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**ACTUARIAL ASSOCIATION
IN BOSNIA AND HERZEGOVINA**

**EDUCATIONAL SYLLABUS FOR FULLY QUALIFIED ACTUARIES AND
LITERATURE**

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A   PRELIMINARY STAGE

A1   Insurance statistics

Aim: To provide grounding in applied mathematical techniques and the basics of modern computational methods necessary for the understanding of statistical modeling and actuarial work.

Part I

(a) Functions, equations and inequalities

(b) Differential and integral calculus

(c) Differential equations

(d) Sequences and series

(e) Linear algebra

(f) Introductory measure theory

(g) Difference equations

(h) Fourier analysis

(i) Numerical analysis

Part II

(a) Structured programme design

(b) File structures

(c) High level programming language

(d) Object orientated programming

(e) Computer applications and use of packages

(f) Algorithm modelling

(g) Data structure

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(h) Database structure and design

(i) Use of Internet

Suggested reading:

Fraleigh, J B (1994) *A first course in abstract algebra.* Addison-Wesley. 592
pages. ISBN: 0201592916
Gramain, A *Integration.* Heimann
McGregor, C M; Nimmo, J; Stothers, W W (1994) *Fundamentals of university
mathematics.* Albion Publishing. 540 pages. ISBN: 1898563098
Vranić – Martić: Matematika za ekonomiste II dio, Školska knjiga Zagreb
M. Čabarkapa, C++ Osnove programiranja, CET 2007
P. McFedries, VBA za početnike, Kompjuter Biblioteka, 2005
Steven Roman, Writing Excel Macros with VBA, 2nd Edition, O'Reilly, 2002
Other books suitable for undergraduate studies in mathematics and programming

A2   Probability and Statistics

Aim: To provide a grounding in statistics and probability.

(a) Main features of data sets

(b) Basic probability theory

(c) Random variables and related concepts

(d) Transformation of variables

(e) Generating functions

(f) Central limit theorem

(g) Concepts of sampling

(h) Methods of estimation

(i) Confidence intervals.

(j) Hypothesis testing

(k) Correlation analysis and regression analysis

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(l) Analysis of variance

(m) Decision theory

(n) Simulation methods

Suggested reading:

Freund, John E (1992) *Mathematical Statistics.* Prentice Hall International
Saporta, G *Probabilité, Analyse des données, Statistique.* Editions Téchnip
Tassi, P *Méthodes Statistiques.* Economica
Faculty & Institute of Actuaries *Subject C1 Core Reading/Subject 101 Core Reading*
 Primijenjena statistika, Šošić, I. Školska knjiga, Zagreb, 2004
F. Daly, D.L. Hand, M.C. Jones, A.D. Lunn, K.J. McConway, Elements of Statistics, Addison-Wesley, 1995.

E.L. Lehmann, G. Casella, Theory of Point Estimation, 2nd edition, Springer, 1998.
Ž. Pauše, Uvod u matematičku statistiku, Školska knjiga, Zagreb, 1993.
I. Šošić, V. Serdar, Uvod u statistiku, Školska knjiga, Zagreb, 1992.

E.L. Lehmann, Testing Statistical Hypotheses, 2nd edition, Springer, 1997.
Other books suitable for undergraduate studies in mathematics and statistics.

A3   Stochastic Processes

Aim: To provide a grounding in stochastic processes and their use in models for actuarial work.

(a) Principles of modeling

(b) Principles and classification of stochastic processes

(c) Markov chains

(d) Markov processes

(e) Time series

(f) Gauss-Wiener processes

(g) Simulation methods for stochastic processes

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Suggested reading:

