

FCIA SYLLABUS: READING LIST

Individual life and annuities track

Exam F1ILA: Finance and Valuation

The aim of this exam is for candidates to develop the following skills:

1. Understand the main principles and techniques for estimating reserves and claims-related expenses (hereafter referred to simply as “claims”) that are relevant to life insurance.
2. Apply these principles and techniques within the context of life insurance.
3. Evaluate the considerations involved in selecting a best estimate reserve.
4. Understand how estimating reserves links to wider business processes (e.g., business planning, pricing, financial reporting, and capital setting).
5. Describe International Financial Reporting Standard 17 – Insurance Contracts (hereafter referred to as IFRS 17) and calculate actuarial values for financial reporting under IFRS 17.
6. Create appropriate proposals and recommendations related to reserves and IFRS 17 financial reporting in the life insurance business.
7. Evaluate hypothetical scenarios, including using judgment to assess the implications of possible actions.

1. Principal terms	
1. Define principal terms used in the valuation of reserves and IFRS 17 financial reporting for life insurers. (A1)	
Reading reference	Source
CIA Educational Note: <i>Application of IFRS 17 Insurance Contracts</i> . p. 232-234.	https://www.cia-ica.ca/publications/221117e/
IFRS 17 <i>Insurance Contracts</i> . Appendix A.	https://www.ifrs.org/content/dam/ifrs/publications/pdf-standards/english/2022/issued/part-a/ifrs-17-insurance-contracts.pdf?bypass=on

2. Regulations and applicable standards (15%)	
<ol style="list-style-type: none"> 1. Apply legislation (e.g., the Insurance Companies Act) and regulations (e.g., Office of the Superintendent of Financial Institutions guidelines) relevant to the Appointed Actuary’s valuation for financial reporting purposes. (A3) 2. Apply actuarial professionalism requirements applicable to the valuation of reserves and IFRS 17 financial reporting. (B3) 	
Reading reference	Source
<i>Insurance Companies Act</i> , SC 1991, c. 47. Division XIV – Actuaries.	https://laws-lois.justice.gc.ca/eng/acts/i-11.8/page-30.html#h-261737
CIA Standards of Practice. Sections 1240, 1400, 1500, 1600, 1700, 2100, 2200, 2400.	https://www.cia-ica.ca/being-a-member/standards-of-practice/
Office of the Superintendent of Financial Institutions (OSFI). 2012. <i>Life Insurance Regulatory Framework</i> . Ottawa (ON): OSFI.	https://www.osfi-bsif.gc.ca/en/supervision/financial-institutions/life-insurance-regulatory-framework
Office of the Superintendent of Financial Institutions (OSFI). 2023. Guideline E-15: <i>Appointed Actuary: Legal Requirements, Qualifications and Peer Review</i> . Ottawa (ON): OSFI.	https://www.osfi-bsif.gc.ca/en/guidance/guidance-library/appointed-actuary-legal-requirements-qualifications-peer-review-guideline-2023

3. Data (10%)	
<ol style="list-style-type: none"> 1. Differentiate the types of data and information required for valuation of reserves, their sources, and main uses. (A4) 2. Differentiate types of data and information required for IFRS 17 financial reporting, their sources, and main uses. (A4) 3. Analyze the implications to data requirements for different life insurance product features (e.g., term vs. whole life vs. universal life, annuities, accumulation guarantees). (B4) 4. Evaluate the insurer's internal environment (such as changes in operations or information technology [IT]) on data used for valuation of reserves. (B5) 5. Analyze the influence of external environments on data used for valuation of reserves and IFRS 17. (B4) 6. Evaluate the possible causes of data errors and the effects of inadequate data and information. (B5) 7. Create appropriate data-validation processes. (C6) 	
Reading reference	Source
Claire DR, Lombardi LJ, Summers SD. 2018. <i>Statutory Valuation of Individual Life and Annuity Contracts</i> . 5th ed. Greenland (NH): ACTEX. Chapters 7, 8, 9, 12 (p. 249-254), 13 (p. 275-278), 14 (p. 299-308), 15 (p. 359-365), 16 (p. 375-381), 17 (p.401-418), 18 (p. 419-425).	https://www.actexamdriver.com/orderselection.aspx?id=453143213
CIA Educational Note: <i>IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts</i> .	https://www.cia-ica.ca/publications/222085e/

4. Principles of valuation – basic topics (15%)
<ol style="list-style-type: none"> 1. Analyze the purpose of reserving for life insurers, including: (A4) <ol style="list-style-type: none"> a. The reasons for calculating reserves and how these might influence the approach (such as financial reporting, financial planning and analysis, and pricing). b. The key stakeholders and their interests in the reserves held and reported. 2. Calculate and evaluate reserves using appropriate methods. (C5) 3. For methods in 2.: <ol style="list-style-type: none"> a. Generate the assumptions and mechanics. (C6) b. Analyze assumption changes and determine their influence on the results of reserves. (C4) c. Critique the technique with varying data quality and completeness and in different situations. (D5) d. Evaluate the strengths and limitations of each technique and the impact of limitations on results. (D5) e. Select the appropriate technique and assumptions given specific circumstances. (D5) 4. Apply processes to integrate more complex factors potentially relevant for the estimation of reserves of a given claims portfolio. <ol style="list-style-type: none"> a. Select the appropriate technique and assumptions given changes to the internal and external environment like changes in underwriting practices, public-health measures, and economic conditions. (C3) 5. Describe the role of valuation assumptions with a focus on the following: (C4) <ol style="list-style-type: none"> a. Regular assumptions vs. one-time adjustments. b. Economic and non-economic assumptions. c. Understand their mechanics, such as how to construct and use select and ultimate tables. (B2) d. Analyze assumption changes, determine their influence on the results, and describe techniques for a controlled implementation process. (B4) e. Explain how assumptions are impacted by impacts to the insurance environment such as legislative changes or changes to availability of underwriting data. (B2)

6. Determine whether to adjust for adverse deviation and calculate such adjustments to a best estimate of reserves. (D5)	
Reading reference	Source
Claire DR, Lombardi LJ, Summers SD. 2018. <i>Statutory Valuation of Individual Life and Annuity Contracts</i> . 5th ed. Greenland (NH): ACTEX. Chapters 1, 10.	https://www.actexamdriver.com/orderselection.aspx?id=453143213
CIA Educational Note: <i>IFRS 17 – Fair Value of Insurance Contracts</i> .	https://www.cia-ica.ca/publications/222088e/
CIA Educational Note: <i>Guidance for the 2023 Valuation of Insurance Contract Liabilities of Life Insurers</i> .	https://www.cia-ica.ca/publications/223130e/
CIA Educational Note: <i>IFRS 17 Discount Rates for Life and Health Insurance Contracts</i> .	https://www.cia-ica.ca/publications/222097e/
CIA Educational Note: <i>IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts</i> .	https://www.cia-ica.ca/publications/222085e/
CIA Explanatory Report: <i>IFRS 17 Expenses</i> .	https://www.cia-ica.ca/publications/222095e/
CIA Educational Note: <i>Use of Models</i> .	https://www.cia-ica.ca/publications/217007e/
CIA Educational Note: <i>IFRS 17 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts</i> .	https://www.cia-ica.ca/publications/222090e/

