Cass Business School
CITY UNIVERSITY LONDON

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Specialist Masters Programme

Course handbook
MSc/PG Diploma in Actuarial Science

September 2012

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Section 1 Course Director's Welcome

Dear Student

On behalf of the Faculty of Actuarial Science and Insurance, I am delighted to welcome you to the MSc/Postgraduate Diploma in Actuarial Science programme.

The programme began in 1985 and the course design and content are reviewed annually to reflect new developments in the field of actuarial science.

The Faculty of Actuarial Science and Insurance, which became part of Cass Business School in August 2002, is one of the world's leading academic centres in this field. It was originally established in 1974 as the Department of Actuarial Science and Statistics within City University and was developed with the direct support of the actuarial profession and insurance companies. The Faculty benefits from a strong and long-standing relationship with the profession. Much of the current research is pursued in pioneering areas such as the application of mathematical, statistical and financial models to investment, insurance, healthcare and pensions.

The teaching quality and the support that we provide to our students reflect our significant experience in these fields. In addition, the programme draws on the expertise of both the Faculty of Finance and the Faculty of Management within Cass Business School.

As you are no doubt aware, Cass Business School is the first institution to have both its undergraduate and postgraduate actuarial programmes accredited by the UK Actuarial Profession. The Institute and Faculty of Actuaries (the professional actuarial bodies in the UK) offer exemptions in eight Core Technical subjects CT1—CT8 based on satisfactory performance on the MSc/Dip Actuarial Science programme at Cass Business School.

My colleagues and I are committed to helping you realise your potential so that you can derive the maximum benefit from the programme.

Dr Andreas Tsanakas
Course Director
MSc/Postgraduate Diploma Actuarial Science

Section 2 Programme information

Programme aims

1. To give students the opportunity to study the fundamentals of actuarial science, statistics, finance and economics, equivalent to subjects CT1 - CT8 of the Actuarial Profession's examinations, and to enable them to gain exemption from the equivalent professional examinations.

2. To enable students with up to four professional exemptions the opportunity to study the remaining CT subjects in with minimal overlap of coverage.

3. To prepare students for employment in actuarial and related fields.

4. To provide students with opportunities for additional study beyond the core syllabus, to enable them to be better prepared both for practical actuarial work and also for tackling the later professional examinations.

5. To be a suitable preparation for students wishing to proceed to the Postgraduate Diploma/MSc in Actuarial Management, and for those wishing to pursue academic research in Actuarial Science.

6. To develop students' abilities for independent research.

7. To enable students to develop their own interests in the field of actuarial science and enable them to prepare for further professional education and for employment in actuarial professional practice or research.

Aims 1-5 above pertain to both the MSc and the Postgraduate Diploma in Actuarial Science. Aims 6 and 7 above pertain only to the MSc in Actuarial Science.

Objectives

1. To provide a grounding in financial mathematics and its simple applications.

2. To provide the student with a basic understanding of the methods and types of instrument used by companies to raise finance. To enable students to interpret the published financial statements of companies and financial institutions.

3. To provide an introduction to the theory of probability and statistics and to statistical modelling applications.

4. To explore stochastic processes and survival models and their applications in finance and actuarial science.

5. To provide a grounding in the mathematical techniques of pricing and evaluating insurance and pensions products.

6. To explain the fundamental statistical techniques used in the analysis of short-term insurance contracts.

7. To provide an introduction to fundamental concepts of economic analysis at both the micro and macro levels focussing on the areas most relevant to actuarial science.

8. To use and critically evaluate modern financial theory, to construct asset-liability models and to value financial derivatives.

9. To examine the various methods for undertaking empirical research.

10. To train students to undertake individual research, to provide them with an opportunity to specialise in a contemporary business or finance topic related to their future career aspirations, and to integrate and apply concepts from different modules.

Objectives 1-8 above pertain to both the MSc and the Postgraduate Diploma in Actuarial Science. Objectives 9 and 10 above pertain only to the MSc in Actuarial Science.

Learning Outcomes

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas:

Values and attitudes:

1. Demonstrate awareness of the professional and public service values of the actuarial profession

Knowledge and understanding:

2. Demonstrate mastery of fundamental concepts in statistics, economics, finance and investment

3. Demonstrate mastery of actuarial theory used in investment, insurance and probability modelling.

4. Demonstrate a detailed and systematic knowledge of a specific area of actuarial theory or practice

Cognitive/intellectual:

5. Demonstrate advanced mathematical problem-solving skills.

6. Present reasoned arguments demonstrating specialised knowledge.

7. Evaluate research papers and professional texts to produce an independent synthesis of knowledge and ideas

Subject specific:

8. Demonstrate proficiency in the use of actuarial and statistical methods to solve problems in insurance and investment.

9. Evaluate and apply alternative approaches in the analysis of financial reports.

10. Develop reasoned arguments on current issues relating to actuarial theory and practice.

11. Demonstrate the ability to evaluate and synthesize information and ideas from articles in actuarial journals.

Transferable:

12. Manage time effectively to cope with intensive study.

13. Use spreadsheets as an effective tool for data analysis and financial modelling.

14. Communicate effectively with academic and professional tutors in written reports.

Learning outcomes 4, 7, 10 and 11 above pertain only to the MSc in Actuarial Science. The remaining learning outcomes pertain to both the Postgraduate Diploma and MSc in Actuarial Science.

Programme structure

The MSc/PGDip Actuarial Science programme consists of two stages:

- Stage 1: Successful completion of stage 1 leads to the award of the Postgraduate Diploma in Actuarial Science.

- Stage 2: Successful completion of both stage one and stage two leads to the award of the MSc in Actuarial Science.

The programme is available for full-time study only.

Stage 1 (Postgraduate Diploma): Terms one and two

Stage 1 of the programme is taught in term one and term two Stage 1 covers the actuarial professional subjects CT1-CT8.

For each module

- About 75% of teaching consists of face-to-face lectures requiring attendance at Cass Business School.

- About 25% of teaching consists of online lectures and material available through the Moodle Virtual Learning Environment, either from your home PC or from the Cass

computing labs. If you access Moodle from your office PC, please check usage and firewall policies with your employer.

