



Institute of Actuaries of Australia

Part I Syllabus:

The IAAust Part I subjects are equivalent to the Subjects CT1-CT8 of the IoA (London).

Subject CT1: Financial Mathematics Core Technical Syllabus

Aim

The aim of the Financial Mathematics subject is to provide a grounding in financial mathematics and its simple applications.

Links to other subject

Subject CT2 Finance and Financial Reporting: develops the use of the asset types introduced in this subject.

Subject CT4 Models: develops the idea of stochastic interest rates.

Subject CT5 Contingencies: develops some of the techniques introduced in this subject in situations where cashflows are dependent on survival.

Subject CT7 Economics: develops the behaviour of interest rates.

Subject CT8 Financial Economics: develops the principles further.

Objectives

On completion of the subject the trainee actuary will be able to:

- (i) Describe how to use a generalised cash-flow model to describe financial transactions.
- (ii) Describe how to take into account the time value of money using the concepts of compound interest and discounting.
- (iii) Show how interest rates or discount rates may be expressed in terms of different time periods.
- (iv) Demonstrate a knowledge and understanding of real and money interest rates.
- (v) Calculate the present value and the accumulated value of a stream of equal or unequal payments using specified rates of interest and the net present value at a real rate of interest, assuming a constant rate of inflation.
- (vi) Define and use the more important compound interest functions including annuities certain.



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- (vii) Define an equation of value.
- (viii) Describe how a loan may be repaid by regular instalments of interest and capital.
- (ix) Show how discounted cash flow techniques can be used in investment project appraisal.
- (x) Describe the investment and risk characteristics of the following types of asset available for investment purposes: fixed-interest Government borrowings; fixed-interest borrowing by other bodies; shares and other equity-type finance; derivatives
- (xi) Analyse elementary compound interest problems.
- (xii) Calculate the delivery price and the value of a forward contract using arbitrage free pricing methods.
- (xiii) Show an understanding of the term structure of interest rates.
- (xiv) Show an understanding of simple stochastic models for investment returns.

Subject CT2:

Finance and Financial Reporting Core Technical Syllabus

Aim

The aim of the Finance and Financial Reporting subject is to provide a basic understanding of corporate finance including a knowledge of the instruments used by companies to raise finance and manage financial risk and to provide the ability to interpret the accounts and financial statements of companies and financial institutions.

Links to other subjects

Subject CT1 Financial Mathematics: uses this subject to provide a grounding in financial mathematics and investments.

Objectives

On completion of this subject the candidate will be able to:

- (i) Demonstrate a knowledge and understanding of the principal terms in use in investment and asset management.
- (ii) Demonstrate an awareness of the key principles of finance.



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- (iii) Describe the structure of a joint stock company and the different methods by which it may be financed.
- (iv) Describe the basic principles of personal and corporate taxation.
- (v) Demonstrate a knowledge and understanding of the characteristics of the principal forms of financial instrument issued or used by companies and the ways in which they may be issued.
- (vi) Discuss the factors to be considered by a company when deciding on its capital structure and dividend policy.
- (vii) Define what is meant by a company's cost of capital and discuss how its cost of capital interacts with the nature of the investment projects it undertakes.
- (viii) Describe the basic construction of accounts of different types and the role and principal features of the accounts of a company.
- (ix) Interpret the accounts of a company or a group of companies and discuss the limitations of such interpretation.
- (x) Show how financial techniques can be used in the assessment of capital investment projects.

Subject CT3: Probability and Mathematical Statistics Core Technical Syllabus

Aim

The aim of the Probability and Mathematical Statistics subject is to provide a grounding in the aspects of statistics and in particular statistical modelling that are of relevance to actuarial work.

Links to other subjects

Subjects CT4 – Models

Subject CT6 - Statistical Methods: use the statistical concepts and models covered in this subject

Objectives

On completion of the subject the trainee actuary will be able to:

- (i) Summarise the main features of a data set (exploratory data analysis).