5. Principles of valuation – advanced topics (25%)
<ol style="list-style-type: none"> 1. Describe, calculate, and evaluate approaches to allow for various other items in an actuary's estimation of reserves, including: (C5) <ol style="list-style-type: none"> a. Claims-management expenses (including allocated and unallocated loss-adjustment expenses) and other costs. b. Latent claims and potential claims features that have not manifested in the reported claims data. c. Late reported claims and potential claims features that have not manifested in the reported claims data. 2. Critique margins for adverse deviations, including their purpose, how they are set, and the financial consequences of setting them inappropriately. (B5) 3. Calculate estimates of reserves for reinsurance. <ol style="list-style-type: none"> a. Compare the approaches to calculating reserves for reinsurance contracts held by analyzing claims gross and net of reinsurance held vs. claims gross of reinsurance held and claims ceded to reinsurance. (C4) b. Calculate reserves for reinsurance held using appropriate techniques and assumptions that reflect the characteristics of reinsurance contracts held (e.g., contract terms and conditions, data availability). (C3) c. Calculate reserves for various layers of claims. (C3) d. Explain the consequences and calculate the effect on both ceding and assuming companies with respect to the following under various structures: (C3) <ol style="list-style-type: none"> i. Risk transfer and its effect on regulatory capital requirements (including impact on minimum regulatory capital requirements). ii. Cash flow. iii. Financial statements. iv. Tax and reserve credit requirements. 4. Evaluate stochastic processes for estimating reserves. <ol style="list-style-type: none"> a. Evaluate the likely sources of uncertainty in estimates of unpaid claims. (B5) b. Evaluate the uses of stochastic techniques for estimating unpaid claims. (B5) c. Evaluate the following types of stochastic techniques, including data required, key assumptions, and mechanics: (B5) <ol style="list-style-type: none"> i. Analytic. ii. Simulation-based.

- d. Evaluate the issues, advantages, and disadvantages of each of the techniques, including sensitivity to assumptions. (C5)
- e. Evaluate the approach to aggregating the results of stochastic estimates of unpaid claims across multiple lines of business and discuss methods of correlation. (C5)
5. Evaluate the results of reserves for adequacy and reasonableness. (D5)
6. Generate alternative estimates of reserves and highlight some of the professional issues in resolving them. (D6)
7. Describe the factors an actuary should consider and the typical diagnostics used in assessing the reasonableness of the results of estimates of unpaid claims. (D2)
8. Critique the reasonableness of changes in the results of reserves over time by describing the factors an actuary should consider. (D5)
9. Analyze current experience to monitor performance and recommend reserves for interim valuations. (D4)
10. Communicate an estimate of unpaid claims:
 - a. Describe what is meant by a best-estimate reserve. (B2)
 - b. Describe the uses, advantages, and disadvantages of estimating ranges of reserves using the following approaches: (B2)
 - i. Stochastic models.
 - ii. Scenario tests.
 - iii. Use of alternative sets of assumptions.
 - c. Understand the issues to be considered when communicating ranges in estimates of reserves and uncertainties. (D2)
11. Compare and analyze valuation methods in Canada and the United States. (B4)

Reading reference	Source
CIA Educational Note: <i>IFRS 17 – Fair Value of Insurance Contracts</i> .	https://www.cia-ica.ca/publications/222088e/
CIA Educational Note: <i>Guidance for the 2023 Valuation of Insurance Contract Liabilities of Life Insurers</i> .	https://www.cia-ica.ca/publications/223130e/
CIA Educational Note: <i>IFRS 17 Discount Rates for Life and Health Insurance Contracts</i> .	https://www.cia-ica.ca/publications/222097e/
CIA Educational Note: <i>IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts</i> .	https://www.cia-ica.ca/publications/222085e/
CIA Explanatory Report: <i>IFRS 17 Expenses</i> .	https://www.cia-ica.ca/publications/222095e/
CIA Standards of Practice. Sections 1000, 1620, 2300, 2500, 2833.	https://www.cia-ica.ca/being-a-member/standards-of-practice/
CIA Report: <i>Report of the CIA Task Force on the Appropriate Treatment of Reinsurance</i> .	Documentation will be provided by the CIA following the exam registration process.
Educational Note: <i>IFRS 17 – Actuarial Considerations Related to Reinsurance Contracts Issued and Held</i> .	https://www.cia-ica.ca/publications/222129e/
Tiller JE, Fagerberg Tiller D. <i>Life, Health and Annuity Reinsurance</i> . 4th ed. Greenland (NH): ACTEX. Sections 1-6, 17.	https://www.actexamdriver.com/orderselection.aspx?id=453086447
Office of the Superintendent of Financial Institutions (OSFI). 2023 [effective 2024 Jan 1]. Guideline A: <i>Life Insurance Capital Adequacy Test</i> . Ottawa (ON): OSFI. Section 6.8.	https://www.osfi-bsif.gc.ca/en/guidance/guidance-library/life-insurance-capital-adequacy-test-guideline-2024
Hardy M. 2003. <i>Investment Guarantees: Modeling and Risk Management for Equity-Linked Life Insurance</i> . Hoboken (NJ): Wiley. Chapters 1, 4, 6, 9, 11.	https://www.wiley.com/en-us/Investment+Guarantees%3A+Modeling+and+Risk+Management+for+Equity+Linked+Life+Insurance-p-9780471460121
Larson A, Leemhuis J, Niernerg M. 2018. “Anticipating events: Using member-level predictive models to calculate IBNR reserves.” <i>The Actuary</i> . Schaumburg, IL: Society of Actuaries.	https://www.theactuarymagazine.org/anticipating-events/
CIA Research Report: <i>Lapse Experience Under Term-to-100 Insurance Policies</i> .	https://www.cia-ica.ca/publications/rp221131e/
CIA Research Report: <i>Lapse Experience Under Universal Life Level Cost of Insurance Policies</i> .	https://www.cia-ica.ca/publications/rp221132e/
CIA Mortality Study: <i>Canadian Standard Ordinary Life Experience 2014–2015 Using 97–04 Tables</i> .	https://www.cia-ica.ca/publications/217078e/
CIA Revised Educational Note Supplement: <i>Calibration of Stochastic Risk-Free Interest Rate Models for Use in CALM Valuation</i> .	https://www.cia-ica.ca/publications/221066e/

CIA/SOA/CAS Paper: <i>Emerging Risks Survey: Guide for Use</i> .	https://www.cia-ica.ca/publications/rp222114e/
Hoshino T, Hines W. 2019. <i>IFRS 17 vs. US GAAP LDTI: Different Animals?</i> . Seattle (WA): Milliman.	https://us.milliman.com/-/media/milliman/pdfs/articles/ifrs17_vs_usgaap_ldti.ashx
Deloitte. 2019. <i>Leveraging LDTI Regulatory Intersections With IFRS 17, PBR, and CECL</i> . New York (NY): Deloitte.	https://www2.deloitte.com/content/dam/Deloitte/us/Documents/financial-services/us-fasb-leveraging-ldti-regulatory-intersections.pdf
MacKenzie G, Su S, Guo T. 2022. "Bridging the GAAP: IFRS 17 and LDTI differences explored." <i>The Financial Reporter</i> . Schaumburg (IL): Society of Actuaries.	https://www.soa.org/sections/financial-reporting/financial-reporting-newsletter/2022/july/fr-2022-07-mackenzie/

