabus under review and to update it as appropriate on a regular basis
- It is the intention that all aspects of the IAA Education Syllabus are covered by the AAE Core Syllabus, also adding relevant knowledge for the area of practice

## A new Core Syllabus – Guidelines and Content

- In 2017 a Task Force was installed by the AAE Education Committee to review the existing Core Syllabus
  - Members: Janne Kaippio (Finland), Régis de Laroulliere (France), Rafael Moreno Ruiz (Spain), Gelu Ruptureanu (Romania), Olivier Steiger (Switzerland), Marjon Tjia (The Netherlands), Henning Wergen (Germany, Chair)

# A new Core Syllabus – Guidelines and Content

- Terms of Reference for the Task Force:
  - Develop a new AAE Core Syllabus and present this to the Education Committee in autumn 2018
- Following criteria were fixed:
  - The syllabus should be based on learning objectives
  - Bloom's taxonomy will be used as a guide but not a requirement
  - ECTS/hours expectations will also be used as a guide but not a requirement
  - The mathematics requirement will be made more explicit than in the current IAA Education Syllabus
  - There will be sufficient flexibility built into the compliance requirements without detracting from substantive compliance
  - The starting point for the new AAE Syllabus will be the current IAA Syllabus

# A new Core Syllabus – Guidelines and Content

## PART TWO: AAE SYLLABUSES

### GENERAL SKILLS

#### 1. Computing

**Aim:** To provide a grounding in modern Actuary.

The student is expected to have a working knowledge of communication and technology (ICT) as part of the syllabus.

A formal assessment of this part is not necessary.

#### 2. Regulation and Legislation and

**Aim:** To give students an appreciation of the regulatory and legislative framework of the EU. This part is recommended as part of the syllabus.

- (a) Purpose of international structures
- (b) Understanding variations in country
- (c) Structures within the EU
- (d) Relevant EU legislation

A formal assessment of this part is not necessary.

#### 3. Communication Skills

**Aim:** To develop the ability to present a technical subject orally in a manner which will enable them to be understood by a lay person.

##### Objectives:

- (a) The student would be expected to be able to:
  - present a technical subject in a clear and concise manner
  - be acceptable as a final document
  - moderate number of more minor details
  - might be appropriate for a newly qualified actuary rather than a specialist experienced actuary).
  - convey the major concepts and contain no major mis-statements of fact or omissions or unsupported opinion.
- (b) The student would also be expected to be able to make an oral presentation on a technical subject to a lay person.

A formal assessment of this part is not necessary.

#### 4. Language Skills

**Aim:** To enable students to communicate in business discussions and to read actuarial literature in at least two of the languages of the countries within the EU. This part would not be compulsory but is recommended as part of a European qualification.

A formal assessment of this part is not necessary.

October 2011

4

### Syllabus Presentation

6. The syllabus has been prepared as four stages:

#### Generic Technical Subjects

Included in this stage are subjects that are not unique to actuarial science but are essential background for study in this area. The subjects need not be covered individually but could be integrated with other subjects.

#### Actuarial Technical Subjects

Included in this stage are subjects that form the fundamental tools for actuarial science and finance.

#### Actuarial Applications

Included in this stage are subjects in which the principles and practice of actuarial techniques are developed in a variety of applications areas. The purpose at this stage is to provide a generalised framework for actuarial risk management for varying types of risk. The subjects need not be covered individually but the actuarial concepts are important with examples to demonstrate different approaches depending on the different nature of risk.

#### Specialisation

Included in this stage are subjects and items which are needed for an actuary in order to be a specialist within a certain country or certain area of actuarial work and risk management. Each actuary is expected to have studied to the appropriate level in at least one specialism.

Student actuaries will need to study the regulatory, legislative, cultural and administrative framework of the EU and the country in which they intend to work.

October 2011

1

### ACTUARIAL TECHNICAL SUBJECTS

The subjects at this stage are:

- 7. Financial Mathematics
- 8. Multiple State Modelling
- 9. Contingencies
- 10. Risk Mathematics
- 11. Finance and Financial Markets
- 12. Quantitative Risk Management and Solvency

#### 7. Financial Mathematics

**Aim:** To provide a grounding in financial mathematics and their applications to actuarial science.

- (a) Theory of deterministic interest
- (b) Introduction to contingent claims analysis
- (c) Stochastic calculus for finance
- (d) Theory of stochastic interest
- (e) Asset management

#### 8. Multiple State Modelling

**Aim:** To provide a grounding in multiple state modelling

- (a) Survival models and parameter estimation
- (b) Multiple state models and parameter estimation
- (c) Construction of a decrement table
- (d) Population characteristics and risk classification

#### 9. Contingencies

**Aim:** To provide a grounding in the mathematical techniques, including stochastic techniques, which are of relevance to actuarial work.