Faculty & Institute of Actuaries *Core Reading for subject 103*
Dana, R A; Jeanblanc-Picque, M (1994) *Marchés financiers en temps continu: valorisation et equilibre.* Economica
Demange, G; Rochet, J C *Méthodes mathématiques de la finance.* Economica
Devolder, B *Finance stochastique.* de Beuck University
Gourieroux, C; Monfort A *Séries temporelles et modèles dynamiques.* Economica
Karlin S and Taylor H (1975) *A first course in stochastic processes.* 2nd ed. Academic Press
Lamberton, D; Lapeyre, B (1996) *Introduction to stochastic calculus applied to finance.* Chapman & Hall December 1998 8
Roger, P *Les outils de la modélisation financière.*
Society of Actuaries *Monograph on Stochastic Calculus*
Torrelles, E; Viladomiu, N (1995) *Anàlisi de Sèries Temporals (I I ll.).* Departament d'Econometria, Estadistica i Econòmica Espanyola de la Facultat de Ciències Econòmiques, Universitat de Barcelona
T.Rolski, H.Schmidli, V.Schmidt, J.Teugels (1998) Stochastic Processes for Insurance and Finance, Wiley
S. I. Resnick (1992), Adventures in Stochastic Processes, Birkhäuser, Basel
G.R.Grimmett, D.R.Stirzaker (1992), Probability and Random Processes, Clarendon Press, Oxford
P. J. Brockwell, R. A. Davis (1987), Time Series: Theory and Methods, Springer, New York
G. E. P. Box, G. M. Jenkins (1976), Time Series Analysis: Forecasting and Control, Holden Day, San Francisco

A4   Insurance economics

Aim: To provide a grounding in the fundamental concepts of economics as they affect the operation of insurance and other financial systems

(a) Supply, demand and equilibrium price (in both free and controlled markets)

(b) Elasticity of supply and demand

(c) Utility theory and consumer choice (including analysis of insurance problems)

(d) Theory of the firm under differing market structures

(e) General equilibrium theory

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(f) Public sector finance and taxation

(g) Aggregate national income: measurement and analysis

(h) The multiplier, accelerator and aggregate supply and demand

(i) Government policies and their effects (direct and via the banking system)

(j) Domestic macroeconomic factors and their management

(k) International trade, exchange rates and the balance of payments

Suggested reading:

Faculty & Institute *Core Reading for Subject 107*.
Economics by Begg, Fischer and Dornbusch, published by McGraw-Hill.
Ekonomija, Samuelson, P., Nordhaus, W., MATE, Zagreb, 2005
Osnove osiguranja – Upravljanje rizicima, Emmet Vaughan, Therese Vaughan, Mate Zagreb, 2000.
Osiguranje i upravljane rizikom, Dr. Boris Marović i dr Veselin Avdalović DDOR, Novi Sad i Birografika, Subotica, 2005.
Ekonomika osiguranja Dr. Sanja Andrijašević i Vladimir Petranović, Alfa, Zagreb, 1999.
Osnove osiguranja upravljanje rizicima, Emmett J. Vaughan, MATE, Zagreb, 2000.
Other books suitable for undergraduate studies in economics.

A5   Insurance accounting

Aim: To provide the ability to interpret the accounts and financial statements of companies and financial institutions.

(a)   Basic principles of accounting – including the role of accounting standards

(b)   Different types of business entity and their financial structure

(c)   The basic principles of personal and corporate taxation, including the taxation of investments.

(d)   The role of main entities of financial markets

(e)   Basic structure of company accounts, including group accounts
            the balance sheet

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- *the profit and loss account*
- *the cash flow statement*
- *provisions*

(f)   The calculation and use of financial indicators

(g)   Limitations of company accounts

Suggested reading:

Faculty & Institute *Core Reading for Subject 108.*
"Analysing Financial Performance" članak u
Principles of Corporate Finance, by Brearley and Myers, Izdavač McGraw-Hill.
Računovodstvo: temelj poslovnog odlučivanja, Meigs, R. F. I Meigs, W.B, Mate, Zagreb, 1999.
Računovodstvo osiguravajućih društava, Kristina Mičin, HASIBO, DOO, Zagreb, 2008. Međunarodni standardi finanicijskog izvještavanja (i Međunarodni računovodstveni standardi), Savez računovođa, revizora i finansijskog radnika FbiH, Mostar, 2006.

A6   Insurance regulations

Aim: To provide a grounding in terms of structure and regulations of the EU and BH in the field of insurance.