6. IFRS 17 financial reporting (25%)	
<ol style="list-style-type: none"> 1. Describe IFRS 17 – Accounting for Insurance Contracts, including its purpose, scope, classification of contracts, and contract boundaries. (A2) 2. Analyze how insurance contracts are measured using the: (B4) <ol style="list-style-type: none"> a. General measurement approach. b. Variable fee approach. c. Premium allocation approach. 3. Reflect considerations related to the level of aggregation when accounting for business under IFRS 17, including determination of the unit of account and setting of portfolios and groups of contracts. (C3) 4. Estimate future cash flows for the liability for remaining coverage and the liability for incurred claims under the general measurement approach, variable fee approach, and the premium allocation approach. (C4) 5. Create discount rate curves both using the top-down and bottom-up approaches referred to in IFRS 17. (C6) 6. Determine risk adjustment for non-financial risk, including: <ol style="list-style-type: none"> a. Reflect the criteria for and measurement of the risk adjustment under the general measurement approach, variable fee approach, and the premium allocation approach. (C4) b. Apply multiple methods, including: (C4) <ol style="list-style-type: none"> i. Quantile. ii. Cost of capital. iii. Margin. c. Adjust the role of diversification and allocation in the determination and the application of the risk adjustment. (C4) d. Determine the risk adjustment for reinsurance contracts held. (C4) 7. Determine key actuarial components of IFRS 17 financial statements, including: <ol style="list-style-type: none"> a. Contractual service margin. (C4) b. Liability for remaining coverage. (C4) c. Liability for incurred claims. (C4) d. Risk adjustment for non-financial risk. (C4) e. Discounting. (C4) f. Loss component. (C4) g. Onerous contracts. (C4) h. Non-distinct investment component. (C4) 8. Analyze the components (statements, key exhibits, and schedules) of the Canadian regulatory return and how they interrelate. (B4) 9. Calculate key financial metrics and evaluate an insurer's financial performance and strength based on such ratios. (D5) 10. Describe the Appointed Actuary's role with respect to IFRS 17 financial reporting. (B2) 	
Reading reference	Source
CIA Educational Note: <i>Application of IFRS 17 Insurance Contracts</i> . Introduction, preamble, Sections A, B, E.	https://www.cia-ica.ca/publications/221117e/

CIA Educational Note: <i>Assessing Eligibility for the Premium Allocation Approach Under IFRS 17 for Property & Casualty and Life & Health Insurance Contracts.</i>	https://www.cia-ica.ca/publications/222091e/
CIA Educational Note: <i>IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts.</i>	https://www.cia-ica.ca/publications/222085e/
CIA Educational Note: <i>IFRS 17 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts.</i>	https://www.cia-ica.ca/publications/222090e/
CIA Educational Note: <i>IFRS 17 Discount Rates for Life and Health Insurance Contracts.</i>	https://www.cia-ica.ca/publications/222097e/
CIA Draft Educational Note: <i>Transition from CALM to IFRS 17 Valuation of Canadian Participating Insurance Contracts.</i>	https://www.cia-ica.ca/publications/219036e/
Great-West Lifeco, Manulife, Sun Life. 2022. <i>Overview of Earnings Presentation and Reporting under the New IFRS 17 Accounting Standard.</i> Winnipeg (MB): Great-West Lifeco.	https://www.manulife.com/content/dam/corporate/en/documents/investors/IFRS-17-accounting-standard.pdf
Office of the Superintendent of Financial Institutions (OSFI). 2023. <i>Guideline A: Life Insurance Capital Adequacy Test.</i> Ottawa (ON): OSFI. Chapter 1.	https://www.osfi-bsif.gc.ca/en/guidance/guidance-library/life-insurance-capital-adequacy-test-guideline-2024
Office of the Superintendent of Financial Institutions (OSFI). 2023. <i>IFRS 17 Life Memorandum to the Appointed Actuary – 2023.</i> Ottawa (ON): OSFI.	https://www.osfi-bsif.gc.ca/en/data-forms/reporting-returns/filing-financial-returns/financial-reporting-instructions/ifrs-17-life-memorandum-appointed-actuary-2023
CIA Standards of Practice. Section 2400.	https://www.cia-ica.ca/being-a-member/standards-of-practice/
Office of the Superintendent of Financial Institutions (OSFI). 2023. <i>Guideline E-15: Appointed Actuary: Legal Requirements, Qualifications and Peer Review.</i> Ottawa (ON): OSFI.	https://www.osfi-bsif.gc.ca/en/guidance/guidance-library/appointed-actuary-legal-requirements-qualifications-peer-review-guideline-2023

7. Financial management (10%)	
<ol style="list-style-type: none"> 1. Describe and calculate financial performance measures. (C3) 2. Perform financial analysis by product line and total company. (C4) 3. Apply methods of valuation to business and asset acquisitions and divestitures, including embedded-value methodologies. (C3) 4. Explain and apply methods of surplus management and financial management. (C3) 5. Describe and apply the principle of creation of value from a financial economics perspective. (C3) 6. Describe the principles underlying the determination of Canadian regulatory capital (i.e., the Canadian Life Insurance Capital Adequacy Test, or LICAT), including the following: (B2) <ol style="list-style-type: none"> a. Identification of significant risk components. (B2) b. Identification of specialized product LICAT requirements. c. Interpreting results from a regulatory perspective. (B2) d. Compare and contrast to other regulatory capital regimes. (C4) 	
Reading reference	Source
CIA Educational Note: <i>Guidance for the 2021 Reporting on Capital and Financial Condition Testing for Life, P&C, and Mortgage Insurers.</i>	https://www.cia-ica.ca/publications/221037e/
Office of the Superintendent of Financial Institutions (OSFI). 2016 [revised 2022 Apr., effective 2023 Jan] <i>IFRS 9 Financial Instruments and Disclosures.</i> Ottawa (ON): OSFI.	https://www.osfi-bsif.gc.ca/en/guidance/guidance-library/ifrs-9-financial-instruments-disclosures
Frasca R, LaSorella K. 2009. "Embedded value: Practice and theory." <i>Actuarial Practice Forum.</i> Schaumburg (IL): Society of Actuaries.	https://www.soa.org/globalassets/assets/library/journals/actuarial-practice-forum/2009/march/apf-2009-03-frasca-lasorella.pdf
Office of the Superintendent of Financial Institutions (OSFI). 2017 [effective 2023 Jan 1]. <i>Guideline A-4: Regulatory Capital and Internal Capital Targets.</i> Ottawa (ON): OSFI.	https://www.osfi-bsif.gc.ca/en/guidance/guidance-library/regulatory-capital-internal-capital-targets
CIA Educational Note: <i>Life Insurance Capital Adequacy Test (LICAT) and Capital Adequacy Requirements for Life and Health Insurance (CARLI).</i>	https://www.cia-ica.ca/publications/218033e/

Office of the Superintendent of Financial Institutions (OSFI). 2023 [effective 2024 Jan 1]. Guideline A: <i>Life Insurance Capital Adequacy Test</i> . Ottawa (ON): OSFI. Chapter 1.	https://www.osfi-bsif.gc.ca/en/guidance/guidance-library/life-insurance-capital-adequacy-test-guideline-2024
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Exam F2ILA: Product Design and Pricing

The aim of this exam is for candidates to develop the following skills:

1. Understand the main principles and techniques of pricing that are relevant to life insurance, including techniques to estimate the key components of a technical price.
2. Apply these principles and techniques within the context of life insurance.
3. Understand how pricing links to wider business processes (e.g., business planning, estimating reserves, and capital setting).
4. Create and evaluate hypothetical scenarios, including using judgment to assess the implications of possible actions and to develop appropriate proposals or recommendations relating to pricing life insurance products.

