Subject A213

2025 Study Guide

Contents

Please note that Subject A213 is based on Chapters 14-27 of the Institute and Faculty of Actuaries' (IFoA) Subject CM1 as used for the IFoA's 2023 examinations. Therefore the majority of your study materials will refer to CM1 and not A213.

The chapters have not been renumbered and so the first chapter will be Chapter 14.

Please see the following two pages for further information explaining the course structure, why it is based on the IFoA 2023 and not 2025 examinations, and consistency with other ActEd products.

0   The course structure

There are three parts to the Subject A213 course. The parts are broken down into chapters.

The following table shows how the parts, the chapters and the syllabus items relate to each other. We have also given you a broad indication of the length of each chapter. This table should help you plan your progress across the study session.

Part	Ch	Title	No of pages	ASSA 2025 syllabus objectives*	IFoA 2023 Syllabus objectives referred to in course notes*
1	14	The life table	45	1.1, 1.2	4.1, 4.2
	15	Life assurance contracts	45	1.1, 1.2	4.1, 4.2
	16	Life annuity contracts	44	1.1, 1.2	4.1, 4.2
	17	Evaluation of assurances and annuities	31	1.2	4.2
	18	Variable benefits and conventional with-profits policies	41	1.1, 1.2	4.1, 4.2
2	19	Gross premiums	41	3.1, 3.2	6.1, 6.2
	20	Gross premium reserves	59	1.2, 3.2	4.2, 6.2
	21	Joint life and last survivor functions	41	2.1	5.1
	22	Contingent and reversionary benefits	61	2.1	5.1
3	23	Mortality profit	35	3.3	6.3
	24	Competing risks	61	2.3, 2.3	5.2, 5.3
	25	Unit-linked and accumulating with-profits contracts	25	1.1	4.1
	26	Profit testing	53	3.4	6.4
	27	Reserving aspects of profit testing	56	3.4, 3.5	6.4, 6.5

*The numbering of syllabus objectives in the course notes is based on the IFoA Subject CM1's syllabus in 2023, rather than the 2025 syllabus published on the ASSA's website. This is for reasons explained below. The wording of the syllabus objectives are consistent between the two – but the numbering differs.

Relationship with Institute and Faculty of Actuaries (IFoA) Subject CM1 Course Structure and Consistency with Other ActEd Products

Subject A213 is based on Chapters 14 to 27 of the IFoA's Subject CM1 from 2023. The earlier chapters of Subject CM1 map to Subject A211. We are using the 2023 version as the syllabus objectives used are a closer match to the current ASSA Syllabus for Subject A213.

The table on the previous page shows the mapping of the syllabus items given in the chapters with the newly published ASSA syllabus for 2025.

Please note that the chapter numbering used in ActEd's Subject CM1 2025 course, differs from that used in 2023. Hence, if you decide to use ActEd's CM1 Revision Notes, Flashcards or ASET, the chapter references stated will be two chapters out (as two chapters were removed by the IFoA in 2024). For example, instead of Chapter 14, you will see Chapter 12 referenced in the 2025 revision products.

1   Before you start

When studying for the actuarial exams, you will need:

*   a copy of the Formulae and Tables for Examinations of the Faculty of Actuaries and the Institute of Actuaries, 2nd Edition (2002) – these are often referred to as simply the Yellow Tables or the Tables

*   a 'permitted' scientific calculator – you will find the list of permitted calculators on the profession's website. Please check the list carefully, since it is reviewed each year.

The tables are available from the Institute and Faculty of Actuaries' eShop. Please visit actuaries.org.uk.

2   Core study material

This section explains the role of the Core Reading and how it links to the Syllabus, supplementary ActEd text and the examination.

Syllabus

The relevant individual Syllabus Objectives are included at the start of each course chapter and a complete copy of the Syllabus is included in this Study Guide. We recommend that you use the Syllabus as an important part of your study.

Core Reading

The Core Reading has been produced by the Institute and Faculty of Actuaries. It supports students in their learning and development of this subject by providing information and explanation of the topics and objectives in the Syllabus.

The Core Reading is updated annually to reflect any changes to the Syllabus and current practice, as well as for continuous improvement.

Accreditation

The Institute and Faculty of Actuaries would like to thank the numerous people who have helped in the development of the material contained in the Core Reading.