(a)   Insurance Regulations

(b)   EU Insurance legislation

(c)   Insurance and insurance entities

(d)   Material liability and financial structure of insurance companies

(e)   The basic categories of insurance regulations

(f)   The concept and the legal nature of insurance contracts

(g)   Characteristics of insurance contracts

(h)   The subject of the insurance contract

(i)   The conclusion of insurance contract

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(j)   Insurance policy

(k)   The duration of insurance contracts

(l)   Obligations of the parties

(m)   Reinsurance treaties

(n)   Subrogation

(o)   Social aspects of existing concepts such as consumer protection, etc

Pravo osiguranja, Milić Simić, Aktuarsko društvo, Sarajevo, 2004.;
Poslovno pravo - ugovori, hartije od vrijednosti i pravo konkurencije, Prof. dr
Miloš Trifković, prof. dr Milić Simić i doc. dr Veljko Trivun, Ekonomski fakultet u
Sarajevu, 2004.;

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B   ACTUARIAL FOUNDATION STAGE

B1   Financial Mathematics

Aim: To provide a grounding in financial mathematics and their applications to actuarial science.

(a) Deterministic theory of interest

(b) Introduction to contingent claims analysis

(c) Stochastic calculus for finance

(d) Stochastic theory of interest

(e) Dynamic portfolio management

(f) Introductory applications to insurance liabilities

Suggested reading:

Betzuen Zalbidegoitia, A. (2001) *Curso de matemáticas financieras: Análisis financier fundamental, rentas y constitución de capitales.* Bilbao: Instituto de Estudios Financiero-Actuariales.
Betzuen Zalbidegoitia, A. (2003) *Curso de matemáticas financieras: Operaciones de préstamo.*
Operaciones de empréstito-obligaciones. Bilbao: Instituto de Estudios Financiero-Actuariales.
Bjork, T. (2004) *Arbitrage theory in continuous time.* Oxford University Press.
Bowers, N. L.; Gerber, H. U.; Hickman, J. C. et al (1997) *Actuarial mathematics.* 2nd ed.
Schaumburg, IL: Society of Actuaries. 753 pages. ISBN: 0938959468.
Brigo, D. and Mercurio, F. (2001) *Interest rate models: theory and practice.* Springer.
Broverman, S. A. (2004) *Mathematics of investment and credit.* 3rd ed. Winsted, CT: Actex. 521 pages. ISBN: 1566984750.
Butcher, M. V.; Nesbitt, C. J. (1971) *Mathematics of compound interest.* Michigan: Ulrich's Books. 324 pages. ISBN: 0960300015.
De Felice, M.; Moriconi, F. (1991) *La teoria dell'immunizzazione finanziaria: modelli e strategie.* Bologna: il Mulino. 364 pages. ISBN: 8815024573.
Devolder, P. *Finance Stochastique.* Editions ULB

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Elliott, R.J. and Kopp, P.E. (1999) *Mathematics of Financial Markets.* Springer.
September 2005 10

Faculty and Institute of Actuaries. *Core reading for Subjects CT1 and CT8.*

Fontanals, H ; Galisteo, M. (1997) *Estructura temporal de los tipos de interés.*
Col·lecció de Publicacions del Departament de Matemàtica Econòmica,
Financiera i Actuarial N.35, Universitat de Barcelona.

Gil Pelaez, L. (1989) *Matemática de las operaciones financieras: problemas resueltos.* Madrid: Ediciones A.C. 504 pages. ISBN: 8472881229.

Gil Peláez, L. (1987) *Matemática de las operaciones financieras.* Madrid:
Ediciones A.C. 735 pages. ISBN: 8472881237.

González Catalá V.T. (1992) *Análisis de las operaciones financieras, bancarias y bursátiles.* Madrid: Ciencias Sociales.

González Catalá V.T. (1993) *Operaciones financieras, bancarias y bursátiles.*
Curso practico. Madrid: Ciencias Sociales

Hull, J.C. (2002) *Options, futures and other derivatives.* 5th ed. Upper Saddle
River, NJ: Prentice Hall. 744 pages. ISBN: 0130465925

Ingersoll, J. E. (1987) *Theory of financial decision making.* Savage, MD: Rowman
& Littlefield. 474 pages. ISBN: 0847673596.