1. Principal terms	
1. Define the principal terms used in pricing life insurance products. (A1)	
Reading reference	Source
Atkinson DB, Dallas JW. 2000. <i>Life Insurance Products and Finance: Charting a Clear Course</i> . Schaumburg (IL): Society of Actuaries. Sections 1.1-1.4, 2.1-2.9.	https://www.soa.org/publications/books/
CIA Research Paper: <i>Life Insurance Costing and Risk Analysis</i> .	Documentation will be provided by the CIA following the exam registration process.

2. Data (10%)	
<ol style="list-style-type: none"> 1. Differentiate the types of data and information required for pricing, their sources, and main uses. (A4) 2. Apply the concepts of homogeneity and credibility in selecting data for pricing analyses. (B3) 3. Analyze the implications to data requirements of different characteristics of insurance. (B4) 4. Evaluate the influence of the insurer's internal environment (such as changes in operations or IT) on data used for pricing analyses. (B5) 5. Evaluate the influence of external environments on data used for pricing analyses. (B5) 6. Understand the possible causes of data errors and the effects of inadequate data and information. (B2) 7. Create appropriate data-validation processes. (C6) 	
Reading reference	Source
Atkinson DB, Dallas JW. 2000. <i>Life Insurance Products and Finance: Charting a Clear Course</i> . Schaumburg (IL): Society of Actuaries. Sections 3.1 to 3.8.	https://www.soa.org/publications/books/
CIA Research Paper: <i>The Application of Credibility Theory in the Canadian Life Insurance Industry</i> .	https://www.cia-ica.ca/publications/219120e/
Actuarial Standards Board (ASB). 2021. Actuarial Standard of Practice No. 2: <i>Nonguaranteed Elements for Life Insurance and Annuity Products</i> . Washington (DC): ASB.	https://www.actuarialstandardsboard.org/wp-content/uploads/2021/12/asop002_204-2.pdf
CIA Educational Note: <i>Use of Models</i> .	https://www.cia-ica.ca/publications/217007e/
Actuarial Standards Board. 2016. Actuarial Standard of Practice No. 23: <i>Data Quality</i> . Washington (DC): ASB.	https://www.actuarialstandardsboard.org/wp-content/uploads/2017/01/asop023_185.pdf
CIA Standards of Practice. Section 1400.	https://www.cia-ica.ca/being-a-member/standards-of-practice/

3. Drivers of product design (25%)

1. Describe and explain the insurance market stakeholders, how they interact, and their needs: (B2)
 - a. Customers.
 - b. Distributors.
 - c. Internal stakeholders (claims, underwriting, marketing, admin/operations, etc.).
2. Describe, explain, and evaluate drivers of product design (B5):
 - a. Company strengths and weaknesses.
 - b. Economic conditions.
 - c. Marketplace demographics.
 - d. Consumer behaviour.
 - e. Distribution channel behaviour.
 - f. Market evolution, such as availability of market data and advancement of technology.
 - g. Market shocks (i.e., COVID-19 and the loss of fluid-tested underwriting).
 - h. Competition.
 - i. Regulatory requirements.

Reading reference	Source
Atkinson DB, Dallas JW. 2000. <i>Life Insurance Products and Finance: Charting a Clear Course</i> . Schaumburg (IL): Society of Actuaries. Sections 5.1-5.10, 6.5, 7.3-7.5, 8.1-8.4, 9.1-9.6, 10.7, 13.1-13.11, 16.1-16.8.	https://www.soa.org/publications/books/
Bennett DJ, Zultowski WH. 2014. <i>The Art and Science of Life Insurance Distribution</i> . Greenland (NH): ACTEX. Chapters 1-7, 9.	https://www.actexamdriver.com/orderselection.aspx?id=453139727
SOA Research Report: <i>Understanding the Product Development Process of Individual Life Insurance and Annuity Companies</i> .	https://www.soa.org/4937cd/globalassets/assets/files/research/understanding-product-development-report.pdf
SOA Research Report: <i>Understanding the Product Development Process of Individual Life Insurance and Annuity Companies: Overview</i> .	https://www.soa.org/4937cd/globalassets/assets/files/research/understanding-product-development-overview.pdf
CIA/SOA Research Report: <i>The Use of Predictive Analytics in the Canadian Life Insurance Industry</i> .	https://www.soa.org/498c1c/globalassets/assets/files/resources/research-report/2019/predictive-analytics-canadian-life-insurance-report.pdf
SOA Research Report: <i>Big Data and the Future Actuary: How Access to Non-Traditional Data Is Unleashing Innovation Opportunities for the Actuarial Profession and Insurance Industry</i> .	https://www.soa.org/4988fc/globalassets/assets/files/resources/research-report/2019/big-data-future-actuary.pdf
CIA Educational Note: <i>Financial Condition Testing</i> , excluding Appendix B – Property and casualty insurers	https://www.cia-ica.ca/publications/223010e/

4. Design and purpose of various product types, benefits, and features (25%)

1. Describe, in detail, product types, benefits, and features of life and annuity products. (B2)
2. Construct and recommend designs consistent with the market needs and constraints identified in the idea-generation step. (C6)
3. Evaluate feasibility of designs with respect to: (D5)
 - a. Profitability.
 - b. Product risk profile.
 - c. Systems implementation.
 - d. Marketing and competition.

<p>e. Operations.</p> <p>4. Describe and apply the principles of macro pricing (project-based analysis vs. unit-based pricing). (C3)</p> <p>5. Describe and evaluate how diversification of insurance risks can reduce volatility. (C5)</p>	
Reading reference	Source
CIA Research Paper: <i>Life Insurance Costing and Risk Analysis</i> .	Documentation will be provided by the CIA following the exam registration process.
CIA Proceedings: <i>Session 11 (Life): Recent Developments in Pricing and Product Development, and their Implications for Risk and Capital Management and Reserving</i> . [presentation] CIA Appointed Actuary Seminar; 2015.	Documentation will be provided by the CIA following the exam registration process.
CIA Proceedings: <i>Session 32: Big Data, Big Changes – Practical Examples of How Advanced Analytics and Predictive Modelling are Changing Insurance in Canada</i> . [presentation] CIA Annual Conference; 2015.	Documentation will be provided by the CIA following the exam registration process.
CIA Proceedings: <i>Session 24: Development of Simplified Issue Products in Canada</i> . [presentation] CIA Annual Conference; 2014.	Documentation will be provided by the CIA following the exam registration process.
Dall KA, Robbins DL. 2003. "Session 7PD: Pricing risk management." <i>Record</i> . 29(1). Proceedings of the Society of Actuaries Spring Meeting; 2003 May 29-30, Washington (DC).	https://www.soa.org/4937a2/globalassets/assets/library/proceedings/record-of-the-society-of-actuaries/2000-09/2003/may/rso03v29n17pd.pdf
Chalke SA. 1999. "Macro pricing: A comprehensive product development process." In <i>Product Development Section Monograph</i> . Schaumburg (IL): Society of Actuaries.	https://www.soa.org/493624/globalassets/assets/library/monographs/50th-anniversary/product-development-section/1999/january/m-as99-3-02.pdf
CIA Research Paper: <i>Risk Aggregation and Diversification</i> .	https://www.cia-ica.ca/publications/216037e/
CIA/CAS/SOA Survey Report: <i>Survey of Reflecting Risk in Pricing</i> .	https://web.actuaries.ie/sites/default/files/erm-resources/research_reflecting_risk_pricing_report.pdf