The structure of Stage 1 of the programme is described in more detail later in this handbook.

Stage 2 (MSc): Terms two and three, Summer

Stage 2 of the programme starts in term 2 with a preparatory module (the Research Project Management Skills module), and continues in term three with *either* five electives *or* with one elective and a Business Research Project. The Project is completed during the summer.

Stage 2 goes beyond Stage 1 and enables students to prepare for actuarial employment and further professional education.

Most of the teaching consists of face-to-face lectures or lab sessions, with some online material also provided.

The structure of Stage 2 is described in more detail later in this handbook.

Schedule of Online Lectures

For each module, about 25% of teaching consists of online lectures. You can access online material at all times via the Moodle Virtual Learning Environment.

Stage 1 (Postgraduate Diploma)

Successful completion of Stage 1 of the MSc Actuarial Science programme leads to the award of the *Postgraduate Diploma in Actuarial Science*. Stage 1 is taught in terms one and two.

Programme Content

Stage 1 of the MSc Actuarial Science programme covers the actuarial professional subjects. Eight subjects are offered and they correspond exactly to the professional Core Technical subjects. The subjects are described in detail later in this handbook.

Brief Description of Award Regulations

To qualify for the award of *Postgraduate Diploma in Actuarial Science*, you must achieve at least 120 credits from any of Subjects CT1—CT8, including the compulsory subjects:

	Subject/module	*Credits*
Compulsory subjects unless you hold a prior exemption	CT1 Financial Mathematics	20
	CT3 Probability and Mathematical Statistics	20
	CT5 Contingencies	30
	CT2 Finance and Financial Reporting	20
	CT4 Modelling	30
	CT6 Statistical Methods	30
	CT7 Business Economics	20
	CT8 Financial Economics	30

Subjects CT1, CT3 and CT5 are compulsory unless you hold a *prior exemption* (see section 5 for information on prior exemptions*)*. To obtain at least 120 credits students will need to complete the compulsory modules CT1, CT3 and CT5, as well as two more modules, at least one of which must be a 30 credit module (i.e. CT4, CT6 or CT8). See section 4 of this handbook for detailed award and assessment regulations.

Professional Exemptions

Exemptions from the professional actuarial examinations are available if performance on the programme is satisfactory. See section 5 for more details.

You can take as many additional subjects as you wish, over and above the 120 credits required for the Diploma, purely for exemption purposes.

The Actuarial Profession appoints independent examiners who approve examination papers, review examination and coursework scripts and decide on the award of exemptions from professional exams.

Stage 2 (MSc)

Successful completion of **both** Stage 1 and Stage 2 of the programme leads to the award of the *MSc in Actuarial Science.* It is important to note also that the award of Postgraduate Diploma stands in its own right but that the MSc subsumes the Diploma.

Programme Content

Whereas Stage 1 of the programme covers the actuarial professional (Core Technical) subjects, Stage 2 goes further. Stage 2 enables students to prepare for actuarial employment and further professional education by:

- Acquiring practical skills (eg modelling, programming, spreadsheets)
- Learning about actuarial applications and specialist technical topics (eg health insurance)
- Researching an actuarial topic in depth (through a project)
- Improving written communication skills (by writing an extended project report)
- Learning about other disciplines (eg finance).

Schedule

Stage 2 of the programme starts in term two with a preparatory module in Research Project Management Skills, and continues in term three with *either* five short elective modules *or* with one short elective and the Business Research Project. The Business Research Project is completed over the summer.

Award and Assessment Regulations

To qualify for the award of *MSc in Actuarial Science*, you must pass the Postgraduate Diploma in Actuarial Science (120 credits) and achieve a further 60 credits by passing the subjects listed below:

Compulsory module:

SMM522 Research Project Management Skills (10 credits)

and either

Five elective modules (10 credits each)

or

One elective module (10 credits) and SMM527 Business Research Project (40 credits)

The 10-credit electives must be taken from a list to be authorised by the Course Director and published in term two.

More Information about SMM522 Research Project Management Skills Module

This module is compulsory for the award of the *MSc in Actuarial Science*. It does not count towards the award of the *Postgraduate Diploma in Actuarial Science*. This module runs in term two. If you are working towards the *Postgraduate* Diploma and are uncertain about whether you wish to proceed to the MSc, you are encouraged to take this module in order to keep your options open.

Assessment is by means of coursework (typically a written report of 1,500-2000 words).

More Information about SMM527 MSc Business Research Project

At the conclusion of the Research Project Management Skills module, you will be in a position to choose a topic for your Business Research Project. You will have to write a Project Proposal. If your proposal is deemed acceptable, you can start working on your Business Research Project in term three under the supervision of an academic member of staff who is an expert in your chosen area.

General guidelines on the Business Research Project module are provided to students later in the academic year.

Assessment Matrix

Module Title	Module Code	Credits	Assessment weightings used to calculate module mark	
			Coursework	Examination
Term One				
Financial Mathematics (CT1) (C)	SMM061	20	20%	80%
Finance and Financial Reporting (CT2) (E)	SMM062	20	20%	80%
Probability and Mathematical Statistics (CT3) (C)	SMM063	20	20%	80%
Business Economics (CT7) (E)	SMM071	20	20%	80%
Term Two				
Modelling (CT4) (E)	SMM064	30	20%	80%
Contingencies (CT5) (C)	SMM065	30	20%	80%
Statistical Methods (CT6) (E)	SMM066	30	20%	80%
Financial Economics (CT8) (E)	SMM068	30	20%	80%
RPMS (C)	SMM522	10	100%	100%
Term Three				
Option One				
Elective 1	SMMXXX	10	100%	
Elective 2	SMMXXX	10	100%	
Elective 3	SMMXXX	10	100%	
Elective 4	SMMXXX	10	100%	
Elective 5	SMMXXX	10	100%	
Option Two				
Business Research Project	SMM527	40	100%	
Elective 1	SMMXXX	10	100%	
Degree Total		180		

C= Core

E= Elective

ECTS equivalencies

Each MSc course is worth between 180 - 210 CAPS credits. As a general rule two CAPS credits equal one ECTS credit. (For example, a course with 180 CAPS credits is worth 90 ECTS credits.)