Lamberton, D. and Lapeyre, B. (1996) *Introduction to stochastic calculus applied to finance.* Chapman & Hall (CLC Press, London)

Kellison, S. G. (1991) *The theory of interest.* 2nd ed. Homewood, IL: Irwin. 446
pages. ISBN: 0256091501.

McCutcheon, J. J.; Scott, W. F. (1986) *An introduction to the mathematics of finance.* London: Heinemann. 463 pages. ISBN: 043491228X.

Meneu, V.; Jordá, M.P. and Barreira, M.T. (1996) *Operaciones financieras en el Mercado español.* Barcelona: Ariel.

Mikosch, T. (1998) *Elementary stochastic calculus with finance in view.* World
Scientific.

Moriconi, F. (1995) *Matematica finanziaria.* Bologna: il Mulino. 319 pages. ISBN:
8815048189.

Musiela, M and Rutowski, M. (?) *Martingale methods in financial modelling.*
Springer Verlag.

Panjer, H. H. (1986) *Actuarial mathematics.* Providence, R.I.: American
Mathematical Society. 127 pages. ISBN: 0821800965.

Parmenter, M. M. (1999) *Theory of interest and life contingencies, with pension applications: a problem-solving approach.* 3rd ed. Winsted, CT: Actex. 301
pages. ISBN: 1566983339.

Poncet, P.; Portrait, R.; Hayat, S. (1999) *Mathématiques financières.* Paris:
Dalloz-Sirey. 448 pages. ISBN: 2247015255.

Rodríguez, A. (1994) *Matemática de la financiación.* Barcelona: Ediciones S.

Rodríguez, A. (1998) *Fundamentos de la matemática financiera.* Barcelona:
Alfonso Rodríguez.

Ross, S.M. (2003) *An elementary introduction to mathematical finance.*
Cambridge

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Shreve, S. (2004) *Stochastic calculus for Finance (vol I and II).* Springer.
Trowbridge, C. L. (1989) *Fundamental concepts of actuarial science.*
Schaumburg, IL: Society of Actuaries. 79 pages.
Zima, P.; Brown, R. L. (1993) *Mathematics of finance.* 4th ed. Toronto: McGraw-Hill Ryerson. 350 pages. ISBN: 0075515148.
Finansijska matematika i metode investicionog odlučivanja, Krčmar, M, Kemigrafika, Sarajevo, 2002.
Finansijska matematika, Trklja, B, Ekonomski fakultet, Sarajevo, 2002.

B2　　Survival Models

Aim: To provide a grounding in survival models

(a) Survival models

(b) Statistical models of transfers between multiple states

(c) State-space and Markov models for life insurance

(d) Maximum likelihood estimators for transition intensities

(e) Construction of a multiple decrement table.

(f) Binomial model of mortality

(g) Graduation

(h) Comparison of actual against expected experience.

(i) The use of single figure indices, for describing the variation of mortality and sickness.

(j) Heterogeneity within a population with regard to mortality and sickness.

Suggested reading:

Faculty & Institute of Actuaries *Core Reading - Subject 104*
Faculty and Institute of Actuaries Core Reading 2000, Subject105: Actuarial Mathematics 1
Andersen P K, Brogan O, Gill R D and Keiding N (1993) *Statistical models based on counting processes* Springer, New York

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Artis, M; Ayuso, M (1996) *Estadistica Actuarial Vida (ParteI, II).* Departament de d'Econometria, Estadistica i Econòmica Espanyola de la Facultat de Ciències Econòmiques, Universitat de Barcelona

Cipra, Tomas (1990) *Matematicke methody demografie a pojisteni (Mathematical methods of demography and insurance*). Praha

Collett, D (1994) *Modelling survival data in medical research.* Chapman & Hall, London

Cox, D R; Oakes, D (1984) *Analysis of survival data.* Chapman & Hall, London

Elandt-Johnson, Regina C; Johnson, Norman L (1980) *Survival models and data analysis.* Wiley, New York. xvi, 457 pages. ISBN: 0-471-03174-7

Haberman, S; Pitacco, E (1998) *Actuarial models for disability insurance.* Chapman & Hall, London

Leguina, J (1989) *Fundamentos de demografia (4th Edition)* SigloXXI de España editores, Madrid

Marubini, E; Valsecchi, M G (1995) *Analysing survival data from clinical trials and observational studies.* Wiley

H.U. Gerber, Life Insurance Mathematics, Springer-Verlag Berlin Heidelberg and Swiss Association of Actuaries Zürich, 1990.

