COURSE STRATEGY GUIDE

CP 312 – Model Development and Governance

Nov 2026/Mar 2027

This Course Strategy Guide provides an overview of CP 312, to help the candidate understand the essence of this course and to provide a Guide for how to prepare for the examination of this course. While this guide can be a valuable aid in preparation, the material in it will not be tested.

I. Purpose of this Course

The purpose of the Model Development and Governance course is to continue the model building education for our candidates at the FSA education level by covering more complex models and providing a solid foundation of model development and governance. Model development is an important skill to have for actuarial professionals. Thus, it is important for our candidates to gain a thorough understanding and knowledge of the development, application and usage of various models.

Model governance is an important framework that an organization uses to oversee model development, validation and usage to ensure regulatory compliance and proper control and accuracy. Thus, this course also covers model governance.

This course is a good supplement to all fellowship specialties, especially for candidates with an interest in long-term insurance products, as it enhances the analytical techniques and critical thinking skills of candidates to help them succeed in their careers.

This course has been developed assuming candidates are familiar with the content of the Advanced Long-Term Actuarial Mathematics (ALTAM) exam. CP 312 candidates who did not take ALTAM may want to review Chapter 15 (sections 1-3) of *Actuarial Mathematics for Life Contingent Risks*, Third Edition Dickson, C.M.D., Hardy, M.R., Waters, H.R. (2020) and Study Note ALTAM-21-23: Variable Annuity Guarantees.

II. Recommended Approach in Preparing for Course Exam

Our recommended study approach is to first read the descriptions of the Learning Objectives and Learning Outcomes in the syllabus; then read the Case Study in conjunction with the syllabus resource materials in the order presented for each course topic in the syllabus.

Exam questions are based on Learning Objectives and Outcomes, sometimes using case study contexts for modeling scenarios. Solutions from resource materials may suit those contexts but not necessarily exam questions, which focus on critical thinking and applying knowledge to new situations. Candidates should use syllabus materials to understand core concepts and techniques, then adapt and apply these insights to solve presented problems in the exam.

Copyright © Society of Actuaries

III. The Case Study and Its Relevance

The Case Study is designed to give candidates practical context for internalizing and applying key concepts from the syllabus. By situating the study materials within the framework of a fictional company's products and models, candidates can better connect theory to more realistic practice.

The Case Study simulates an insurance company long-term products, their models and model governance policy. Accompanying spreadsheet models enable candidates to explore and practise modelling various insurance and financial products and risks, providing hands-on experience in a simplified but realistic environment.

The Case Study also serves as a platform for tackling multi-faceted business problems, allowing candidates to demonstrate skills in model development, application, validation, and efficiency.

Materials include a narrative PDF and Excel spreadsheets with proxy models for the company's products. These spreadsheets, adapted from the Long-Term Actuarial Models Part II textbook, have been simplified to remove features, such as macros, not supported in the SOA exam environment. There are three Excel cashflow projection models provided in the Case Study for the following products:

- Universal Life with Secondary Guarantees
- Fixed Indexed Annuity (FIA)
- Disability Income Insurance (DII)

Candidates should thoroughly review the case study and related Excel models, as exam questions may reference these materials.

The pdf and the spreadsheets will be available to candidates when they sit for the exam.

IV. Exam Syllabus Learning Objectives and Readings

Three topics are chosen for this course:

1. Cash Flow Models for Long-Term Insurance Business
2. Other Types of Models for Financial Business
3. Model Governance

Details of the Learning Objectives, Learning Outcomes and syllabus study materials associated with the Learning Outcomes for each of the three topics can be found in the Syllabus. The candidate should be familiar with the Learning Outcomes as described in the syllabus. These Learning Outcomes represent the knowledge candidates are expected to be able to perform after completing this course and will guide the assessment committee when developing questions.

These three topics are chosen for the following reasons:

Topic 1: Cash Flow Models for Long-Term Insurance Business

Life, annuity, and disability insurance products typically involve long-term cash flows. Models serve critical functions including pricing, valuation, strategic planning, and asset-liability management. Mastery of cash flow modelling techniques for these insurance products is essential, as improper modeling can adversely affect an insurer's financial stability. Topic 1 is designed to deepen candidates' expertise in these vital modeling areas.

Over time, insurance products have evolved and become more complex. These complexities increase model risk, inherent risks within products and modeling challenges. The "Model Risk Video and Notes" included in this course support candidates in identifying and understanding these risks, aligning with Learning Outcome 1a. Additionally, Chapter 3 of *Modeling in Life Insurance - A Management Perspective* and Chapter 1 of *Long-Term Actuarial Models Part II* provide further insight into cash flow modelling development and applications, fulfilling Learning Outcome 1a.