- (a) Reserving methodology
- (b) Pricing of long term and short term insurance products
- (c) Valuation techniques
- (d) Analysis of changes in technical results

#### 10. Risk Mathematics

**Aim:** To provide a grounding in risk mathematics and its use in actuarial work.

- (a) Distribution of frequency and severity of claims
- (b) Risk theory
- (c) Credibility theory
- (d) Dependencies
- (e) Generalised linear models

#### 11. Finance and financial markets

**Aim:** To provide a grounding in finance, investment and portfolio theory.

- (a) Financial markets
- (b) Pricing and valuation of financial products
- (c) Corporate finance

October 2011

7

# A new Core Syllabus – Guidelines and Content

- Guidelines to the syllabus:
  - Introduction
  - Purpose of the Core Syllabus
    - Define common understanding
    - Underpin MRA
  - Structure of the Syllabus
    - Basic actuarial education with nine learning areas / Advanced skills / Necessary prerequisites
    - Appropriate breadth of coverage
    - Regular check for compliance by Education Committee
  - Depths of coverage
    - Content presented via learning objectives
    - Classification via revised Bloom's Taxonomy
  - Mutual Recognition Agreement
  - Core Syllabus Development



# A new Core Syllabus – Guidelines and Content

- Bloom's Taxonomy:

Verbs →  Objects ↓	1. <b>REMEMBER</b> Recognize, Recall	2. <b>UNDERSTAND</b> Interpret, Exemplify, Classify, Summarize, Infer, Compare, Explain	3. <b>APPLY</b> Execute, Implement	4. <b>ANALYZE</b> Differentiate, Organize, Attribute	5. <b>EVALUATE</b> Check, Critique	6. <b>CREATE</b> Generate, Plan, Produce
A. Factual Knowledge	A1	A2	A3	A4	A5	A6
B. Conceptual Knowledge	B1	B2	B3	B4	B5	B6
C. Procedural Knowledge	C1	C2	C3	C4	C5	C6
D. Metacognitive Knowledge	D1	D2	D3	D4	D5	D6

## A new Core Syllabus – Guidelines and Content

- Bloom's Taxonomy – examples:
  - 1.7.1 Explain the concepts of Monte Carlo simulation. (B2)
  - 3.3.3 Calculate the value of a forward contract. (B3)
  - 3.4.4 Calculate investment return on a project using different methods and evaluate each method. (C5)
  - 6.1.4 Describe common data structures and data storage systems. (A1)
  - 9.2.10 Use common project management techniques to design and implement a work plan. (C6)

# A new Core Syllabus – Guidelines and Content

- Content of the Syllabus
  - Statistics
  - Economics
  - Finance
  - Financial Systems
  - Assets
  - Data and Systems
  - Actuarial Models
  - Actuarial Risk Management
  - Personal and Actuarial Professional Practice
  - Advanced Skills
  - Foundation Mathematics

# What has changed?

- Statistics
  - 1.1 Random variables
  - 1.2 Statistical inference
  - 1.3 Graduation and statistical tests
  - 1.4 Regression
  - 1.5 Bayesian statistics and credibility theory
  - 1.6 Stochastic processes and time series
  - 1.7 Simulation
- Changes to the IAA Education Syllabus:
  - Added 1.3 to have this more explicitly in the syllabus

# What has changed?

- Statistics – 1.3 Graduation and statistical tests
  - 1.3.1 Use the main statistical tests of crude estimates in order to compare with a standard table (e.g. chi-square test, standardized deviation test, sign test, cumulative deviation test, grouping of signs test, serial correlation test) and describe for each of them:
    - a) the formulation of the hypothesis
    - b) the test statistic
    - c) the distribution of the test statistic using approximation where appropriate
    - d) the application of the test statistic (C3)
  - 1.3.2 Describe the reasons for graduating crude estimates of transition intensities or probabilities and state the desirable properties of a set of graduated estimates. (B3)
  - 1.3.3 Execute a test for smoothness of a set of graduated estimates. (C3)
  - 1.3.4 Describe the process of graduation by parametric formula, standard table and graphical method, and state the advantages and disadvantages of each method. (B3)
  - 1.3.5 Describe how the statistical tests should be amended:
    - a) to allow for the presence of duplicate policies
    - b) to compare crude and graduated set of estimates. (B3)
  - 1.3.6 Carry out a comparison of a set of crude estimates and a standard table, as well as a set of crude estimates and a set of graduated estimates. (C3)