Further reading

The exam will be based on the relevant Syllabus. The ActEd course material will be the main source of tuition for students.

A list of additional resources to support candidate learning and development for this subject can be found on the Module pages on the Institute and Faculty of Actuaries' website:

> actuaries.org.uk/curriculum/

ActEd text

The Core Reading deals with each syllabus objective and covers what is needed to pass the exam, and the Subject A213 Course Notes include the Core Reading in full, integrated throughout the course.

However, the tuition material that has been written by ActEd enhances it by giving examples and further explanation of key points. Here is an excerpt from some ActEd Course Notes to show you how to identify Core Reading and the ActEd material. **Core Reading is shown in this bold font.**

Note that in the example given above, the index *will* fall if the actual share price goes below the theoretical ex-rights share price. Again, this is consistent with what would happen to an underlying portfolio.

This is ActEd text

After allowing for chain-linking, **the formula for the investment index then becomes:**

This is Core Reading

$$I(t) = \frac{\sum_i N_{i,t} P_{i,t}}{B(t)}$$

where **$N_{i,t}$ is the number of shares issued for the ith constituent at time t;**

$B(t)$ is the base value, or divisor, at time t.

Paper B Online Resources (PBOR)

The Paper B Online Resources (PBOR) will help you prepare for the computer-based paper. Delivered through a virtual learning environment (VLE), you will have access to worked examples and practice questions. PBOR also includes a Y Assignment, which is an exam-style assessment.

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3   Skills

Technical skills

Subject A213 is very mathematical and has relatively few questions requiring wordy answers.

Exam skills

In each examination, students will be expected to demonstrate, through their answers, that they have knowledge of, can apply and use higher order skills in this subject:

- Knowledge will be demonstrated through answering questions that assess understanding of that knowledge as well as through questions that ask for the application of relevant knowledge to scenarios.

- Application will be demonstrated through answering questions that assess the ability to identify and apply relevant concepts and skills to solve problems (both numerical and non-numerical).

- Higher order skills will be demonstrated through questions that will assess the ability to use relevant knowledge, concepts and skills to solve problems, draw appropriate conclusions, and make meaningful and appropriate comments on those conclusions.

In subject A213, the approximate split of assessment across the three skill types is:

- Knowledge – 20%

- Application – 65%

- Higher Order skills – 15%.

Further information on study skills can be found on our website at ActEd.co.uk.

Some useful formulae

Formulae are explained and developed in the relevant chapters of the Course Notes. However, we have also put together a document containing some of the most commonly used formula within Subject CM1. Broadly the first 4 pages of this are relevant to Subject A211, with the rest relating to subject A213. This can be found on our website at ActEd.co.uk, and then navigating to 'Subjects' and then 'CM1'. You may find this document helpful when starting to practice questions. Other useful formulae are given on pages 36 and 37 of the *Tables.*

4   Syllabus

The Syllabus for Subject A213 is given here. To the right of each objective are the chapter numbers in which the objective is covered in this course.

Aim

The aim of the Contingencies subject is to provide a grounding in the principles of modelling as applied to actuarial work – focusing particularly on deterministic models which can be used to model and value cashflows that are dependent on death, survival, or other uncertain risks.

Competences

On the successful completion of this subject, the candidate will be able to describe, interpret and discuss mathematical techniques used to model and value cashflows which are contingent on mortality and morbidity risks.

Syllabus topics

1.   Single decrement models   (20%)

2.   Multiple decrement models   (20%)

3.   Pricing and reserving   (60%)

The weightings are indicative of the approximate balance of the assessment of this subject between the main syllabus topics, averaged over a number of examination sessions.

The weightings also have a correspondence with the amount of learning material underlying each syllabus topic. However, this will also reflect aspects such as:

- the relative complexity of each topic, and hence the amount of explanation and support required for it

- the need to provide thorough foundation understanding on which to build the other objectives

- the extent of prior knowledge which is expected

- the degree to which each topic area is more knowledge or application based.

Skills level

The use of a specific command verb within a syllabus objective does not indicate that this is the only form of question which can be asked on the topic covered by that objective. The Examiners may ask a question on any syllabus topic using any of the agreed command verbs, as are defined in the document "Command verbs used in the Associate and Fellowship written examinations".