Chin Long Chiang, Introduction to Stochastic Processes in Biostatistics, Wiley, 1968.

N.L Bowers et al., Actuarial Mathematics, 2nd edition, Society of Actuaries, 1997.

B. Benjamin, J.H. Pollard, The Analysis of Mortality and Other Actuarial Statistics, 3rd edition, Institute of Actuaries and Faculty of Actuaries, 1993.

B3   Actuarial Mathematics I

Aim: To provide a grounding in the mathematical techniques which are of particular relevance to actuarial work in life insurance, health insurance and pensions.

(a) Formulae for annuity values and assurance factors for single life and joint life assurances and annuities.

(b) Surrender values and policy alternations.

(c) The use of computational tools (for example commutation functions).

(d) Net premiums and net premium reserves.

(e) Gross premiums and gross premium reserves.

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Suggested reading:

Faculty & Institute of Actuaries *Core Reading - Subjects 104 and 105*.
Bowers, N L; Gerber, H U; Hickman, J C; Jones, D A; Nesbitt, C J (1997)
Actuarial mathematics. 2nd ed, Society of Actuaries, Schaumburg, IL. xxvi, 753
pages. ISBN: 0938959 46 8
Bruijns, H G W K; Pinkse, C C W (1989) *Levensverzekeringswiskunde.* Wolters-
Noordhoff, Groningen. ISBN: 90-01-18089-2
Bruijns, H G W K; Pinkse, C C W (1994) *Levensverzekeringswiskunde*
[Studieboek]. 2nd ed, Wolters-Noordhoff, Groningen. 181 pages. ISBN: 90-01-
18095-7
Bruijns, H G W K; Pinkse, C C W (1996) *Levensverzekeringswiskunde*
[Studieboek]. 3rd ed, Wolters-Noordhoff, Groningen. 183 pages. ISBN: 90-01-
18096-5
Gerber, Hans U (1997) *Life insurance mathematics.* 3rd ed, Springer; Swiss
Association of Actuaries, Berlin; Zurich. 217 pages. ISBN: 3-540-62242-X
Haberman, S; Booth, P; Chadburn, R; Cooper, D; James, D (1998) *Modern
actuarial theory and practice.* Chapman & Hall, London
Isenbart, Fritz; Münzner, Hans (1987) *Lebensversicherungsmathematik für
Praxis und Studium.* 2, vollst überarb Aufl ed, Gabler, Wiesbaden, 117 pages.
ISBN: 3-409-85833-4
Nieto de Alba U and Vegas Asensioj (1993) *Matematica actuarial editorial.
Mapfre, Madrid*
Wolff, K-H (1970) *Versicherungsmathematik.* Springer, Wien
Wolthuis, Henk (1994) *Life insurance mathematics (the Markovian model);
CAIRE Education Series 2.* CAIRE, Brussels. 255 pages. ISBN: 90 74958 02 x
B. Benjamin, J.H. Pollard, The Analysis of Mortality and Other Actuarial Statistics,
3rd edition, Institute of Actuaries and Faculty of Actuaries, 1993.
A. Neill, Life contingencies, Heinemann, 1977.
P.M. Booth et al., Modern actuarial theory and practice, Chapman & Hall, 1999.

B4   Actuarial Mathematics II

Aim: To provide a grounding in risk mathematics and its use in actuarial
work.

(a) Loss distributions.

(b) Risk models.

(c) Aggregate claim distributions for short term insurance contracts.

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(d) Ruin theory.

(e) The impact of reinsurance.

(f) Credibility theory.