5. Relationship between the product features, risks, assumptions, and modelling (25%)

1. Identify and evaluate the setting of appropriate assumptions for product characteristics, like: (B5)
 - a. Riders.
 - b. Policyholder dividends.
 - c. Equity-linked account/fund values.
 - d. Embedded options.
 - e. Return of premium (e.g., on death, lapse, maturity).
 - f. Secondary guarantees.
 - g. Premium payment patterns.
 - h. Payout annuity benefits.
 - i. Crediting methodology.
2. Identify and evaluate the setting of appropriate assumptions for risks and other factors, like (B5):
 - a. Mortality, morbidity, lapse.
 - b. Company experience and industry data.
 - c. The marketplace.
 - d. Underwriting.
 - e. Distribution channel characteristics.
 - f. Business mix.
 - g. Reinsurance.
 - h. Expenses (fixed, variable, marginal).
 - i. Taxes (income and premium).
 - j. Investment strategy.
3. Analyze results and recommend actions with respect to risk and profit measures, like: (D5)

<ul style="list-style-type: none"> a. IFRS 17. b. Rate-of-return measures: <ul style="list-style-type: none"> i. ROE, IRR, ROI, ROA. ii. Risk-adjusted versions of i. above. c. Market-consistent pricing. d. Embedded value. <ul style="list-style-type: none"> 4. Analyze the capital requirements for a product and solutions such as reinsurance and securitization. (C4) 5. Describe the use of generalized linear, stochastic, and multi-state models, the advantages and disadvantages of each, and the methods for their construction. (C2) 6. Interpret and analyze model results described in 5. (B4) 7. Describe and apply methods for modelling guarantees linked to investment performance and their hedges (GMMB, GMDB, GMAB). (C2) 8. Draw insights from financial data to validate past decisions and support future proposals. (C3) 9. Understand source-of-earnings analysis and its use in decision-making with regards to product development and pricing. (C5) 10. Understand, explain, and use results for purposes of decision-making. (C3) 11. Understand and describe Part 2700 of the CIA Standards of Practice – Policyholder Dividend Determination. (C2) 	
Reading reference	Source
CIA Standards of Practice. Sections 1600, 2700.	https://www.cia-ica.ca/being-a-member/standards-of-practice/
CIA Educational Note: <i>Dividend Determination for Participating Policies</i> .	https://www.cia-ica.ca/publications/214008e/
CIA/SOA Research Paper: <i>The Use of Predictive Analytics in the Canadian Life Insurance Industry</i> .	https://www.cia-ica.ca/publications/219050e/
CIA Draft Educational Note: <i>Sources of Earnings: Determination and Disclosure</i> .	https://www.cia-ica.ca/publications/204047e/
Bradfield A, Sproat C. 2019. <i>Session 061: What Industry Data Tells Us About Policyholder Behavior</i> [presentation]. Society of Actuaries 2019 Annual Meeting; 2019 Oct 27-30, Toronto (ON). Schaumburg (IL): Society of Actuaries.	https://www.soa.org/4902c4/globalassets/assets/files/e-business/pd/events/2019/annual-meeting/pd-2019-10-annual-session-061.pdf
CIA Educational Note Supplement: <i>Selective Lapsation for Renewable Term Insurance Products</i> .	https://www.cia-ica.ca/publications/217019e/
CIA Educational Note: <i>Best Estimate Assumption for Expenses</i> .	https://www.cia-ica.ca/publications/205004e/
Atkinson DB, Dallas JW. 2000. <i>Life Insurance Products and Finance: Charting a Clear Course</i> . Schaumburg (IL): Society of Actuaries. Sections 11.1-11.6.	https://www.soa.org/publications/books/
Sun F. 2017. "Pricing surface." <i>Product Matters!</i> [digital newsletter]. (108): 30-34. Schaumburg (IL): Society of Actuaries.	https://www.soa.org/4934bb/globalassets/assets/library/newsletters/product-development-news/2017/november/pro-2017-iss108-sun.pdf
Seng G, Wang D. 2013. "Risk-adjusted pricing: Risk-neutral, real-world, or does it matter?." <i>Product Matters!</i> [digital newsletter]. (87): 13-15. Schaumburg (IL): Society of Actuaries.	https://www.soa.org/4934a6/globalassets/assets/library/newsletters/product-development-news/2013/october/pro-2013-iss87-qoh.pdf
Stuenkel W. 2013. "Relationship of IRR to ROI on a level term life insurance policy." <i>Product Matters!</i> [digital newsletter]. (86): 18-20. Schaumburg (IL): Society of Actuaries.	https://www.soa.org/globalassets/assets/library/newsletters/product-development-news/2013/june/pro-2013-iss86-stuenkel.pdf
Hrischenko G. 2015. "Evolving strategies to improve inforce post-level term profitability." <i>Product Matters!</i> [digital newsletter]. (91): 23-28. Schaumburg (IL): Society of Actuaries.	https://www.soa.org/globalassets/assets/library/newsletters/product-development-news/2015/february/pro-2015-iss91-hrischenko.pdf
SOA Research Report: <i>Report on Pricing Using Market Consistent Embedded Value (MCEV)</i> .	https://www.soa.org/493896/globalassets/assets/files/research/projects/research-report-pricing-report.pdf
Tiller JE, Fagerberg Tiller D. <i>Life, Health and Annuity Reinsurance</i> . 4th ed. Greenland (NH): ACTEX. Chapters 1, 2, 3, 4, 6, 12, 17, 24.	https://www.actexamdriver.com/orderselection.aspx?id=453086447
Hardy M. 2003. <i>Investment Guarantees: Modeling and Risk Management for Equity-Linked Life Insurance</i> . Hoboken (NJ): Wiley. Chapters 1, 2, 6, 7, 8.	https://www.wiley.com/en-us/Investment+Guarantees%3A+Modeling+and+Risk+Management+for+Equity+Linked+Life+Insurance-p-9780471460121