*CAPS *(Credit Accumulation of Programme Specification)*

*ECTS *(European Credit Transfer and Accumulation System)*

Term Dates and Assessment Periods

Induction

16 – 28 September 2012

Term One

01 October – 07 December 2012

Term One Examinations

14 – 25 January 2013

Term Two

28 January – 09 April 2013

Term Two Examinations

29 April – 10 May 2013

Term Three

13 May – 28 June 2013

Term Three Assessments

01 – 12 July 2013

Resit Examinations and Assessments (terms one, two and three)

19 – 30 August 2013

Business Research Project Submission Date

02 September 2013

Section 3 Module Descriptions

FINANCIAL MATHEMATICS (CT1)
SMM061

Module Leader Dr Douglas Wright

Sessions 10 x 3 hour sessions plus 10 hours online

Module Assessment

Coursework	20%
Examination	80%

Educational aims

- To provide a grounding in financial mathematics and its simple applications.

Learning outcomes

Knowledge and understanding and subject-specific outcomes:

- To apply compound interest theory to find the present value or the accumulation of a cash flow, and apply financial mathematics to solve a broad range of practical problems.
- To show how loan repayments can be determined once interest rate assumptions have been made, and demonstrate specialised knowledge and understanding of investments.
- To analyse and compare alternative capital projects and value fixed-interest stock

Cognitive and transferable outcomes:

- To be able to evaluate the significance of numerical results by general reasoning, to communicate effectively with other finance professionals, and to work on problems within groups.

Syllabus

- Time value of money using compound interest and discounting
- Present values and accumulated values
- Interest rates and discount rates for different time periods
- Compound interest functions
- Equations of value

- Project appraisals using discounted cash-flow techniques
- Investment valuation
- Real returns; index linked bonds
- Yield curves; spot and forward interest rates
- Duration, convexity and immunisation
- Stochastic interest rate models

Reading List

Students will be provided with a comprehensive list of core reference texts for the module. Below are the key recommended texts:

Institute and Faculty of Actuaries' Core Reading for Subject CT1. (C)

McCutcheon and Scott. (1991). *An Introduction to the Mathematics of Finance*. Heinemann.

Adams, Booth, Bowie and Freeth. (2003*). Investment Mathematics*. Wiley.

FINANCE AND FINANCIAL REPORTING (CT2)
SMM062

Module Leader	Alison Osbourne	
Sessions	10 x 3 hour sessions plus 10 hours online	
Module Assessment	Coursework	20%
	Examination	80%

Educational aims

- To provide the student with a basic understanding of the methods and types of instrument used by companies to raise finance.
- To enable students to interpret the published financial statements of companies and financial institutions.

Learning outcomes

Knowledge and understanding and subject-specific outcomes:

- To demonstrate knowledge of the structure of limited companies, and of principal forms of financial instruments, and to discuss characteristics of different financial instruments
- To demonstrate mastery of the principles underlying the construction of financial statements
- To demonstrate the ability to apply and evaluate alternative approaches in interpreting the financial statements of companies and financial institutions, and be able to construct financial statements in a form suitable for publication

Cognitive and transferable outcomes:

- To be able to evaluate and interpret complex financial data, solve specialised numerical problems related to the financial situation of companies and institutions, present ideas in clear concise English, and communicate effectively with other finance professionals

Syllabus

- Key principles of finance
- Limited company and other business entities
- Capital structure of a limited company
- Personal and corporate taxation
- Capital markets and financial instruments

- Financial institutions
- Cost of capital and dividend policy
- Assessment of capital investment projects
- Legal requirements that apply to financial reporting
- Fundamental accounting concepts and financial statements
- Construction of simple financial statements and group accounts
- Financial statements of insurance companies.
- Interpretation of accounts by the calculation of simple ratios
- Limitations to the interpretation of accounts

Reading List

Students will be provided with a comprehensive list of core reference texts for the module. Below are the key recommended texts:

Institute and Faculty of Actuaries' Core Reading for Subject CT2. (C)

Holmes and Sugden. *Interpreting Company Reports and Accounts*. Prentice-Hall.

Brealey and Myers*. Principles of Corporate Finance*. McGraw.

PROBABILITY AND MATHEMATICAL STATISTICS (CT3)
SMM063

Module Leader Professor Linda Wolstenholme

Sessions 12 x 3 hour sessions plus 14 hours online

Module Assessment

Coursework	20%
Examination	80%

Educational aims

- To provide an introduction to the theory of probability and statistics and to statistical modelling applications.

Learning outcomes

Knowledge and understanding and subject-specific outcomes:

- To demonstrate mastery of the axioms of probability, of conditional probability, of the concept of a random variable, and of the theory underlying statistical techniques. To demonstrate proficiency in the use of random variables in a broad range of applications.

- To construct statistical displays of data, solve problems with more than one random variable, find moments of distributions, carry out and interpret analysis of variance, simple linear regression, and test hypotheses and derive confidence intervals.

Cognitive and transferable outcomes:

- To be able to solve a broad range of problems in probability, apply statistical methods to explore complex data sets and draw conclusions from summary statistics, and interpret numerical examples.

Syllabus

- Presentation of data
- Measures of central tendency and dispersion
- Basic concepts of probability
- Continuous and discrete probability distributions and their moments
- Generation of discrete and continuous random variables using simulation
- Expectation, probability and moment generating functions
- Limiting distributions

- Central Limit Theorem
- Inference: confidence intervals and hypothesis testing
- Estimation: method of moments and maximum likelihood, and asymptotic results
- Correlations and regression, and inference on the parameters of the model
- One-way analysis of variance
- Bivariate distributions, conditional distributions and conditional expectations

Reading List

Students will be provided with a comprehensive list of core reference texts for the module. Below are the key recommended texts:

Institute and Faculty of Actuaries Official Core Reading for CT3.