Questions may be set at any skill level: Knowledge (demonstration of a detailed knowledge and understanding of the topic), Application (demonstration of an ability to apply the principles underlying the topic within a given context) and Higher Order (demonstration of an ability to perform deeper analysis and assessment of situations, including forming judgements, taking into account different points of view, comparing and contrasting situations, suggesting possible solutions and actions, and making recommendations).

In the Contingencies subject, the approximate split of assessment across the three skill types is 20% Knowledge, 65% Application and 15% Higher Order skills.

Detailed syllabus objectives

The numbering of syllabus objectives below is based on the 2023 IFoA Subject CM1 syllabus, rather than the 2025 ASSA Subject A211 syllabus. This is in order to be consistent with the chapters that follow, where the numbering of syllabus objectives also follows that of the 2023 IFoA Subject CM1 Syllabus objectives. However, although the numbering differs, the syllabus objective wordings are consistent between the two. See page 2 of this Study Guide for further explanation.

4.   Single decrement models

      4.1   Define various assurance and annuity contracts.   (Chapters 14, 15, 16, 18 and 25)

            4.1.1   Define the following terms:

- whole life assurance
- term assurance
- pure endowment
- endowment assurance
- whole life level annuity
- temporary level annuity
- guaranteed level annuity
- premium
- benefit

including assurance and annuity contracts where the benefits are deferred.

4.1.2   Describe the operation of conventional with-profits contracts, in which profits are distributed by the use of regular reversionary bonuses, and by terminal bonuses. Describe the benefits payable under the above assurance-type contracts.

4.1.3   Describe the operation of conventional unit-linked contracts, in which death benefits can be expressed as combination of an absolute amount and the value of a unit fund.

4.1.4   Describe the operation of accumulating with-profits contracts, in which benefits take the form of an accumulating fund of premiums, where either:

- the fund is defined in monetary terms, has no explicit charges, and is increased by the addition of regular guaranteed and bonus interest payments plus a terminal bonus; or

- the fund is defined in terms of the value of a unit fund, is subject to explicit charges, and is increased by regular bonus additions plus a terminal bonus (unitised with-profits).

In the case of unitised with-profits, the regular additions can take the form of (a) unit price increases (guaranteed and/or discretionary), or (b) allocations of additional units.

In either case, a guaranteed minimum monetary death benefit may be applied.

4.2   Develop formulae for the means and variances of the payments under various assurance and annuity contracts, assuming a constant deterministic interest rate.
(Chapters 14, 15, 16, 17, 18 and 20)

4.2.1   Describe the life table functions l_x and d_x and their select equivalents $l_{[x]+r}$ and $d_{[x]+r}$.

4.2.2   Define the following probabilities: $_np_x$, $_nq_x$, $_{n|m}q_x$, $_{n|}q_x$ and their select equivalents $_np_{[x]+r}$, $_nq_{[x]+r}$, $_{n|m}q_{[x]+r}$, $_{n|}q_{[x]+r}$.

4.2.3   Express the probabilities defined in 4.2.2 in terms of life table functions defined in 4.2.1.

4.2.4   Define the assurance and annuity factors and their select and continuous equivalents. Extend the annuity factors to allow for the possibility that payments are more frequent than annual but less frequent than continuous.

4.2.5   Understand and use the relations between annuities payable in advance and in arrear, and between temporary, deferred and whole life annuities.

4.2.6   Understand and use the relations between assurance and annuity factors using equation of value, and their select and continuous equivalents.

4.2.7   Obtain expressions in the form of sums/integrals for the mean and variance of the present value of benefit payments under each contract defined in 4.1.1, in terms of the (curtate) random future lifetime, assuming:

- contingent benefits (constant, increasing or decreasing) are payable at the middle or end of the year of the contingent event or continuously.

- annuities are paid in advance, in arrear or continuously, and the amount is constant, or increases or decreases by a constant monetary amount or by a fixed or time-dependent variable rate.

- premiums are payable in advance, in arrear or continuously; and for the full policy term or for a limited period.

Where appropriate, simplify the above expressions into a form suitable for evaluation by table look-up or other means.

4.2.8   Define and evaluate the expected accumulations in terms of expected values for the contracts described in 4.1.1 and contract structures described in 4.2.7.