6. Actuarial requirements of product implementation and monitoring (15%)	
<ol style="list-style-type: none"> 1. Describe and evaluate compliance with illustration regulations and other policy-form regulations. (C5) 2. Evaluate variation in the actual experience from expected in assumptions – including (but not limited to) business mix, mortality, investment returns, expenses, and policyholder behavior such as policy and premium persistency – through the use of experience studies. (C5) 3. Evaluate and explain the impact of the variation in the actual experience from expected to other actuaries, insurance professionals, and a non-technical audience. (D5) 4. Recommend changes to non-guaranteed elements for deviations from expected. (C6) 	
Reading reference	Source
CIA Standards of Practice. Sections 1600, 2700.	https://www.cia-ica.ca/being-a-member/standards-of-practice/
Canadian Life and Health Insurance Association (CLHIA). 2005. Guideline G1: <i>Product Disclosure</i> . Toronto (ON): CLHIA.	https://www.clhia.ca/web/CLHIA_LP4W_LND_Webstation.nsf/page/F63611774BD110A58525784F0058C452/\$file/G1.pdf
Canadian Life and Health Insurance Association (CLHIA). 2014. Guideline G2: <i>Individual Variable Insurance Contracts Relating to Segregated Funds</i> . Toronto (ON): CLHIA.	https://www.clhia.ca/web/CLHIA_LP4W_LND_Webstation.nsf/page/A2653E476D68FE0D8525784F0058BF59/\$file/Guideline%20G2.pdf
Canadian Life and Health Insurance Association (CLHIA). 2009. Guideline G6: <i>Illustrations</i> . Toronto (ON): CLHIA.	https://www.clhia.ca/web/CLHIA_LP4W_LND_Webstation.nsf/page/7B785D7C7342484C8525784F0058BD17/\$file/G6.pdf
Canadian Life and Health Insurance Association (CLHIA). 2011. Guideline G15: <i>Guaranteed Withdrawal Benefit (GWB) Illustrations</i> . Toronto (ON): CLHIA.	https://www.clhia.ca/web/CLHIA_LP4W_LND_Webstation.nsf/page/5ED6EFD73ACFF3E8525785E00796170/\$file/G15.pdf
CIA/SOA Research Report: <i>Report on the Survey of Post-Level Premium Period Lapse and Mortality Assumptions for Level Premium Term Plans</i> .	https://www.soa.org/495768/globalassets/assets/files/resources/experience-studies/2020/post-level-premium-period.pdf
SOA Research Report: <i>Mechanics of Dividends</i> .	https://www.soa.org/globalassets/assets/files/resources/research-report/2022/mechanics-dividends.pdf
SOA Educational Tool: <i>Experience Study Calculations</i> . Sections 2-4, 11, 12 15, 17, 18 (excluding 18.2, 18.8, 18.9).	https://www.soa.org/globalassets/assets/Files/Research/experience-study-calculations.pdf
Office of the Superintendent of Financial Institutions (OSFI). 2023. <i>IFRS 17 Life Memorandum to the Appointed Actuary</i> . Ottawa (ON): OSFI.	https://www.osfi-bsif.gc.ca/en/data-forms/reporting-returns/filing-financial-returns/financial-reporting-instructions/ifrs-17-life-memorandum-appointed-actuary-2023

Exam F3ILA: Risk Management

The aim of this exam is for candidates to develop the following skills:

1. Understand the main principles and techniques of enterprise risk management (ERM) and economic capital modelling that are relevant to life insurance.
2. Apply these principles and techniques within the context of life insurance.
3. Understand how ERM and economic capital modelling links to wider business processes (e.g., business planning, pricing, estimating reserves, and capital setting).
4. Create and evaluate hypothetical scenarios, including using judgement to assess the implications of possible actions and to develop appropriate proposals or recommendations for life insurers.

1. Principal terms	
1. Define principal terms used in ERM, economic capital modelling, and stress and scenario testing. (A1)	
Reading reference	Source
Sweeting P. 2017. <i>Financial Enterprise Risk Management</i> . 2nd ed. Cambridge (UK): Cambridge University Press. Chapter 1.	https://www.cambridge.org/ca/academic/subjects/mathematics/optimization-or-and-risk-analysis/financial-enterprise-risk-management-2nd-edition?format=AR
Lam J. 2014. <i>Enterprise Risk Management: From Incentives to Controls</i> . 2nd ed. Hoboken (NJ): Wiley. Chapter 1.	https://www.wiley.com/en-us/Enterprise+Risk+Management%3A+From+Incentives+to+Controls%2C+2nd+Edition-p-9781118413616

2. ERM concept, framework, and process (10%)
<ol style="list-style-type: none"> 1. Apply the concept of ERM. (D3) 2. Apply the framework for risk management and control within an insurer. (D3) 3. Describe regulatory requirements related to ERM including own-risk and solvency assessment (ORSA). (A2) 4. Describe the perspectives of credit-rating agencies. (B2) 5. Reflect data issues in general and special considerations with respect to ERM. (C3) 6. Demonstrate how to determine and articulate: (C3) <ol style="list-style-type: none"> a. Risk appetite. b. Risk identification. c. Risk assessment. d. Risk monitoring. e. Risk limits. f. Risk mitigation. g. Risk capacity. h. Risk tolerances. i. Desired risk profile. j. Risk objectives. k. Risk reporting. 7. Assess the implications of financial and other risks and opportunities for strategic planning. (C4) 8. Describe the risk management control cycle, including the relevance of external influences and emerging risks. (C2) 9. Utilize methods to identify risks and their causes and implications. (D4)

Reading reference	Source
Sweeting P. 2017. <i>Financial Enterprise Risk Management</i> . 2nd ed. Cambridge (UK): Cambridge University Press. Chapters 2, 3.	https://www.cambridge.org/ca/academic/subjects/mathematics/optimization-or-and-risk-analysis/financial-enterprise-risk-management-2nd-edition?format=AR
Lam J. 2014. <i>Enterprise Risk Management: From Incentives to Controls</i> . 2nd ed. Hoboken (NJ): Wiley. Chapters 3, 4.	https://www.wiley.com/en-us/Enterprise+Risk+Management%3A+From+Incentives+to+Controls%2C+2nd+Edition-p-9781118413616
Office of the Superintendent of Financial Institutions (OSFI). 2017 [effective 2018 Jan 1]. Guideline A-4: <i>Regulatory Capital and Internal Capital Targets</i> . Ottawa (ON): OSFI.	https://www.osfi-bsif.gc.ca/en/guidance/guidance-library/regulatory-capital-internal-capital-targets
Office of the Superintendent of Financial Institutions (OSFI). 2017 [effective 2018 Jan 1]. Guideline E-19: <i>Own Risk and Solvency Assessment</i> . Ottawa (ON): OSFI.	https://www.osfi-bsif.gc.ca/en/guidance/guidance-library/own-risk-solvency-assessment
Wong-Fupuy C, McGuignan M. 2020. <i>Best's Credit Rating Methodology</i> . Oldwick (NJ): AM Best. Part 1: Introduction	https://www3.ambest.com/ambv/ratingmethodology/OpenPDF.aspx?rc=250950
Global Methodology for Rating Life and P&C Insurance Companies and Insurance Organizations	https://www.dbrsmorningstar.com/research/350346/global-methodology-for-rating-life-and-pc-insurance-companies-and-insurance-organizations
CRO Forum, 2020, Data quality in the insurance sector.	https://www.thecroforum.org/wp-content/uploads/2020/09/Data-quality-in-the-insurance-sector.pdf
Herzog TN, Scheuren FJ, Winkler WE. 2007. <i>Data Quality and Record Linkage Techniques</i> . New York (NY): Springer. Chapters 2, 5.	https://link.springer.com/book/10.1007/0-387-69505-2
Hardy MR, Saunders D. 2022. <i>Quantitative Enterprise Risk Management</i> . Cambridge (UK): Cambridge University Press. Chapter 1.	https://www.cambridge.org/highereducation/books/quantitative-enterprise-risk-management/C861F6558943791EBF7DC55AD9B554B5#overview
Airmic. 2021. <i>Risk Appetite: The Facts, the Myths, and the Links with Culture, Maturity and Sustainability</i> . London (UK): Airmic. (Airmic Explained Guides). Section 2.	https://www.airmic.com/sites/default/files/Airmic-EXPLAINED-guide-Risk-Appetite-Revised.pdf
CAS/CIA/SOA Research Report: <i>Risk Appetite: Linkage with Strategic Planning</i> .	https://www.soa.org/globalassets/assets/Files/Research/Projects/research-risk-app-link-report.pdf
CIA Practice Resource Document: <i>Actuarial Aspects of Enterprise Risk Management</i> .	https://www.cia-ica.ca/publications/221035e/

3. Risk categories and risk identification (10%)

1. Explain what is meant by risk and uncertainty, including different definitions and concepts of risk. (B2)
2. Describe risk taxonomy, including an awareness of how individual risks might be categorized in different ways. (B1)
3. Describe and evaluate common risks faced by life insurers, including: (B2)
 - a. Market risk.
 - b. Economic risk.
 - c. Interest rate risk.
 - d. Foreign exchange risk.
 - e. Basis risk.
 - f. Credit risk.
 - g. Counterparty risk.
 - h. Liquidity risk.
 - i. Insurance risk.
 - j. Operational risk.
 - k. Legal risk.