Statistical method for Business and Economics, by Gert Nieuwenhuis. McGraw Hill

John E. *Freund's Mathematical Statistics*, by Miller and Miller. Prentice Hall

MODELLING (CT4)
SMM064

Module Leader Dr Iqbal Owadally

Sessions 4 x 10 hour sessions plus 10 hours online

Module Assessment

Coursework	20%
Examination	80%

Educational aims

- To explore stochastic processes and survival models and their applications in finance and actuarial science.

Learning outcomes

Knowledge and understanding and subject-specific outcomes:

- To demonstrate understanding of modelling principles, stochastic processes, the Markov property, and Markov processes. To be able to construct mathematical models for business problems involving uncertainty, design and calibrate stochastic models, analyse univariate time series.

- To demonstrate mastery of the theory of survival models and multiple state transfer models, including transition intensities and conditional probabilities. To be able to estimate mortality and hazard rates and carry out and test graduations of mortality data.

Cognitive and transferable outcomes and values and attitudes:

- To design and apply mathematical models in different business situations. To demonstrate higher-level mathematical skills, apply probability theory in specialised models and apply mathematics to complex business models.

Values and attitudes:

- To appreciate the actuarial control cycle, the importance of stochastic processes in various disciplines and the benefits and limitations of stochastic modelling.

Syllabus

- Fundamental modelling principles, deterministic v stochastic models, interpretation of results.

- Simulation of stochastic models.

- Definition and classification of stochastic processes, filtration, Markov property.

- Markov chains on finite and infinite state spaces and in discrete and continuous time, simple random walk, Poisson process, Chapman-Kolmogorov equation, Kolmogorov differential equations, stationary distribution and equilibrium, applications, simulation.

- Statistical models of lifetime and of transfer between multiple states.

- Estimation procedures for survival models and multiple-state transfer models.

- Estimating between-state transition intensities from data grouped by age, exactly and using the census approximation, and the problems caused by heterogeneous data.

- Testing experience data for consistency with a standard basis or with a set of graduated estimates. Graduation.

Reading List

Students will be provided with a comprehensive list of core reference texts for the module. Below are the key recommended texts:

Institute and Faculty of Actuaries Official Core Reading for Subject CT4 (C).

S M Ross. (2006). *Introduction to Probability Models*. Academic Press.

N L Bowers, M U Gerber, J C Hickman, D A Jones and C J Nesbitt. (1997). *Actuarial Mathematics*. The Society of Actuaries.

B Benjamin and J H Pollard. (1993). *The Analysis of Mortality and Other Actuarial Statistics*. Institute and Faculty of Actuaries.

A S Puzey. (1986). *Exposed to Risk*. Institute of Actuaries.

CONTINGENCIES (CT5)
SMM065

Module Leader Dr Ben Rickayzen and Dr Pietro Millossovich

Sessions 10 x 4 hour sessions plus 10 hours online

Module Assessment

Coursework	20%
Examination	80%

Educational aims

- To provide a grounding in the mathematical techniques of pricing and evaluating insurance and pensions products.

Learning outcomes

Knowledge and understanding and subject-specific outcomes:

- To demonstrate knowledge and understanding of a broad range of life insurance products and of their pricing and reserving, and mastery of life insurance mathematics. To understand the problems created by heterogeneity and selection in risk models.

- To be able to evaluate means and variances of present values of cash flows for complex insurance contracts, and calculate gross premiums and reserves using the equivalence principle, profit testing and related techniques.

Cognitive and transferable outcomes:

- To use mathematics and statistics to solve quantitative and practical problems and to develop and present reasoned arguments.

Syllabus

- Simple assurances and annuities
- The evaluation of assurances and annuities
- Net premiums and reserves
- Variable benefits and annuities
- Gross premiums and reserves for fixed and variable benefit contracts
- Annuities and assurances involving two lives
- Competing risks
- Discounted emerging cost techniques

Reading List

Students will be provided with a comprehensive list of core reference texts for the module. Below are the key recommended texts:

Institute and Faculty of Actuaries Official Core Reading for Subject CT5 (C).

N L Bowers, M U Gerber, J C Hickman, D A Jones and C J Nesbitt. (1997). *Actuarial Mathematics.* The Society of Actuaries.

H U Gerber and S H Cox. (2004). *Life Insurance Mathematics*. Springer-Verlag.

S David Promislow. (2006*). Fundamentals of Actuarial Mathematics*. Wiley.

D. C. M. Dickson, M. R. Hardy, H. R. Waters (2009), *Actuarial Mathematics For Life Contingent Risks*, Cambridge University Press.

STATISTICAL METHODS (CT6)
SMM066

Module Leader Dr Vali Asimit

Sessions 10 x 2 hour sessions plus 10 hours online

Module Assessment

Coursework	20%
Examination	80%

Educational aims

- To explain the fundamental statistical techniques used in the analysis of short-term insurance contracts.

Learning outcomes

Knowledge and understanding and subject-specific outcomes:

- To demonstrate proficiency in the application of models used for insurance losses and to show how these models are used to assess insurance premiums. To be able to solve specialised insurance problems and explain the assumptions underlying different statistical models.

Cognitive and transferable outcomes:

- To use statistical models and probabilistic arguments to solve specialised insurance problems, develop and present reasoned arguments on statistical inference, and to identify and apply the most suitable statistical methods for a broad range of general insurance problems.

Syllabus

- Bayesian methods
- Credibility theory
- Simulation
- Time-series models
- Loss distributions
- Loss run-off triangles
- Reinsurance
- Theory of ruin
- Generalised Linear Models

Reading List

Students will be provided with a comprehensive list of core reference texts for the module. Below are the key recommended texts:

Institute and Faculty of Actuaries Official Core Reading for Subject CT6.

S A Klugman, H H Panjer, and G E Willmot. (2008). *Loss Models: from data to decisions,* 3rd ed. Wiley.

I B Hossack, J H Pollard and B Zehnwirth. (1999). *Introductory Statistics with Applications in General Insurance* (2nd edition). Cambridge University Press.

Kaas, Goovaerts, Dhaene & Denuit. (2001). *Modern Actuarial Risk Theory*, Kluwer.