(g) Loss reserving

(h) No claim discount (NCD) systems.

(i) Use of scenario testing and simulation for dynamic financial analysis
of general insurance business of a company

Suggested reading:

Casualty Actuarial Society textbooks for their examinations 3 and 4.
Faculty & Institute of Actuaries *Subject C2 Core Reading/Subject 106 Core Reading*
Daykin, C D; Pentikäinen, T; Pesonen, M (1994) *Practical risk theory for actuaries*. Chapman & Hall, London
Gerber, H U (1979) *An introduction to mathematical risk theory.* University of Pennsylvania
Heilmann, Wolf-Rüdiger (1988) *Fundamentals of risk theory*. Verlag Versicherungswirtschaft
Herzog, Thomas N (1996) *Introduction to credibility theory*. 2nd ed, Actex
Hossack, Ian B; Pollard, John H; Zehnwirth, Benjamin (1983) *Introductory statistics with applications in general insurance*. Cambridge University Press
Klugman, S A; Panjer, H H; Wilmot, G E (1998) *Loss models: from data to decisions*. Wiley
T.Rolski, H.Schmidli, V.Schmidt, J.Teugels (1998), Stochastic Processes for Insurance and Finance, Wiley
E. De Vylder Advanced Risk Theory: A Self-Contained Introduction,
H. Bühlmann (1970), Mathematical methods in risk theory. Springer, Heidelberg
N.Bowers et al. (1997) Actuarial Mathematics, 2nd edition, Society of Actuaries
R. V. Hogg, S. A. Klugmann (1984), Loss distributions. Wiley, NewYork
H.-P. Schmidli, Risk theory.

B5   Investments and asset management

Aim: 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 evaluate critically modern financial theories.To instil the ability to apply, in simple situations, the principles of

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actuarial planning and control to the appraisal of investments, to the measurement of investment performance, and to the selection and management of investments appropriate to the needs of investors.

(a) Fixed income securities

(b) Company shares (equities)

(c) Property investment

(d) International investment (bonds and equities)

(e) Derivatives

(f) Investment indices

(g) Performance measurement

(h) Portfolio selection and management

(i) Valuation

(j) Principles of regulation

(k) Arbitrage free markets

(l) The different methods for the valuation of individual investments and their appropriateness in different situations

(m)   Methods an institution can use to monitor and control its exposure to the following types of risk:

- actuarial risk
- market risk
- credit risk
- operational risk
- relative performance risk.]

(n)   The use of actuarial techniques to develop an appropriate investment strategy

(o)   Measures of investment risk

(p)   Mean-variance portfolio theory

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(q)   Single and multifactor models of asset returns

(r)   Asset pricing models

(s)   Efficient Markets Hypothesis

(t)   Stochastic models of the behaviour of security prices

(u)   Brownian motion (or Wiener Processes)

(v)   Interest rate derivatives and the Black model

(w)   Models of the term structure of interest rates

Suggested reading:

Faculty & Institute *Core Reading for Subjects 109 & 301*.
Augros, J C *Les options de taux d'intéret.* Economica
Bodie, Z; Kane, A; Marcus, A J (1996): *Investments.* 3rd ed, Irwin
Bouchard, J B; Potters, M *Thórie des risques financier.* Saclay
Boyle, Phelim P (1992) *Options and the management of financial risk.* Society of
Actuaries, Schaumburg, IL. 210 pages. ISBN: 0 938959 26 3
Cox, J C; Rubinstein, M (1985) *Options markets.* Prentice-Hall
December 1998 18
De Felice, M; Moriconi, F (1991) *La teoria dell'immunizzazione finanziaria.* Il
Mulino, Bologna
Elton, E J; Gruber, M J (1995) *Modern portfolio theory and investment analysis.*
5th ed, Wiley
Fernandez P (1996) *Opciones y futuros e instrumentos derivados.* Editorial
Densto Bilbao
Haberman, S; Booth, P; Chadburn, R; Cooper, D; James, D (1998) *Modern
actuarial theory and practice.* Chapman & Hall, London
Ho, T S Y (1990) *Strategic fixed-income investment.* Dow Jones; Irwin
Hull, John C (1996) *Options, futures and other derivatives.* 3rd ed, Prentice Hall,
Upper Saddle River, NJ. 572 pages. ISBN: 0 13 264367 7
Maginn, J L; Tuttle, D L (1990) *Managing investment Portfolios.* 2nd ed, Warren
Gorham & Lamont.
Merton, R C (1992) *Continuous-time finance.* Blackwell, Oxford. 500 pages.
ISBN: 0631185089
Ontiveros E (1991) *Mercados financieros internacionales Espana Calpe*
Panjer H H ed (1998) *Financial economics with application to investments,
insurance and pensions.*
Quittard-Pinon, F *Marché des capitaux et théorie financière.* Economica

