

# Actuarial Studies

## Ordinary degree first year

### 300-101 Introduction to Actuarial Studies

**Note:** Students who have completed a level-2 actuarial studies subject will not normally be permitted to enrol in this subject.

**Credit points:** 12.5

**Coordinator:** D Pitt

**Prerequisites:** 620-121 Mathematics A (Advanced) or 620-141 Mathematics A.

**Contact:** Two 1-hour lectures and a 1-hour tutorial per week (*Semester 2*).

**Description:** This subject is an introduction to compound interest functions and operations; valuation of annuities, bonds and loans; demography, and factors affecting population growth and size; construction and use of the life table; applications of these in life insurance; types of insurance products; the role of the actuary; and the significance of financial institutions utilising actuarial management.

**Assessment:** A 2-hour end-of-semester examination (70%), two assignments totalling not more than 2000 words (20%), and a 45 minute mid-semester examination (10%). Satisfactory completion of this subject requires a 50% pass in the end of semester examination.

## Second year

In addition to satisfying the individual subject prerequisites, students must have completed or gained credit for at least 75 level-1 points before they will be permitted to enrol in any of the level-2 (second year) subjects listed.

### 300-203 Financial Mathematics I

**Credit points:** 12.5

**Coordinator:** TBA

**Prerequisites:** A mark of 60 or better in either 620-120 UMEP Mathematics for High Achieving Students or 620-121 Mathematics A (Advanced) or a mark of 75 or better in 620-141 Mathematics A.

**Contact:** Two 1-hour lectures and a 1-hour tutorial per week (*Semester 1*).

**Description:** Topics include compound interest functions; valuation of a series of payments, including where the cash flows and/or the force of interest are continuous functions of time; equations of value; loans repayable by instalments; characteristics of major asset types; and discount valuation of fixed interest securities, ordinary shares and property, including effects of tax.

**Assessment:** A 2-hour end-of-semester examination (70%), two assignments totalling not more than 2000 words (20%), and a 45 minute mid-semester examination (10%). Satisfactory completion of this subject requires a 50% pass in the end of semester examination.

### 300-204 Financial Mathematics II

**Credit points:** 12.5

**Coordinator:** R M Fitzherbert

**Prerequisites:** 300-203 Financial Mathematics I and 620-201 Probability.

**Contact:** Two 1-hour lectures and a 1-hour tutorial per week (*Semester 2*).

**Description:** Topics include discount valuation of index-linked bonds and forward contracts; term structure of interest rates; duration and convexity; discounted cash flow techniques; distributions of accumulations and present values; stochastic simulation; time series models.

**Assessment:** A 2-hour end-of-semester examination (70%), two assignments totalling not more than 2000 words (20%), and a 45 minute mid-semester examination (10%). Satisfactory completion of this subject requires a 50% pass in the end of semester examination.

### 300-205 Introduction to Actuarial Practice

**Credit points:** 12.5

**Coordinator:** J Gribble

**Prerequisites:** 620-201 Probability and 300-203 Financial Mathematics I.

**Contact:** Three hours of lectures and/or tutorials per week (*Semester 2*).

**Description:** This subject will develop the student's knowledge of basic actuarial principles applicable to a range of actuarial practice areas. The focus will be mainly on actuarial issues within Australia, but there will also be international references.

**Assessment:** A 2-hour end-of-semester examination (60%) and up to three assignments totalling not more than 4000 words (40%). Satisfactory completion of this subject requires a 50% pass in the end of semester examination.

## Third year

In addition to satisfying the individual subject prerequisites, students must have completed or gained credit for at least 175 level-1 and level-2 points before they will be permitted to enrol in any of the level-3 (third year) subjects listed below.

### 300-312 Actuarial Modelling I

**Note:** Students may not gain credit for both 300-312 Actuarial Modelling I and 300-330 Survival Models: Theory and Applications.

**Credit points:** 12.5

**Coordinator:** D C M Dickson

**Prerequisites:** 300-204 Financial Mathematics II, 620-202 Statistics and 620-123 Applied Mathematics (Advanced).

**Contact:** Three hours of lectures and/or tutorials per week (*Semester 1*).

**Description:** Topics include survival models concepts; estimation procedures for lifetime distributions; multiple state models; binomial model of mortality; actuarial applications of Markov processes.

**Assessment:** A 2-hour end of semester examination (80%) and up to three assignments totalling not more than 20 pages (20%).

### 300-313 Actuarial Modelling II

**Note:** Students may not gain credit for both 300-313 Actuarial Modelling II and 300-330 Survival Models: Theory and Applications.