P.J.Boland. (2007*). Statistical and Probabilistic Methods in Actuarial Science*. Chapman and Hall/CRC Press.

A J Dobson. (2001). *An Introduction to Generalised Linear Models*. Chapman and Hall/CRC Press.

Miller and Miller. (2003). *John E Freund's Mathematical Statistics*, (7th edition). Prentice-Hall.

C Chatfield (2004). *The Analysis of Time Series*, 6th ed. Chapman and Hall/CRC.

BUSINESS ECONOMICS (CT7)
SMM071

Module Leader	Professor Keith Pilbeam	
Sessions	10 x 3 hour sessions plus 10 hours online	
Module Assessment	Coursework	20%
	Examination	80%

Educational aims

- To provide an introduction to fundamental concepts of economic analysis at both the micro and macro levels focussing on the areas most relevant to actuarial science.

Learning outcomes

Knowledge and understanding and subject-specific:

- To understand the key aspects of the operation of markets, consumer demand, the production decisions of the firm, the determinants of market structure, and the effects of market structure on a firm's supply and pricing decisions.

- To understand macroeconomic analysis and interpret the economic environment with regard to the business cycle and growth, inflation and unemployment, fiscal and monetary policies, exchange rates, balance of payments, and international trade and investment.

Cognitive and Transferable Outcomes:

- To analyse a broad range of different markets and the influences on them through the use of economic principles.

Syllabus

- The relevance of Economics to the world of business

- Markets, supply and demand forces

- Elasticity

- Consumer behaviour analysis

- The theory of costs and the difference between the short and long run

- Different market structures – perfect competition, monopolistic competition, oligopoly and monopoly

- Alternative theories of the Firm – sales maximisation, growth and pricing strategies

- GDP, GNP and Net National Product
- Macroeconomic equilibrium and unemployment
- Fiscal policy
- Monetary policy and the role of the banking system
- Interaction of monetary and fiscal policies
- International trade, balance of payments and exchange rate mechanisms

Reading List

Students will be provided with a comprehensive list of core reference texts for the module. Below are the key recommended texts:

John Sloman, Alison Wride and Dean Garratt (2012*) Economics,* 8th edition FT/Prentice Hall

Institute and Faculty of Actuaries Official Core Reading for Subject CT7 (C).

FINANCIAL ECONOMICS (CT8)
SMM068

Module Leader Dr Iqbal Owadally

Sessions 10 x 4 hour sessions plus 10 hours online

Module Assessment

Coursework	20%
Examination	80%

Educational aims

- To use and critically evaluate modern financial theory, to construct asset-liability models and to value financial derivatives.

Learning outcomes

Knowledge and understanding and subject-specific outcomes:

- To demonstrate proficiency in the application of models used in financial economics and understand how these models are used.
- To explain the assumptions and ideas underlying different financial models, and to apply finance theory to assess risk, make portfolio decisions, model asset prices and interest rates and value derivatives.

Cognitive and transferable outcomes:

- To appreciate the strength and limitations of models of financial markets.
- To be able to use mathematics and statistics to solve quantitative financial and practical problems. To be able to communicate effectively with other finance professionals.

Syllabus

- Utility theory and investment risk measures.
- Types of financial securities.
- Portfolio theory.
- Equilibrium pricing models.
- Efficient markets.
- Stochastic models of security prices. Brownian motion and stochastic calculus.
- Types of derivatives including forwards.

- Binomial pricing model.
- Black-Scholes pricing model.
- Interest rate term-structure models
- Simple credit risk models.

Reading List

Students will be provided with a comprehensive list of core reference texts for the module. Below are the key recommended texts:

Elton and Gruber. (2006). *Modern Portfolio Theory and Investment Analysis*. Wiley.

J C Hull. (2006*). Options, Futures and Other Derivatives*. Prentice Hall.

U F Wiersema (2008). *Brownian Motion Calculus*. Wiley.

RESEARCH PROJECT MANAGEMENT SKILLS
SMM522

Module Leader	Dr Zaki Khorasanee	
Sessions	4 x 3 hour sessions plus self directed study	
Module Assessment	Coursework	20%
	Examination	80%

Educational aims

The aim of this module is to familiarise students with active research areas relevant to the actuarial profession and the process of writing a business report. After attending the introductory seminars, students will be required to submit a business research report of 1,500-2,000 words on a topic that has been approved by the module leader.

The course aims to make it possible for participants to:

- Understand methods used to generate ideas for relevant projects
- Understand recent research developments in the actuarial field
- Develop an understanding of commonly used sources of data/literature available and correct methods of referencing these sources
- Learn how to communicate research ideas effectively
- Appreciate the links between academic theory and practical relevance.

Learning outcomes

On successful completion of the course the participants will:

- Have an overview of topical research areas in actuarial science
- Understand how to formulate and test research questions
- Know how find relevant data sources and literature
- Be able to prepare a business research report of a professional standard
- Have a sound grasp of a particular research topic.

Syllabus

Research Process

A business research report should enable a non-specialist reader to acquire a sound basic knowledge of the topic covered. The process starts with selecting a suitable topic, followed by understanding the related literature, collecting any data required and, lastly, writing a well-structured, well-presented report with appropriate references to the literature.

Data/information sources

Students will be given an overview of sources they can access, including financial databases, academic journals and trade publications. The correct referencing and attribution of sources will be discussed.

Actuarial research areas

Staff from the Faculty of Actuarial Science and Insurance will present introductions to their areas of expertise and will highlight related topical research areas.

Communication skills

There will be sessions enabling students to work on their written and oral communication skills. There will be particular focus on the elements of writing a professionally-presented business research report.

Reading List

A list of websites and journals from where source information can be found will be provided in the introductory seminar to the module.

BUSINESS RESEARCH PROJECT
SMM527

Module Leader A project supervisor will be allocated

Sessions This is an individual project which students will develop in their own time with support from their project supervisor.

Module Assessment Coursework 100%

Delivery of the final project, indicative length: 10,000 words

Educational aims

- To train students to undertake individual research and provide them with an opportunity to specialise in a contemporary business or finance topic related to their future career aspirations
- To integrate and apply concepts from different aspects of their MSc.