# What has changed?

- Economics
  - 2.1 Macroeconomics
  - 2.2 Microeconomics
  - 2.3 Financial economics
- Finance
  - 3.1 Financial reporting and taxation
  - 3.2 Securities and other forms of corporate finance
  - 3.3 Financial mathematics
  - 3.4 Corporate finance

# What has changed?

- Financial systems
  - 4.1 Role and structure of financial systems
  - 4.2 Participants in financial systems
  - 4.3 Financial products and benefits
  - 4.4 Factors affecting financial system development and stability

# What has changed?

- Assets
  - 5.1 Investments and markets
  - 5.2 Asset valuation
  - 5.3 Portfolio management
  - 5.4 Investment strategy and performance measurement

# What has changed?

- Data and systems
  - 6.1 Data as a resource for problem solving
  - 6.2 Data analysis
  - 6.3 Statistical learning
  - 6.4 Professional and risk management issues
  - 6.5 Visualising data and reporting
- Changes to the IAA Education Syllabus:
  - Clarification on application of neural networks and decision trees (6.3.4)
    - 6.3.4 Use an appropriate computer package to apply neural network and decision tree based techniques to simple machine learning problems. (C3)

# What has changed?

- Actuarial models
  - 7.1 Principles of actuarial models
  - 7.2 Fundamentals of severity models
  - 7.3 Fundamentals of frequency models
  - 7.4 Fundamentals of aggregate models
  - 7.5 Survival models
  - 7.6 Actuarial applications



# What has changed?

- Actuarial models (Cont'd)
- Changes to the IAA Education Syllabus:
  - Change in taxonomy on calculating risk measures from B to C (7.1.9)
  - Change in taxonomy on techniques for creating new distributions from B to C (7.2.2)
  - Changes in taxonomy on aggregate models and survival models from B to C with an additional clarification in 7.4.2 (7.4.1 – 7.5.5)
  - Changes in taxonomy from B to C (7.6.2, 7.6.4, 7.6.5)
  - Additions and clarifications in non-life and reinsurance techniques (7.6.6 – 7.6.8)

# What has changed?

- 7. Actuarial models
  - 7.1.9 Calculate risk measures, including Value at Risk and Tail Value at Risk, and explain their properties, uses and limitations. (C3)
  - 7.2.2 Apply the following techniques for creating new distributions: multiplication by a constant, raising to a power, exponentiation, mixing. (C3)
- 7.4 Fundamentals of Aggregate Models
  - 7.4.1 Compute relevant moments, probabilities and other distributional quantities for collective risk models. (C3)
  - 7.4.2 Compute aggregate claims distributions and use them to calculate loss probabilities. Apply Panjer recursion and Fast Fourier Transform as numerical methods. (C3)
  - 7.4.3 Evaluate the effect of coverage modifications (deductibles, limits and coinsurance) and inflation on aggregate models. (C3)
- 7.5 Survival Models
  - 7.5.1 Apply multiple state Markov chain and Markov process models. (C3)
  - 7.5.2 Derive maximum likelihood estimators for the transition intensities in models of transfers between multiple states with piecewise constant transition intensities. (C3)
  - 7.5.3 Explain the concepts of survival models. (B2)
  - 7.5.4 Calculate and interpret standard probability functions including survival and mortality probabilities, force of mortality, and complete and curtate expectation of life. (C3)
  - 7.5.5 For models dealing with multiple lives and/or multiple states, explain the random variables associated with the model; calculate and interpret marginal and conditional probabilities, and moments. (C3)
  - 7.5.6 Describe the principal forms of heterogeneity within a population and the ways in which selection can occur. (B2)

# What has changed?

- 7. Actuarial models
  - 7.6.2 Apply survival models to simple problems in long-term insurance, pensions and banking such as calculating the premiums and reserves for a life insurance contract, and the potential defaults on a book of loans for a bank. (C3)
  - 7.6.4 Describe and apply methods of projecting and valuing expected cash flows that are contingent upon multiple state and multiple decrement events, and apply these contracts to insurance and pension problems. (C3)
  - 7.6.5 Describe and apply projected cash flow techniques in pricing, reserving, and assessing profitability of contracts for contingent payments with appropriate allowance for expenses (including life insurance, short term insurance and pension fund applications). (C3)
  - 7.6.6 Describe and apply techniques for analysing a delay (or run-off) triangle and projecting the ultimate position. Compare deterministic and stochastic claims reserving methods and describe the claims development result (C3)
  - 7.6.7 Describe different methods of pricing a non-life insurance portfolio, explain their relative advantages and disadvantages. Apply different methods in appropriate situations:
    - a) GLM on a heterogeneous portfolio, e.g. car insurance
    - b) Credibility method on a portfolio with volatile risks, e.g. due to small volumes. (C3)
  - 7.6.8 Describe and apply techniques to calculate basic reinsurance contracts. (C3)