- (ii) Explain the concepts of probability.
- (iii) Explain the concepts of random variable, probability distribution, distribution function, expected value, variance and higher moments, and calculate expected values and probabilities associated with the distributions of random variables.
- (iv) Define a probability generating function, a moment generating function, a cumulant generating function and cumulants, derive them in simple cases, and use them to evaluate moments.
- (v) Define basic discrete and continuous distributions, be able to apply them and simulate them in simple cases.
- (vi) Explain the concepts of independence, jointly distributed random variables and conditional distributions, and use generating functions to establish the distribution of linear combinations of independent random variables.
- (vii) State the central limit theorem, and apply it.
- (viii) Explain the concepts of random sampling, statistical inference and sampling distribution, and state and use basic sampling distributions.
- (ix) Describe the main methods of estimation and the main properties of estimators, and apply them.
- (x) Construct confidence intervals for unknown parameters.
- (xi) Test hypotheses.
- (xii) Investigate linear relationships between variables using correlation analysis and regression analysis.
- (xiii) Explain the concepts of analysis of variance and use them.
- (xiv) Explain the concepts of conditional expectation and compound distribution, and apply them.



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Subject CT4: Models Core Technical Syllabus

Aim

The aim of the Models subject is to provide a grounding in stochastic processes and survival models and their application.

Links to other subjects

Subject CT1 Financial Mathematics: provides an introduction to stochastic interest rates.

Subject CT3 Probability and Mathematical Statistics: introduces the concepts of statistical distributions and modelling.

Subjects CT5 Contingencies and CT6 Statistical Methods: develop the application of Markov chains.

Subject CT8 Financial Economics: develops the concepts introduced here further.

Interim arrangements

Under the transitional arrangements, two half papers will be offered. One will cover the 103 related aspects of CT4, CT4 (103), including Markov models. The second will cover the 104 aspects, CT4 (104). Each of these examinations will be 11/2 hours.

CT4 (103) will examine syllabus objectives (i) (iv), (v) 8., (vii) and (viii) 2., 3. below. CT4 (104) will examine syllabus objectives (v) 1. 7., (vi), (viii) 1., 4. and (ix) (xi) below.

CT4 (104) will also include material on Markov models from the current 104 syllabus, but this will be examinable under CT4 (103) only.

Objectives

On completion of the subject the trainee actuary will be able to:

- (i) Describe the principles of actuarial modelling.
- (ii) Describe the general principles of stochastic processes, and their classification into different types.
- (iii) Define and apply a Markov chain.
- (iv) Define and apply a Markov process.
- (v) Explain the concept of survival models.



- (vi) Describe estimation procedures for lifetime distributions.
- (vii) Describe statistical models of transfer between multiple states, including processes with single or multiple decrements, and derive relationships between probabilities of transfer and transition intensities.
- (viii) Derive maximum likelihood estimators for the transition intensities in models of transfers between states with piecewise constant transition intensities.
- (ix) Describe the Binomial model of mortality, derive a maximum likelihood estimator for the probability of death and compare the Binomial model with the multiple state models.
- (x) Describe how to estimate transition intensities depending on age, exactly or using the census approximation.
- (xi) Describe how to test crude estimates for consistency with a standard table or a set of graduated estimates, and describe the process of graduation.

Subject CT5: Contingencies Core Technical Syllabus

Aim

The aim of the Contingencies subject is to provide a grounding in the mathematical techniques which can be used to model and value cash flows dependent on death, survival, or other uncertain risks.

Links to other subjects

Subjects CT1 Financial Mathematics

Subject CT3 Probability and Mathematical Statistics

Subject CT4 Models: introduce techniques that will be drawn upon and used in the development of this subject.

Objectives

On completion of this subject the candidate will be able to:

- (i) Define simple assurance and annuity contracts, and develop formulae for the means and variances of the present values of the payments under these contracts, assuming constant deterministic interest.



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- (ii) Describe practical methods of evaluating expected values and variances of the simple contracts defined in objective (i).
- (iii) Describe and calculate, using ultimate or select mortality, net premiums and net premium provisions of simple insurance contracts.
- (iv) Describe the calculation, using ultimate or select mortality, of net premiums and net premium provisions for increasing and decreasing benefits and annuities.
- (v) Describe the calculation of gross premiums and provisions of assurance and annuity contracts.
- (vi) Define and use straightforward functions involving two lives.
- (vii) Describe methods which can be used to model cashflows contingent upon competing risks.
- (viii) Describe the technique of discounted emerging costs, for use in pricing, reserving, and assessing profitability.
- (ix) Describe the principal forms of heterogeneity within a population and the ways in which selection can occur.

**Subject CT6:
Statistical Methods Core Technical Syllabus**

Aim

The aim of the Statistical Methods subject is to provide a further grounding in mathematical and statistical techniques of particular relevance to financial work.

Links to other subjects

Subject CT3 Probability and Mathematical Statistics: provides a grounding in probability and statistics.