Learning outcomes

On completing the project students will be able to:

- Identify specific business or finance related issues which would be useful to research and shape an achievable research question around them.
- Develop a research question and plan and carry out a research programme to address the question.
- Understand the theories and recent research relating the project topic.
- Understand how to apply research methodologies to practical business and commercial issues.
- Show confidence in overcoming problems raised in the course of a practical research project and
- Accept the challenge of carrying out a piece of research with elements of originality.

Project requirements

The choice of project is **your** responsibility. It is most important that you choose an area you are happy to work in, and in which you are confident of your abilities.

Students are encouraged to start thinking about project ideas at the beginning of their studies. By the end of the first term you will have gained sufficient knowledge to start to develop ideas that can be discussed with faculty. We expect you to identify the basic idea or research question, though this is likely to be modified after discussion with academic staff.

Make effective use of the RPMS module. This module can be used to help to formulate your ideas and design an appropriate methodology. It can also help you develop a specific project topic – the greater clarity you have about the topic of your project the more successful it is likely to be.

The types of project allowed are:

What you can do.	What you can't do
• Business report on a contemporary issue • Business plan • Statistical test of literature driven hypothesis • Empirical feasibility of a financial strategy • Development of a new product/ service / finance strategy • Market survey • Case study on a specific issue within a particular company / organisation • Numerical project that describes and implements one or more numerical methods for pricing, hedging or reserving for derivatives or portfolios	• Pure literature surveys • Some evidence that the writer has learnt a new subject, a sort of extra elective • A synthesis of other writing or a piece of journalism • A mere compendium of facts and statistics • Projects totally unrelated to relevant academic discipline and literature

Reading list

Student research and reading list will be defined by the subject matter of the project.

Elective Information

Cass Business School provides an extensive range of elective modules for the different MSc programmes. A special elective handbook, regarding your term three selection of modules, will be distributed in the second term and will provide further information.

Electives which have previously been provided by MSc Actuarial Science include:

Enterprise Risk Management

Introduction to Model Office Building in Life Insurance

Longevity Risk in Pensions Products

Modelling and Data Analysis

Stochastic Asset Models

Topics in Quantitative Risk Management

Introduction to Copula Modelling

Apart from these electives, students will also be able to choose from preselected modules offered by other MSc programmes. In the past these have included, among others:

Pension Finance

Hedge Funds

Mergers and Acquisitions

Reinsurance

Please note the School reserves the right to withdraw an elective if demand is insufficient and to add new electives if they are available. Space restrictions and timetable availability may also apply.

Section 4 Regulations

4.1 Degree Requirements

Described below are the rules governing the award of a master degree in Actuarial Science. For further information, the City University's complete set of "Ordinances and Regulations", including the Assessment Regulations (Regulation 19), are published on the University's website http://www.city.ac.uk/about/education/academic-services/senate-regulations

Periods of Registration

The periods allowed for completion of the qualifications are:

- Four years for a masters degree
- Two years for a postgraduate diploma

Regulations for the Award of the Postgraduate Diploma

Described below are the rules governing the award of the *Postgraduate Diploma in Actuarial Science.*

Qualification Requirements

To qualify for the Postgraduate Diploma, a candidate must achieve the following:

- Credits in Subjects CT1, CT3 and CT5, unless a prior exemption has been obtained (see section 5 of this handbook); and
- At least 120 credits in total from Subjects CT1-CT8.

The sum of the credits for the compulsory subjects CT1, CT3 and CT5 is 70. Students will therefore require at least a further 50 credits to pass the Diploma. Students can take as many additional subjects as they wish.

Award of Merit and Distinction of Postgraduate Diploma

The overall degree mark is calculated as the credit-weighted average of the marks on the compulsory modules and remaining highest-marked modules such that the student achieves 120 credits. Modules on which prior exemptions are held are excluded from the weighting.

The award of merit for the Postgraduate Diploma is based on:

- An average mark between 65% - 69.9% inclusive and no modules failed at first attempt;
- Or an overall degree mark of 70% or more and one module failed at first attempt

The award of Distinction for the Postgraduate Diploma is based on:

- An overall degree mark of at least 70% with no modules failed at first attempt.

Compensatory award of Graduate Diploma

The pass mark for each module is 50% to achieve the attached credits for the *Postgraduate Diploma*.

However, should this not be achieved in all required modules then a lower pass mark of 40% is required to achieve the attached credits for the lesser award of the *Graduate Diploma in Actuarial Science*. The rules concerning compulsory subjects, prior exemptions and minimum required credits are the same for both awards.

However, it should be noted that whilst students awarded the Graduate Diploma only will be eligible for any professional exemptions obtained during the course they will not be eligible for the award of the MSc in Actuarial Science.

Regulations for the Award of the MSc

Described below are the rules governing the award of the *MSc in Actuarial Science.*

Qualification Requirements

To qualify for the award of the *MSc in Actuarial Science*, a candidate must achieve the following:

- Award of Postgraduate Diploma in Actuarial Science (120 credits)
- Credits in SMM522 Research Project Management Skills (10 credits)
- A further 50 credits either from five 10-credit term three electives or from one 10-credit elective and SMM527 Business Research Project (40 credits). Term three electives are shared across the Cass MSc programmes from a list to be authorised by the Course Director.

Award of Merit and Distinction of MSc

The overall degree mark for the MSc is calculated as the credit-weighted average of the Postgraduate Diploma mark and marks on the electives in term three, on the Business Research Project (if applicable) and on the Research Project Management Skills module. No credits are awarded for core modules not passed because of prior exemptions being in place.

The award of merit for the MSc is based on:

- An average mark between 65% - 69.9% inclusive and no modules failed at first attempt;

- Or an overall degree mark of 70% or more and one module failed at first attempt

The award of Distinction for the MSc is based on:

- An overall degree mark of at least 70% with no modules failed at first attempt.