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Reilly, F K (1994) *Investment analysis and portfolio management.* 4th ed, Dryden Press

Roger, P *L'évaluation des actifs financiers.* de Beuck University

Rodriguez, A (1997) *Matematica de la Inversión.* Romargraf, Barcelona

Rodriguez, A (1994) *Immunidad Financiera.* Ediciones S, Barcelona

Sharpe, W. F. (1978) *Investments.* Prentice Hall, New Jersey; and Radcliffe *Investments*

Shaumberg, *The Actuarial Foundation*

Shimko, D (1995) *Finance in continuous time.* Blackwell, Oxford

Stoll, H R; Whaley, R E (1993) *Futures and options.* South-Western Publishing

B. G. Malkiel, A Random Walk Down Wall Street (7th edition), Norton

J. J. Siegel, Stocks for the Long Run (2nd edition), McGraw Hill

I. Karatzas, S. Shreve (1998), Methods of mathematical finance, Springer

S. Shreve (2004), Stochastic calculus for finance, Springer

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C   GENERALISED APPLICATIONS STAGE

C1   Life Insurance and General Insurance

Aim: To instil the ability, in simple situations, to use judgement and apply the principles of actuarial planning and control needed for the operation on sound financial lines of providers of life insurance. To instil the ability to apply, in simple situations, the principles of actuarial planning and control needed for the operation of providers of general insurance on sound financial lines.

Part I- Life Insurance

(a) Principal terms

(b) The main contract types

(c) The principles of life insurance markets

(d) Data requirements and verification

(e) Product pricing

(f) Reserving

(g) Surrender values

(h) Policy alterations

(i) Derivation of actuarial assumptions

(j) Measurement and analysis of surplus

(k) Methods of distributing surplus to policyholders

(l) Principles of investment and asset-liability modelling

(m) Principles of regulation and accounting

(n) Risk and uncertainty in life insurance business

(o) Principles of risk management including reinsurance

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(p) Life insurance regulations, including:

Taxation

Accounting

Supervisory regulation

EU requirements

(q) Experience rating

(r) Future financial requirements including dynamic financial analysis

(s) Value of a life company

(t) Evaluation of the capital requirements of a life insurer for the purpose of determining the strategy for growth in business.

Suggested reading:

Faculty & Institute of Actuaries *Core Reading for Subject 302*
Black, Kenneth; Skipper, Harold D (1994) *Life insurance.* 12th ed, Prentice-Hall, Englewood Cliffs, NJ. 1064 pages. ISBN: 0135329957
Bruijns, H G W K; Pinkse, C C W (1989) *Levensverzekeringswiskunde.* Wolters-Noordhoff, Groningen. ISBN: 90-01-18089-2
Bruijns, H G W K; Pinkse, C C W (1996) *Levensverzekeringswiskunde [Studieboek].*3 ed, Wolters-Noordhoff, Groningen. 183 pages. ISBN: 90-01-18096-5
Bruijns, H G W K; Pinkse, C C W *Levensverzekeringswiskunde [Studieboek].* 2 ed, Wolters-Noordhoff, Groningen. 181 pages. ISBN: 90-01-18095-7
Chabannes, Jean-Antoine; Gauclin-Eymard, Nathalie (1992) *Le manuel de l'assurance-vie. 1: Principes généraux, les assurances individuelles*. Argus. 317 pages. ISBN: 2 85384 214 2
Collignan, Daniel; Collignan, Corinne (1989) *L'assurance vie: contrats individuels.* 2nd ed, Argus. 426 pages. ISBN: 2 85384 176 6
Haberman, S; Booth, P; Chadburn, R; Cooper, D; James, D (1998) *Modern actuarial theory and practice.* Chapman and Hall, London
Isenbart, Fritz; Muenzner, Hans (1987) *Lebensversicherungsmathematik für Praxis und Studium.* 2, vollst ueberarb Aufl ed, Gabler, Wiesbaden. 117 pages. ISBN: 3-409-85833-4
Laiter, Jean-Daniel (1994) *Les clés de l'assurance-vie: produits et techniques.* SEFI. 277 pages. ISBN: 1 895354 27 7