**Credit points:** 12.5

**Coordinator:** D Pitt

**Prerequisites:** 300-204 Financial Mathematics II and 620-202 Statistics.

**Contact:** Three hours of lectures and/or tutorials per week (*Semester 1*).

**Description:** Topics include exact and census methods for estimating transition intensities based on age; goodness of fit and smoothness of graduated estimates versus crude estimates; actuarial modelling; general principles of stochastic processes; Markov chains in actuarial work.

**Assessment:** A 2-hour end of semester examination (80%) and up to three assignments totalling not more than 20 pages (20%).

### 300-314 Contingencies

**Note:** Students may not gain credit for both 300-314 Contingencies and either of 300-341 Actuarial Mathematics I and 300-342 Actuarial Mathematics II.

**Credit points:** 25

**Coordinator:** R M Fitzherbert

**Prerequisites:** 300-312 Actuarial Modelling I.

**Contact:** Six hours of lectures and/or tutorials per week (*Semester 2*).

**Description:** Topics include traditional life insurance products; present values of annuities and assurances for single lives; net and gross premiums and policy values; select mortality; joint life theory; cashflow models; competing risks; discounted emerging costs; multiple decrements; guarantees and options; risk classification.

**Assessment:** Two 2-hour end of semester examinations (80%) and up to three assignments totalling not more than 40 pages (20%).

### 300-315 Actuarial Statistics

**Note:** Students may not gain credit for both 300-315 Actuarial Statistics and either 300-331 Modelling in Insurance and Finance I or 620-301 Stochastic Modelling.

**Credit points:** 12.5

**Coordinator:** D Pitt

**Prerequisites:** 300-313 Actuarial Modelling II.

**Contact:** Three hours of lectures and/or tutorials per week (*Semester 2*).

**Description:** Topics include experience rating; claim run-off triangles; generalised linear models; time series and their applications; simulation; decision theory.

**Assessment:** A 2-hour end-of-semester examination (80%) and up to three assignments totalling not more than 20 pages (20%).

### 300-316 Models for Insurance and Finance

**Note:** Student may not gain credit for both 300-316 Models for Insurance and Finance and 300-332 Modelling in Insurance and Finance II.

**Credit points:** 12.5

**Coordinator:** S Li

**Prerequisites:** 300-334 Financial Mathematics III, 620-202 Statistics and 620-123 Applied Mathematics (Advanced).

**Contact:** Three hours of lectures and/or tutorials per week (*Semester 2*).

**Description:** Topics include: probability concepts; martingales in actuarial studies and finance; applications of Brownian Motion, geometric Brownian

Motion and the lognormal distribution; stochastic calculus; models for financial time series; applications of Monte Carlo simulation in insurance and finance.

**Assessment:** A 2-hour end of semester examination (80%) and up to three assignments totalling not more than 20 pages (20%).

### 300-334 Financial Mathematics III

**Note:** Students may not gain credit for both 300-334 Financial Mathematics III and either 306-331 Investments or 333-301 Investments.

**Credit points:** 12.5

**Coordinator:** M Joshi

**Prerequisites:** 300-204 Financial Mathematics II.

**Contact:** Three hours of lectures and/or tutorials per week (*Semester 1*).

**Description:** This subject introduces actuarial students to stochastic asset liability modelling. It aims to expand the student's knowledge of basic actuarial principles in the fields of investments and asset management. Topics include: utility theory, stochastic dominance, measures of investment risk, portfolio theory, models of asset returns, asset liability modelling, equilibrium models, the efficient markets hypothesis, stochastic models of security prices and Brownian Motion and its application.

**Assessment:** A 2-hour end-of-semester examination (80%) and up to three assignments totalling not more than 4500 words (20%).

## Fourth-year honours

The following subjects are available only to those admitted to the honours degree unless special approval is granted by the Professor of Actuarial Studies.

### 300-400 Actuarial Studies Research Essay

**Note:** Students may not gain credit for 300-400 Actuarial Studies Research Essay and 300-409 Actuarial Studies Projects.

**Credit points:** 25

**Coordinator:** R M Fitzherbert

**Prerequisites:** Entry into the fourth-year honours program in actuarial studies.

**Semester:** Semester 1, repeat 2

**Description:** The research essay of at most 10,000 words will be on a topic approved by the Head of Department.

**Assessment:** The research essay is examined. It must be submitted by the end of Semester 2.

### 300-406 Risk Theory I

**Credit points:** 12.5

**Coordinator:** S Li

**Prerequisites:** 300-315 Actuarial Statistics.

**Contact:** Three hours of lectures and/or tutorials per week (*Semester 1*).

**Description:** Topics include collective risk model, calculation of moments and mgf of aggregate claims; recursion formulae (e.g. Panjer's and Schröter's), effect of reinsurance; individual risk model, De Pril's recursion formula and Kornya's method; fundamentals of decision theory; credibility theory; exact credibility and the Bühlmann-Straub model.