Assessment Calculations

The rules governing calculation of module and overall degree marks are as follows:

- All modules must be passed individually. The module pass mark is 50%.
- There are no minimum mark requirements for separate assessment components. However, it is compulsory to complete all coursework and exam components and no module mark can be awarded until these are completed.
- A module mark is calculated by aggregating marks for all assessment components.
- Where modules are assessed by both exam and coursework, these are weighted 80:20 to calculate the module mark.

Coursework

All coursework and invigilated tests are compulsory and count towards the final degree. In some modules presentations or invigilated tests may replace written coursework assignments.

Some subjects may be assessed by coursework only. Precise details concerning examined and non-examined modules are provided in the module outlines.

Please note coursework is required to be submitted for assessment by the specified deadline date. Late coursework will receive imposed penalties. Late coursework will immediately receive a deduction of five marks on the first day of lateness, with one further mark deducted for each day of lateness, for a maximum of five days. After this point coursework will not be accepted and a mark of zero will be awarded.

All coursework should be submitted electronically via the virtual learning environment, Moodle. **It is essential that you keep a copy of all coursework submitted**.

All sources used should be cited using the Harvard referencing system. Further information about this can be found on the Cass website:

http://www.cass.city.ac.uk/intranet/student/learning-resource-centre/citing-references

Coursework will be returned to students as quickly as possible with the aim of students receiving feedback within three to four weeks of their submission

Failure and the Re-sitting of Modules

- Any module with an aggregate mark of less than 50% is deemed to have been failed and must be re-sat.

- To re-sit a failed module, a candidate must re-do all assessment components which gained marks of less than 50%.

- Candidates may re-sit a module only once.

- A candidate who successfully completes a re-sit will be awarded the credits for the module. The mark awarded for the components will be capped at 50%. The mark awarded for other components will be the original mark. This mark will also be used in calculating the overall degree mark

- A candidate who does not pass his or her re-sit by the date specified by the Assessment Board will not progress on the programme and the Assessment Board will normally make a recommendation that they withdraw.

Grade Related Criteria

Class	%	Literary		Knowledge	Independent thought, uses of sources and research materials	Presentation	Professional
Distinction	85-100	A	Outstanding	Comprehensive and informative knowledge of subject area, may include new knowledge derived from which the marker and wider community may learn; addresses the learning outcomes/ assessment criteria in full	Where relevant, evidence of independent reading, thinking and analysis and strong critical ability	Well-constructed	Distinction
	80-84		Excellent				
	75-79		Very good	Sophisticated or strong - shows knowledge of complex issues or a broad range of issues and addresses the learning outcomes/assessment criteria well.	Where relevant, show evidence of wide and comprehensive reading and critical ability	Clearly written	
	70-74						
Merit	65-69	B	Good	Sound knowledge of a broad range of issues or detailed knowledge of a smaller number of issues; makes a good attempt to address the learning outcomes/assessment criteria, realising all to some extent and some well	Evidence of thorough research of the topic(s) but some answers may not be complete or arguments sufficiently explored. Some critical ability will be evident.	Well-structured and logically written	Merit
Pass	50-64	C	Satisfactory	Adequate knowledge of important issues – some level of response to all learning outcomes/assessment criteria but may not include important elements or information that is fully accurate.	Where relevant, development of ideas is limited but attempts will be made to analyse materials critically	Expression and structure may lack clarity	Pass
Fail (0%-49%)	41-49	D	Poor	Unsatisfactory work - inadequate knowledge of the important issues and doesn't succeed in grasping key issues, therefore learning outcomes/ assessment criteria will not be realised	No real development of ideas and critical analysis will be very limited.	Presentation is confused or incoherent	Fail (0%-49%)
	20-40	E	Very poor	Knowledge is lacking either through omission, the inclusion of large amounts of irrelevant information or evidence of significant misunderstanding - totally inadequate attempt to address the learning outcomes/ assessment criteria	No critical ability will be displayed	Confused, incoherent or unstructured presentation	

Section 5 Additional Information

MSc Course Office

The MSc course office is here to support both staff and students and each MSc course has its own dedicated Course Officer that you will get to know over the course of your time here at Cass. The Course Office team will provide you with course related information, material and your grades, advice relating to other areas of City University and support throughout the duration of your studies.

Location

The course office is located on the 3rd floor of Cass Business School, 106 Bunhill Row, London EC1Y 8TZ

Contact

You can contact the course office team either in person at the office, by email, telephone or via Moodle, our virtual learning environment.

The MSc Actuarial Science Course Officer is Jemma Leahy and can be contacted directly via telephone 020 7040 5245 or by email Jemma.Leahy.1@city.ac.uk

Office Opening Hours

During term time the course office is open to students:

Monday	1300 – 1830
Tuesday	1300 – 2000
Wednesday	1300 – 1830
Thursday	1300 – 2000
Friday	1030 – 1530

Outside of term time the course office is open to students:

Monday to Thursday	1300 – 1700
Friday	1030 – 1530

Moodle: Your Virtual Learning Environment

Moodle is the virtual learning environment used at City University and it provides a wide variety of information and interactive environments to students, including the following:

- Module material and supplementary learning documents, including areas for the submission of coursework and the release of coursework results
- On-line lectures covering approximately 25% of the total material for each module

- Timetables, including teaching and examination

- Specialist Masters, MSc specific and module pages providing information relating to each area with supporting documents and forums

- Links to the Learning Resource Centre, Careers, Student Advice and Clubs and Societies

Students are responsible for checking their Moodle pages and their City email account regularly. This is how all information, including changes to teaching, is communicated. Course Officers manage the communications sent to students via Moodle and all administrative enquiries should be directed to them for assistance.

Personal Tutors

Postgraduate Taught students are assigned a personal tutor at the beginning of the year. This personal tutor will be available to provide general academic, professional and pastoral support and will also ensure students are aware of the additional and more specialised support mechanisms available within the University.

Students should have the opportunity to see their personal tutor at least once a term. Tutors will contact their tutees early in term 1 for a first meeting. Thereafter it is the student's responsibility to contact their personal tutor to make a further appointment.

The Course Office team is also here to assist should you need any support during the course of your studies.