Topic 1 focuses on models for insurance products with complex components:

- Dynamic policyholder assumptions
- Multi-states
- Equity-linked guarantees
- Index-linked credits

The syllabus materials covering these features expand the candidates' modeling knowledge to cover dynamic policyholder assumptions, multi-state model framework, and nested stochastic modeling. Thus, the following materials are chosen to enhance the necessary modeling knowledge and generally align with Learning Outcomes 1a to 1b:

- "Considerations Regarding Dynamic Lapses in Actuarial Modeling"
- Sections I.A, I.B-I.B.3a, I.B.4 of "Stochastic Modeling, Theory and Reality from an Actuarial Perspective"
- Chapter 3, 6, 9 and 11 of *Long-Term Actuarial Models Part II*, and accompanying workbooks
- Sections 1.2-1.3, 3-6 of "Predictive Analytic & Machine Learning - Practical Applications for Actuarial Modeling"

Model validation and model efficiency techniques are essential to improve model accuracy and model performance. Thus, it is essential for our candidates to master the application of these techniques. Learning Outcomes 1c and 1d cover the model validation and efficiency techniques, respectively. Two articles are chosen to cover Learning Outcomes 1c and 1d:

- Section III of "Stochastic Modeling, Theory and Reality from an Actuarial Perspective"
- Sections 1.2-1.3, 3-6 of "Predictive Analytic & Machine Learning - Practical Applications for Actuarial Modeling"

Two additional articles are chosen to cover Learning Outcome 1d only:

- "Heavy Models, Light Models and Proxy Models"

- Chapters 1-3 and 6 of Metamodeling for Variable Annuities

Topic 2: Other types of Models for Financial Business

Topic 2 broadens the candidates' understanding of financial models beyond those covered (but not exclusive of) in Topic 1. The financial industry employs a wide variety of models, including economic scenario generators and market risk models, which are outside the scope of cash flow-based models discussed in Topic 1. Mastery of these models' concepts and practical application, often alongside long-term cash flow models, is essential for candidates.

The "Model Risk Video and Notes" resource helps candidates grasp the inherent risks in modeling and supports both Learning Outcomes 1a and 2a, making it a valuable inclusion for this section.

An economic scenario generator (ESG) is a computer-based tool for simulating future economic and market conditions. ESGs are critical in scenario-based asset and liability modeling. Candidates must understand ESG methodologies, strengths, limitations, and practical uses. The following materials have been selected to address ESGs under Learning Outcome 2a:

- Chapters 1, 2, 4.1-4.3, 5, 6, 7.1-7.3 and 8 of "Economic Scenario Generators: A Practical Guide"
- Three-part series by the SOA on Economic Scenario Generators in The Modeling Platform:
    - Part I - Motivation for Stochastic Modeling
    - Part II - Understanding Economic Scenario Generators
    - Part III - In-depth ESG Case Study – Academy Interest Rate Generator
- Here it "GOES" Again

There are many types of financial risk models of interest that are not Economic Scenario Generators. The following sources are chosen to cover these risk models under Learning Outcome 2a:

- Chapter 8 of the *Quantitative Enterprise Risk Management* textbook
- Chapter 7 of *Derivatives Theory and Practice*
- Chapter 9 of *Asset/Liability Management of Financial Institutions*

Catastrophic events can cause substantial losses to insurance companies and thus jeopardize the financial health of the companies. In recent years, climatic change has increased the importance of catastrophe modeling. Thus, this type of model is covered in Learning Outcome 2a. Three materials are selected to cover this type of modeling:

- Sections I.A, I.B-B.2, IB.3a, IIB-B.1.d of "Stochastic Modeling Theory and Reality from an Actuarial Perspective"
- "Catastrophe Modelling: Guidance for Non-Catastrophe Modelers"
- "Importance of Climate-Related Risks for Actuaries"

Machine Learning and Artificial Intelligence are important emerging techniques for actuaries. They are increasingly used in various models, efficiency, and validation. Thus, they are applicable to topics 2a-2c. The following sources address them.

- A Primer on Generative AI for Actuaries
- Predictive Analytics and Machine Learning – Practical Applications for Actuarial Modeling (Nested Stochastic)
- Rise of the Machines: Application of Machine Learning to Mortgage Pre-Payment Modeling

Note: For the purposes of this exam, the last paper is included as an illustration of the application of Machine Learning to modeling complex cash-flows using mortgage-backed securities.

Similar to Topic 1, model validation and model efficiency techniques are also essential to improve model accuracy and model performance for non-cash flow models. Thus, they are also covered in Learning Outcomes 2b and 2c respectively. Stress testing and back-testing are commonly used techniques for model validation. Two sources are chosen for covering model validation techniques under Learning Outcome 2b:

- "A Financially Justifiable and Practically Implementable Approach to Coherent Stress Testing"
- Chapter 7 of *Modelling in Life Insurance - A Management Perspective*

Three sources are chosen for covering model efficiency techniques under Learning Outcome 2c:

- Sections IIB-B.1.d of "Stochastic Modeling Theory and Reality from an Actuarial Perspective"
- "Heavy Models, Light models and Proxy Models"
- Chapters 1-3 and 6 of Metamodeling for Variable Annuities

Topic 3: Model Governance

Topic 3 aims to strengthen candidates' understanding of model governance, emphasizing best practices and essential process controls. Model governance establishes a framework for accountability and traceability, helping to ensure models produce reliable results and are used appropriately. Without strong governance, model operations may become uncontrolled, prone to errors, and non-compliant with regulatory requirements, leading to potentially serious consequences.

Best practices in model governance are addressed in Learning Outcome 3a, while Learning Outcome 3b focuses on organizational structures, including controls, roles, and responsibilities. Most materials for Topic 3 support both outcomes, except for three sources that exclusively cover best practices outlined in Learning Outcome 3a:

- "ASOP 56: Modeling"
- "Model Validation for Insurance Enterprise Risk and Capital Models"
- "Machine Decisions: Governance of AI and Big Data Analytics"