Subject CT4 Models: provides the groundwork for Markov processes.

Objectives

On completion of the subject the trainee actuary will be able to:

- (i) Explain the concepts of decision theory and apply them.
- (ii) Calculate probabilities and moments of loss distributions both with and without limits and risk-sharing arrangements.



- (iii) Construct risk models involving frequency and severity distributions and calculate the moment generating function and the moments for the risk models both with and without simple reinsurance arrangements.
- (iv) Explain the concept of ruin for a risk model.
- (v) Explain the fundamental concepts of Bayesian statistics and use these concepts to calculate Bayesian estimators.
- (vi) Describe the fundamental concepts of rating and apply them to simple experience rating systems.
- (vii) Describe and apply techniques for analysing a delay (or run-off) triangle and projecting the ultimate position.
- (viii) Explain the fundamental concepts of a generalised linear model (GLM), and describe how a GLM may apply.
- (ix) Define and apply the main concepts underlying the analysis of time series models.
- (x) Explain the concepts of Monte Carlo simulation using a series of pseudo-random numbers.

Subject CT7: Economics Core Technical Syllabus

Aim

The aim of the Economics subject is to provide a grounding in the fundamental concepts of economics as they affect the operation of insurance and other financial systems, both from the point of view of individuals and their requirements for financial security, and from the point of view of financial institutions and their ability to provide products that meet customer needs. It will also provide a sufficient understanding of macroeconomics to enable the future actuary to interpret the economic environment and to make informed judgements as to suitable assumptions to make regarding future inflation, returns on investment, stock market behaviour, exchange rates and economic growth.

Links to other subjects

Subjects CT8 Financial Economics develop the material introduced in this subject.

Objectives

On completion of the subject the trainee actuary will be able to:

- (i) Discuss the interaction between supply and demand in the provision of a product and the way in which equilibrium market prices are determined.



- (ii) Define elasticity of demand and supply and discuss the effects on a market of different levels of elasticity.
- (iii) Describe and discuss the application of utility theory to economic and financial problems.
- (iv) Describe how profit maximising firms make short run and long run production choices.
- (v) Describe what is meant by different sorts of competition, or lack of it, and discuss the practical effect on supply and demand.
- (vi) Use knowledge of the following microeconomic principles to increase their understanding of the markets in which we operate, the regulatory issues and the ramification of strategic decisions:
- (vii) Describe and discuss the structure of the public sector finances of an industrialised economy.
- (viii) Define what is meant by GDP, GNP and Net National Product, show how these concepts may be useful in describing the economy and in making comparisons between countries, and discuss their limitations.
- (ix) Describe how the propensity to save or to consume by the private sector or the corporate sector affects the economy.
- (x) Describe and discuss the impact of fiscal and monetary policy and other forms of government intervention on different aspects of the economy, and in particular on financial markets.
- (xi) Discuss the role of exchange rates and international trade in the economy and the meaning of the term balance of payments.
- (xii) Describe the major factors affecting the rate of inflation, the level of interest rates, the exchange rate, the level of unemployment, and the rate of economic growth in the economy of an industrialised country.

Subject CT8: Financial Economics Core Technical Syllabus

Aim

The aim of the Financial Economics subject is to develop the necessary skills to construct asset liability models and to value financial derivatives. These skills are also required to communicate with other financial professionals and to critically evaluate modern financial theories.



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Links to other subjects

Concepts introduced in Subjects CT1 Financial Mathematics,

CT4 Models

CT7 Economics are used in this subject.

Objectives

On completion of the subject the trainee actuary will be able to:

- (i) Discuss the advantages and disadvantages of different measures of investment risk.
- (ii) Describe and discuss the assumptions of mean-variance portfolio theory and its principal results.
- (iii) Describe and discuss the properties of single and multifactor models of asset returns.
- (iv) Describe asset pricing models, discussing the principal results and assumptions and limitations of such models.
- (v) Discuss the various forms of the Efficient Markets Hypothesis and discuss the evidence for and against the hypothesis.
- (vi) Demonstrate a knowledge and understanding of stochastic models of the behaviour of security prices.
- (vii) Define and apply the main concepts of Brownian motion (or Wiener Processes).
- (viii) Demonstrate a knowledge and understanding of the properties of option prices, valuation methods and hedging techniques.
- (ix) Demonstrate a knowledge and understanding of models of the term structure of interest rates.
- (x) Demonstrate a knowledge and understanding of simple models for credit risk.