5.   Multiple decrement and multiple life models

5.1   Define and use assurance and annuity functions involving two lives.
(Chapters 21 and 22)

5.1.1   Extend the techniques of objectives 4.2 to deal with cashflows dependent upon the death or survival of either or both of two lives.

5.1.2   Extend the technique of 5.1.1 to deal with functions dependent upon a fixed term as well as age.

5.2   Describe and illustrate methods of valuing cashflows that are contingent upon multiple transition events.   (Chapter 24)

5.2.1   Define health insurance, and describe simple health insurance premium and benefit structures.

5.2.2   Explain how a cashflow, contingent upon multiple transition events, may be valued using a multiple state Markov model, in terms of the forces and probabilities of transition.

5.2.3   Construct formulae for the expected present values of cashflows that are contingent upon multiple transition events, including simple health insurance premiums and benefits, and calculate these in simple cases. Regular premiums and sickness benefits are payable continuously and assurance benefits are payable immediately on transition.

5.3   Describe and use methods of projecting and valuing expected cashflows that are contingent upon multiple decrement events.   (Chapter 24)

    5.3.1   Describe the construction and use of multiple decrement tables.

    5.3.2   Define a multiple decrement model as a special case of a multiple state Markov model.

    5.3.3   Derive dependent probabilities for a multiple decrement model in terms of given forces of transition, assuming forces of transition are constant over single years of age.

    5.3.4   Derive forces of transition from given dependent probabilities, assuming forces of transition are constant over single years of age.

6.   Pricing and reserving

6.1   Define the gross random future loss under an insurance contract, and state the principle of equivalence.   (Chapter 19)

6.2   Describe and calculate gross premiums and reserves for assurance and annuity contracts.   (Chapters 19 and 20)

    6.2.1   Define and calculate gross premiums for the insurance contract benefits as defined in objective 4.1 under various scenarios using the equivalence principle or otherwise. This includes scenarios where:

- contracts may accept only a single premium;

- regular premiums and annuity benefits may be payable annually, more frequently than annually, or continuously;

- death benefits (which increase or decrease by a constant compound rate or by a constant monetary amount) may be payable at the end of the year of death, or immediately on death;

- survival benefits (other than annuities) may be payable at defined intervals other than at maturity.

    6.2.2   State why an insurance company will set up reserves.

    6.2.3   Define and calculate gross prospective and retrospective reserves.

    6.2.4   State the conditions under which, in general, the prospective reserve is equal to the retrospective reserve allowing for expenses.

    6.2.5   Prove that, under the appropriate conditions, the prospective reserve is equal to the retrospective reserve, with or without allowance for expenses, for all fixed benefit and increasing / decreasing benefit contracts.

      6.2.6   Obtain recursive relationships between successive periodic gross premium reserves, and use this relationship to calculate the profit earned from a contract during the period.

      6.2.7   Understand the concepts of net premiums, net premium valuation and net premium reserves, and how they relate to gross premiums, gross premium valuation and gross premium reserves respectively.

6.3   Define and calculate, for a single policy or a portfolio of policies (as appropriate):

- death strain at risk;

- expected death strain;

- actual death strain; and

- mortality profit

for policies with death benefits payable immediately on death or at the end of the year of death; for policies paying annuity benefits at the start of the year or on survival to the end of the year; and for policies where single or non-single premiums are payable.   (Chapter 23)

6.4   Project expected future cashflows for whole life, endowment and term assurances, annuities, unit-linked contracts, and conventional/unitised with-profits contracts, incorporating multiple decrement models as appropriate.
                                                                    (Chapters 26 and 27)

      6.4.1   Profit test life insurance contracts of the types listed above and determine the profit vector, the profit signature, the net present value, and the profit margin.

      6.4.2   Show how a profit test may be used to price a product, and use a profit test to calculate a premium for life insurance contracts of the types listed above.

      6.4.3   Show how gross premium reserves can be computed, using the above cashflow projection model, and included as part of profit testing.

6.5   Show how, for unit-linked contracts, non-unit reserves can be established to eliminate ('zeroise') future negative cashflows, using a profit test model.
                                                                    (Chapter 27)

Assessment

Combination of a one hour 45 minute computer based modelling assignment and a two hour and fifteen minutes written examination.