<ul style="list-style-type: none"> l. Regulatory risk. m. Political risk. n. Agency risk. o. Reputational risk. p. Strategic risk. q. Demographic risk. r. Moral hazard. s. Other emerging risks. <ul style="list-style-type: none"> 4. Analyze the relationship between systemic risk vs. non-systemic and specific risk vs. concentration of risk. (B4) 5. Identify, categorize, and evaluate potential sources of operational risk, such as regulatory, marketplace, technology, and expense risks. (C3) 6. Identify, categorize, and evaluate potential sources of risk in products including (but not limited to) mortality, morbidity, and lapse. (C3) 	
Reading reference	Source
Jorion P. 2007. <i>Value at Risk: The New Benchmark for Managing Financial Risk</i> . 3rd ed. New York (NY): McGraw Hill. Chapters 1, 4.	https://www.mheducation.com/highered/custom/product/value-risk-3rd-ed/9780071464956.html
Hardy MR, Saunders D. 2022. <i>Quantitative Enterprise Risk Management</i> . Cambridge (UK): Cambridge University Press. Chapters 2, 8, 12, 13.	https://www.cambridge.org/highereducation/books/quantitative-enterprise-risk-management/C861F6558943791EBF7DC55AD9B554B5#overview
International Association of Insurance Supervisors (IAIS). 2019. <i>Holistic Framework for Systemic Risk in the Insurance Sector</i> . Basel (CH): IAIS.	https://www.iaisweb.org/uploads/2022/01/191114-Holistic-Framework-for-Systemic-Risk.pdf
Lam J. 2014. <i>Enterprise Risk Management: From Incentives to Controls</i> . 2nd ed. Hoboken (NJ): Wiley. Chapter 18.	https://www.wiley.com/en-us/Enterprise+Risk+Management%3A+From+Incentives+to+Controls%2C+2nd+Edition-p-9781118413616
Office of the Superintendent of Financial Institutions (OSFI). 2023 [date January 1, 2024]. Guideline A: <i>Life Insurance Capital Adequacy Test</i> . Ottawa (ON): OSFI. Sections 6.2-6.6.	https://www.osfi-bsif.gc.ca/en/guidance/guidance-library/life-insurance-capital-adequacy-test-guideline-2024

4. Economic capital modelling and aggregation of risks (25%)	
<ul style="list-style-type: none"> 1. Describe the extent to which each of the risks in 3.3 (above) can be amenable to quantitative analysis. (B2) 2. Demonstrate an understanding of the use of correlation measures. <ul style="list-style-type: none"> a. Describe enterprise-wide risk aggregation techniques that incorporate the use of correlation. (C2) 3. Apply different correlation measures based on their relative merits and implications. (C4) 4. Apply copulas as part of the process of modelling multivariate risks and evaluate different types of copulas for a given situation. (C5) 5. Reflect the importance of the tails of distributions and tail correlations. (C4) 6. Describe how extreme-value theory can be used to help model risks that have a low probability. (C2) 7. Demonstrate how model and parameter risk can be incorporated into an economic capital model. (C4) 8. Use economic capital models in the overall ERM decision-making process. (C4) <ul style="list-style-type: none"> a. Describe the development and use of models for decision-making purposes in ERM. (B2) b. Demonstrate how the decision-making process considers the organization's risk appetite and corporate governance and builds on the results of stochastic modelling, scenario analysis, stress testing, and analysis of model and parameter risk. (D4) c. Evaluate different types of models for a given purpose. (D5) 	
Reading reference	Source

Lam J. 2014. <i>Enterprise Risk Management: From Incentives to Controls</i> . 2nd ed. Hoboken (NJ): Wiley. Chapter 21 (p. 369-373).	https://www.wiley.com/en-us/Enterprise+Risk+Management%3A+From+Incentives+to+Controls%2C+2nd+Edition-p-9781118413616
Jorion P. 2007. <i>Value at Risk: The New Benchmark for Managing Financial Risk</i> . 3rd ed. New York (NY): McGraw Hill. Section 1.33; Chapters 7, 9.	https://www.mheducation.com/highered/custom/product/value-risk-3rd-ed/9780071464956.html
Hardy MR, Saunders D. 2022. <i>Quantitative Enterprise Risk Management</i> . Cambridge (UK): Cambridge University Press. Chapters 3, 4, 5, 6, 7, 14.	https://www.cambridge.org/highereducation/books/quantitative-enterprise-risk-management/C861F6558943791EBF7DC55AD9B554B5#overview
Finkelstein G, Hoshino T, Ino R, Morgan E. 2006. <i>Economic Capital Modeling: Practical Considerations</i> . Seattle (WA): Milliman Inc.	https://www.milliman.com/-/media/milliman/pdfs/articles/economic_capital_modeling_practical_considerations.ashx
Sweeting P. 2017. <i>Financial Enterprise Risk Management</i> . 2nd ed. Cambridge (UK): Cambridge University Press. Chapters 9, 11, 15.	https://www.cambridge.org/ca/academic/subjects/mathematics/optimization-or-and-risk-analysis/financial-enterprise-risk-management-2nd-edition?format=AR
CIA Educational Note: <i>Use of Models</i> .	https://www.cia-ica.ca/publications/217007e/

5. Risk measurement and assessment (25%)

1. Using common risk measures (such as VAR, TVAR, and probability of ruin), determine risk exposures and tolerances using these measures. (C3)
2. Understand the key considerations in deriving and applying economic capital modelling techniques using deterministic and stochastic models. (D2)
3. Recommend a specific choice of model based on the results of both quantitative and qualitative analysis of financial and insurance data. (D5)
4. Describe approaches, including parameterization and validation, for the assessment of capital requirements for the following risk types: (C2)
 - a. Catastrophe.
 - b. Underwriting and pricing.
 - c. Reserving.
 - d. Credit.
 - e. Climate-related.
 - f. Liquidity.
 - g. Operational.
5. Describe the practical considerations (including data availability, parameterization, and validation procedures) that should be borne in mind when undertaking capital modelling. (D2)
6. Calculate regulatory capital requirement. (C4)
7. Demonstrate understanding of regulator guidance and context for different approaches to responsible investment and, specifically, the integration of environmental, social, and governance (ESG) factors in the investment process. (C3)
8. Demonstrate an understanding of the underlying issues that constitute factors within each of the ESG areas. (C3)
9. Demonstrate an understanding of the ESG market: relevance, size, scope, key drivers and challenges, and risks and opportunities. (C3)

Reading reference

Hardy MR, Saunders D. 2022. *Quantitative Enterprise Risk Management*. Cambridge (UK): Cambridge University Press. Chapters 3, 12, 13.

Source

<https://www.cambridge.org/highereducation/books/quantitative-enterprise-risk-management/C861F6558943791EBF7DC55AD9B554B5#overview>

Sweeting P. 2017. *Financial Enterprise Risk Management*. 2nd ed. Cambridge (UK): Cambridge University Press. Chapter 13.