Academic Staff Contact Details

In addition to their main teaching responsibilities academics also engage in research, administration and external work. As a result staff members may not be able to see you without an appointment.

If the matter is non-urgent please make an appointment or make use of the office hours many academics hold. If the matter is urgent please make this clear when contacting the member of staff to request an appointment.

Lecturer's contact details and office hours can be found on Moodle.

The Actuarial Profession and Professional Accreditation

The actuarial profession in the UK is represented by the Institute and Faculty of Actuaries, operating under the umbrella name of the Actuarial Profession. The Actuarial Profession organises a variety of activities, including the setting of professional examinations. A wealth of material can be found at the Actuarial Profession's webpages:

http://www.actuaries.org.uk

The MSc Actuarial Science programme at Cass is accredited by the UK Actuarial Profession. This means that the profession validates our teaching and assessment methods and accepts that performance on our degree programme (up to the requisite standard) is equivalent to performance on its own professional examinations.

Professional Exemptions

The Actuarial Profession organises its own professional actuarial examinations. It also awards exemptions from some of these professional examinations to students who can demonstrate satisfactory performance in their university degrees. The MSc/PGDip Actuarial Science programme at Cass enables students to gain exemptions from the Core Technical subjects CT1–CT8, provided performance is satisfactory.

You will be informed of the exemptions available to you after you receive the results of the January and May examinations. Please note that the exemptions become "active" only after you are accepted for membership of the Actuarial Profession and after you apply for these exemptions to be processed.

How Exemptions are Awarded

Exemptions are awarded by Independent Examiners appointed by the Actuarial Profession. This is a confidential process. A higher standard of performance is required to obtain an exemption in any subject than to pass the same subject.

You should **typically** aim either at an overall performance of no less than 65% or at a performance in individual subjects of no less than 60%. Exemptions are normally granted in two different ways:

1. **Exemption by Degree**

This is based on a credit-weighted "Actuarial Average" mark, calculated from the module marks of all CT subjects attempted in January and May. (The module mark includes both exam and coursework marks. Re-sits are not considered under Exemption by Degree.) If you are awarded the Postgraduate Diploma in Actuarial Science and your Actuarial Average over all CT subjects attempted is at or above an exemption threshold mark determined by the Independent Examiner (normally 65%), then you will be recommended for exemptions from all the subjects that you have attempted and passed.

2. **Exemption by Subject**

This applies to any module for which you did not receive an exemption under Exemption by Degree. This is based on exam marks only (not coursework marks) achieved in January and May.

If you are awarded the Postgraduate Diploma in Actuarial Science, then you will be recommended for exemptions in individual CT subjects for which your exam mark is at or above an exemption threshold mark as determined by the Independent Examiner.

It should be noted that the Actuarial Profession and its Independent Examiners can use their discretion and reserve the right to vary the exemption rules and threshold marks in order to ensure consistency with the professional exams and in order to maintain standards.

Prior Exemptions and Prior Passes

It may be possible for you to apply to the Actuarial Profession to get professional exemptions on the basis of your first degree or prior studies. For example, it is possible to get an exemption from Subject CT3 or CT7 if you have covered the relevant material in a first

degree in Statistics or Economics. Exemptions from other examinations may also be possible. We refer to exemptions on the basis of your first degree (ie before you join the MSc Actuarial Science programme at Cass) as prior exemptions. Please consult the web page of the Actuarial Profession to find out how to apply for exemptions based on your first degree.

Some students on the course will already be members of the profession and may have prior passes by virtue of having passed exams directly with the Actuarial Profession.

If you have prior exemptions or prior passes, please inform the MSc Course Office of this. You should provide the original letter from the Actuarial Profession confirming these exemptions or passes to your Course Officer who will keep a copy of the letter and a record of this.

If you have a prior exemption in a core subject (CT1, CT3, CT5), it is not compulsory for you to take this subject. However you are not awarded 20 or 30 credits just because you hold a prior exemption. You are still required to accumulate at least 120/180 credits and pass the remaining compulsory subjects to pass the Postgraduate Diploma/MSc.

Choice of Subjects on the Course

There are eight Core Technical modules (CT1-CT8) offered in terms one and two. Your main objective should be **to achieve at least 120 credits and pass the compulsory modules in the January and May exams.**

Students may attend lectures on all the modules, but typically not do all eight exams in January and May, with five to seven exams being common..

How many modules you should attend and exams you should take is a personal decision. This will depend on how comfortable you are with the material that is being taught, how confident you are, whether you have had some previous experience with a subject etc. The more modules you complete, the more professional exemptions you are attempting to gain. However by doing too many exams you also run the risk of spreading your efforts too thinly and not doing well in the exams.

You should remember that the target of 120 credits from CT subjects, for which 5 modules need to be passed, is enough to keep you very busy throughout the academic year. The exams are tougher and cover more material that you will have typically been exposed to in your undergraduate studies. **If you commit to more modules that you can manage, you are risking low performance or even failure in your MSc, which will lead to no exemptions whatsoever.**

Programme Disclaimer

The information in this Specialist Masters Programme Handbook is correct at the time of going to press in August 2012. The University reserves the right to make amendments to:

a) the contents of the Programme Handbook and in particular to the timetable, location and methods of delivery or the content, syllabus and assessment of any of its programmes as set out in the programme and module specifications in this Handbook and/or on the University's website; and

b) its statutes, ordinances, regulations, policies, procedures and fee structures,

provided that such amendments are (i) as a result of student demand (or lack thereof), (ii) as a result of unforeseen events or circumstances beyond the University's control or (iii) are deemed reasonably necessary by the University.

In the event that amendments are made, the University shall take reasonable steps to notify you as soon as is reasonably possible.

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Cass Business School
In 2002, City University's Business School was renamed Sir John Cass Business School following a generous donation towards the development of its new building in Bunhill Row. The School's name is usually abbreviated to Cass Business School.

Sir John Cass's Foundation
Sir John Cass's Foundation has supported education in London since the 18th century and takes its name from its founder, Sir John Cass, who established a school in Aldgate in 1710. Born in the City of London in 1661, Sir John served as an MP for the City and was knighted in 1713.