**Assessment:** A 50-minute mid-semester test (20%) and a 2-hour end-of-semester examination (80%).

### 300-407 Risk Theory II

**Credit points:** 12.5

**Coordinator:** D.C.M. Dickson

**Prerequisites:** 300-406 Risk Theory I.

**Contact:** Three hours of lectures and/or tutorials per week (*Semester 2*).

**Description:** Topics include premium principles, including variance principle, Esscher principle, risk adjusted principle; applications of utility theory, premium calculation and optimal reinsurance retention levels; reinsurance problems; ruin theory, the adjustment coefficient and Lundberg's inequality, explicit solutions for the probability of ultimate ruin, application of Panjer's recursion formula, the probability and severity of ruin, the effect of reinsurance on the adjustment coefficient.

**Assessment:** A 50-minute mid-semester test (20%) and a 2-hour end-of-semester examination (80%).

### 300-408 Advanced Financial Mathematics I

**Credit points:** 12.5

**Coordinator:** D Dufresne

**Prerequisites:** 300-334 Financial Mathematics III and 300-316 Models for Insurance and Finance.

**Contact:** Three hours of lectures and/or tutorials per week (*Semester 1*).

**Description:** The binomial model; risk-neutral pricing of derivative securities; Brownian motion; introduction to Itô's formula and SDEs; stochastic asset models; Black-Scholes model; arbitrage and hedging; interest-rate models; actuarial applications (e.g. maturity guarantees, SPDAs).

**Assessment:** A 50-minute mid-semester test (20%) and a 2-hour end-of-semester examination (80%).

### 300-409 Actuarial Studies Projects

**Note:** Students may not gain credit for 300-400 and 300-409.

**Credit points:** 25

**Coordinator:** D Dufresne

**Prerequisites:** Entry into the fourth-year honours program in Actuarial Studies.

**Contact:** A series of, at most, five 1-hour meetings per semester (*Semester 1, repeat 2*).

**Description:** Students will complete three projects which will require research, analytical and mathematical skills. The nature of these projects will vary according to the current interests of staff and visitors.

**Assessment:** Students will be required to submit three assignments of between 3000 and 3500 words each, on dates specified at the start of the academic year.

### 300-410 Actuarial Practice and Control I

**Credit points:** 12.5

**Coordinator:** J.D. Gribble

**Prerequisites:** 300-314 Contingencies and 300-315 Actuarial Statistics.

**Contact:** Four hours of lectures and/or tutorials per week (*Semester 1*).

**Description:** Topics include insurance markets and products; underwriting and risk assessment; policy design; actuarial modelling; actuarial assumptions and feedback; reserving methods.

**Assessment:** A 3-hour end-of-semester "open book" examination (70%) and assignments totalling not more than 4500 words (30%).

### 300-411 Actuarial Practice and Control II

**Note:** It is recommended that students complete 300-410 before enrolling in this subject.

**Credit points:** 12.5

**Coordinator:** J.D. Gribble

**Prerequisites:** 300-314 Contingencies and 300-315 Actuarial Statistics.

**Contact:** Four hours of lectures and/or tutorials per week (*Semester 2*).

**Description:** Topics include investments for different types of liabilities; assessment of solvency; analysis of experience; analysis of surplus; actuarial techniques in the wider fields; and an introduction to professionalism.

**Assessment:** A 3-hour end-of-semester "open book" examination (70%) and assignments totalling not more than 4500 words (30%).

### 300-412 Advanced Financial Mathematics II

**Credit points:** 12.5

**Coordinator:** To be advised

**Prerequisites:** 300-408 Advanced Financial Mathematics I.

**Contact:** Three hours of lectures and/or tutorials per week (*Semester 2*).

**Description:** No-arbitrage pricing in continuous-time models; rational bounds for puts and calls; multidimensional Brownian motion and stochastic calculus; Girsanov's Theorem; pricing of options on dividend-paying securities; connections with partial differential equations; exotic options; interest-rate derivatives; actuarial applications.

**Assessment:** A 50-minute mid-semester test (20%) and a 2-hour end of semester examination (80%).