<https://www.cambridge.org/ca/academic/subjects/mathematics/optimization-or-and-risk-analysis/financial-enterprise-risk-management-2nd-edition?format=AR>

Lam J. 2014. <i>Enterprise Risk Management: From Incentives to Controls</i> . 2nd ed. Hoboken (NJ): Wiley. Chapter 14.	https://www.wiley.com/en-us/Enterprise+Risk+Management%3A+From+Incentives+to+Controls%2C+2nd+Edition-p-9781118413616
Office of the Superintendent of Financial Institutions (OSFI). 2023 [effective 2024 Jan 1]. Guideline A: <i>Life Insurance Capital Adequacy Test</i> . Ottawa (ON): OSFI. Chapters 1, 2 (through 2.3), 3-6, 8.	https://www.osfi-bsif.gc.ca/en/guidance/guidance-library/life-insurance-capital-adequacy-test-guideline-2024
CIA Practice Resource Document: <i>Climate Change Scenario</i> . (Including Excel document.)	https://www.cia-ica.ca/publications/221036e/
CIA Educational Note: <i>Use of Models</i> .	https://www.cia-ica.ca/publications/217007e/
Whelan T, Atz U, Van Holt T, Clark C. 2021. <i>ESG and Financial Performance: Uncovering the Relationship by Aggregating Evidence from 1,000 Plus Studies Published between 2105-2020</i> . New York (NY): Rockefeller Asset Management and NYU Stern Center for Sustainable Business.	https://www.stern.nyu.edu/sites/default/files/assets/documents/ESG%20Paper%20Aug%202021.pdf
Am Best. 2022. <i>Am Best and the Principles for Sustainable Insurance</i> . Oldwick (NJ): AM Best.	https://www.ambest.com/about/esg/PSI_Disclosure.pdf

6. Stress and scenario testing (15%)

1. Describe the use of scenario analysis and stress testing in the risk measurement process, including the advantages and disadvantages of each. (B2)
2. Describe the appointed actuary's responsibilities related to financial condition testing (FCT). (A2)
3. Explain the primary categories of risk associated with climate change from a life insurer's perspective, including:
 - a. Transition risk. (A2)
 - b. Physical risk and environmental risks. (A2)
 - c. Liability risk. (A2)
4. Describe the actuary's role with respect to climate-change risk. (B2)

Reading reference	Source
Office of the Superintendent of Financial Institutions (OSFI). 2023. Guideline E-15: <i>Appointed Actuary: Legal Requirements, Qualifications and Peer Review</i> . Ottawa (ON): OSFI.	https://www.osfi-bsif.gc.ca/en/guidance/guidance-library/appointed-actuary-legal-requirements-qualifications-peer-review-guideline-2023
International Actuarial Association (IAA), Insurance Regulation Committee. 2013. <i>Stress Testing and Scenario Analysis</i> . Ottawa (ON): IAA. p. 1-6, 14-17, 19-25.	https://www.actuaries.org/CTTEES_SOLV/Documents/StressTestingPaper.pdf
CIA Educational Note: <i>Financial Condition Testing</i> , excluding Appendix B – Property and casualty insurers	https://www.cia-ica.ca/publications/223010e/
Bank of Canada; Office of the Superintendent of Financial Institutions (OSFI). 2022. <i>Using Scenario Analysis to Assess Climate Transition Risk</i> . Ottawa (ON): Bank of Canada; OSFI.	https://www.bankofcanada.ca/wp-content/uploads/2021/11/BoC-OSFI-Using-Scenario-Analysis-to-Assess-Climate-Transition-Risk.pdf
CIA Public Statement: <i>Time to Act: Facing the Risks of a Changing Climate</i> .	https://www.cia-ica.ca/publications/219104e/

7. Capital management (10%)

1. Apply key elements of ORSA and FCT, specifically: risk identification and assessment, quantification of risk to capital requirements, board oversight and senior management responsibility, monitoring, reporting, and internal controls. (D4)
2. Demonstrate an understanding of capital calculations:
 - a. Utilize the concept of economic measures of value and capital and their uses in corporate decision-making processes. (D5)
 - b. Evaluate different risk measures and capital assessment approaches. (D5)

<p>c. Demonstrate the ability to develop a capital model for a representative financial firm. (D6)</p> <p>3. Compare techniques for allocating capital across an organization. (C4)</p>	
Reading reference	Source
Hardy MR, Saunders D. 2022. <i>Quantitative Enterprise Risk Management</i> . Cambridge (UK): Cambridge University Press. Chapter 18.	https://www.cambridge.org/highereducation/books/quantitative-enterprise-risk-management/C861F6558943791EBF7DC55AD9B554B5#overview
Office of the Superintendent of Financial Institutions (OSFI). 2017 [effective 2018 Jan 1]. Guideline A-4: <i>Regulatory Capital and Internal Capital Targets</i> . Ottawa (ON): OSFI.	https://www.osfi-bsif.gc.ca/en/guidance/guidance-library/regulatory-capital-internal-capital-targets
CIA Practice Resource Document: <i>Actuarial Aspects of Enterprise Risk Management</i> .	https://www.cia-ica.ca/publications/221035e/
CIA Educational Note: <i>Life Insurance Capital Adequacy Test (LICAT) and Capital Adequacy Requirements for Life and Health Insurance (CARLI)</i> .	https://www.cia-ica.ca/publications/218033e/
Office of the Superintendent of Financial Institutions (OSFI). 2023 [effective 2024 Jan 1]. Guideline A: <i>Life Insurance Capital Adequacy Test</i> . Ottawa (ON):	https://www.osfi-bsif.gc.ca/en/guidance/guidance-library/life-insurance-capital-adequacy-test-guideline-2024

8. Asset/liability management (10%)	
<p>1. For an asset/liability management (ALM) model for a block of life insurance policies or annuity contracts and a given asset portfolio:</p> <ol style="list-style-type: none"> Select and use appropriate assumptions and scenarios. (C3) Incorporate dynamic behavior of both assets and liabilities. (B2) Incorporate, explain, and apply risk-mitigation strategies, including hedging and immunization. (C3) Analyze and evaluate results, including actual vs. projected differences. (C5) <p>2. Analyze the application of ALM and liability-driven investment principles to investment policy and asset allocation. (C5)</p> <p>3. Describe and assess performance measurement methodologies and hedge risk metrics for asset portfolios with regards to ALM. (C5)</p> <p>4. Apply constraints that prevent the optimization of asset portfolios considering: (C3)</p> <ol style="list-style-type: none"> Performance objectives of the ALM strategy. Investment policy restrictions. Available assets. Liquidity. Regulations. 	
Reading reference	Source
Maginn JL, Tuttle DL, Pinto JE, McLeavey DW, editors. 2007. <i>Managing Investment Portfolios: A Dynamic Process</i> . 3rd ed. Hoboken (NJ): Wiley. Chapters 1 (p. 15-17), 3 (p. 101-126), 12, 17 (p. 253-278).	https://www.actexamdriver.com/orderselection.aspx?id=453147610
Litterman B, Quantitative Resources Group. 2003. <i>Modern Investment Management: An Equilibrium Approach</i> . Hoboken (NJ): Wiley. Chapter 10.	https://www.wiley.com/en-us/Modern+Investment+Management:+An+Equilibrium+Approach-p-9780471124108
Derman E, Miller MB, Park D. 2016. <i>The Volatility Smile</i> . Hoboken (NJ): Wiley. Chapters 6-7.	https://www.wiley.com/en-us/The+Volatility+Smile-p-9781118959183