# What has changed?

- Actuarial Risk Management
  - 8.1 The risk environment
  - 8.2 Risk identification
  - 8.3 Risk measurement and modelling
  - 8.4 Risk mitigation and management
  - 8.5 Risk monitoring and communication
- Changes to the IAA Education Syllabus:
  - Additions and clarifications on risk measurement and modelling (8.3.3 – 8.3.5)
  - Addition on stakeholders in risk management strategies (8.4.4)
  - Clarification and change in taxonomy on communication in risk management (8.5.3)

# What has changed?

- Actuarial Risk Management
  - 8.3.3 Describe different methods of risk aggregation, explain their relative advantages and disadvantages and use these techniques to model dependencies. (C3)
  - 8.3.4 Explain the diversification benefits, allocation principles and risk contributions and how they can be used to allocate capital to risk faced by different business lines (C2)
  - 8.3.5 Apply various concepts of risk measures, including Value-at-Risk, Expected Shortfall and Stress scenarios/testing in relation to capital management (C3)
  - 8.4.4 Identify and analyze various stakeholders, their interests and their influence on risk management strategy (C6)
  - 8.5.3 Describe well-argued choices in the field of risk measurements and risk management to managers and stakeholders. (C3)



# What has changed?

- Personal and actuarial professional practice
  - 9.1 Effective communications
  - 9.2 Problem solving and decision making
  - 9.3 Professional standards
  - 9.4 Professionalism in practice
  - 9.5 International and institutional awareness of professional standards
- Changes to the IAA Education Syllabus
  - Clarification and change in taxonomy on communication (9.1.2)
  - Clarifications and changes in taxonomy on decision making process (9.2.6 – 9.2.8 and 9.2.10)
  - Additions on international umbrella organisations and their roles and tasks (9.5)

# What has changed?

- Personal and actuarial professional practice
  - 9.1.2 Use effective technical communications to communicate actuarial work results for a relevant audience of peers, managers or clients. (C6)
  - 9.2.6 Explain how the culture and structure of an organization affect decision-making processes (C2)
  - 9.2.7 Apply a decision-making process to a particular case study. (C3)
  - 9.2.8 Apply common time management techniques in small project for the benefits of own work and team work. (C3)
  - 9.2.10 Use common project management techniques to design and implement a work plan. (C6)
- 9.5 International and institutional awareness of professional standards
  - 9.5.1 Explain the role and key features of the International Actuarial Association (IAA) including governance structure, protocols for member associations, sections, colloquia and congress. (B2)
  - 9.5.2 Explain the role and key features of the Actuarial Association of Europe (AAE), including governance structure and the Mutual Recognition Agreement (B2)
  - 9.5.3 Explain the role of a Full Member Association (FMAs) in relation to (activities of) local associations. (B2)

# What has changed?

- Advanced skills:
  - Possible areas of actuarial practice: Life, Pensions, General insurance, Enterprise Risk Management, Investments, Health care, Accounting, Banking, Social security, Reinsurance, Management / Leadership, Data Science
  - Obtained via: Deeper studies, Studies of European and country specific topics, Research, Practical application of actuarial principles

# What has changed?

- Foundation mathematics:
  - The mentioned learning objectives define a minimum of fundamental mathematical knowledge and skills that should be seen as a prerequisite before starting an actuarial qualification
  - Functions and sets, Differentiation, Integration, Sequences and series, Differential equations, Real and complex numbers, Matrices and systems of linear equations, Vectors and vector spaces and inner product spaces, Probability

# Preliminary results

- Newer and modern topics have been added to the syllabus
- Structure has been changed by using learning objectives instead of topics
- The IAA Education Syllabus is a complete subset of the proposed AAE Core Syllabus by design (all learning objectives included; Bloom's classification not below level of IAA syllabus)
- Robust system for checks for compliance will be established by the Education Committee



# ACTUARIAL ASSOCIATION OF EUROPE

Actuarial House

1 Place du Samedi

100 Brussels

Belgium

[www.actuary.eu](http://www.actuary.eu)

Follow us on twitter: @InfoAAE