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Lamelot, Guy; Leriche, Jacques (1994) *Assurance-vie: prévoyance, épargne, retraite*. 3rd ed, Delmas. 248 pages. ISBN: 2 7144 3059 7
Lepape, Jacqes; Leroy, Guillaume *Assurance-vie et fonds de pension*. LAMY
Pétauton, Pierre (1991) *Théorie et pratique de l'assurance-vie.* Dunod. 199 pages. ISBN: 2 04 019862 8
Pitacco, Ermanno (1992) *Lezione di tecnica attuariale delle assicurazioni libere sulla vita*. 2nd ed, Edizioni Lint, Trieste
Wolff, K-H (1970) *Versicherungsmathematik*. Springer, Wien

Part II- General Insurance

(a) Principal terms

(b) Product types.

(c) The principles of general insurance markets.

(d) Data requirements and verification.

(e) Pricing bases for general insurance contracts.

(f) Tariff systems.

(g) Methods of determining the value of the insurance liabilities of a general business insurer and the value of the assets, in terms of emerging costs and in terms of discounted values, for the purposes of:

- the establishment of provisions and reserves for the accounts

- the estimation of solvency

- the pricing of products

(h) Experience rating.

(i) Claim reserving.

(j) Modelling the uncertainty in claim frequency and amount.

(k) Bases for valuing the assets and liabilities of a general business insurer.

(l) Methods of analysing the experience of a general business insurer for the purposes of determining pricing and valuation assumptions and identifying the main sources of profit and loss.

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(m) Principles of investment for general business insurers' assets.

(n) Principles of regulation and accounting for general insurance.

(o) Risk and uncertainty in general insurance business.

(p) Principles of risk management including reinsurance.

Suggested reading:

Faculty & Institute of Actuaries *Subject G Core Reading/Subject 303/ Subject 403 Core Reading.*
Claims reserving manual. 2nd ed, Faculty and Institute of Actuaries. 2 vols
Daykin. C D; Pentikäinen, T; Pesonen, M (1994) *Practical risk theory for actuaries.* Chapman and Hall, London
Foundations of casualty actuarial science (1996) 3rd ed, Casualty Actuarial Society, New York
Haberman, S; Booth, P; Chadburn, R; Cooper, D; James, D (1998) *Modern actuarial theory and practice.* Chapman & Hall, London
Hart, D G; Buchanan, R A; Howe, B A (1996) *Actuarial Practice of General Insurance.* Institute of Actuaries of Australia, Sydney
Lucca, J L de (1992) *Elsevier's dictionary of insurance and risk prevention: in English, French, Spanish, German and Portuguese.* Elsevier, Amsterdam. 429 pages. ISBN: 0-444-89614-7
Mack, Thomas 'Measuring the variability of chain ladder reserve estimates' *Casualty Actuarial Society Forum* Spring 1994, 101-182
Straub, Erwin (1988) *Non-life insurance mathematics.* Springer; Swiss Association of Actuaries, Berlin; Zurich. 136 pages. ISBN: 3 540 18787 1
Sundt, Björn. (1991) *An introduction to non-life insurance mathematics.* 2nd ed, Verlag Versicherungswirtschaft, Karlsruhe. 163 pages. ISBN: 3-88487-255-9
Taylor, Greg C (1986) *Claims reserving in non-life insurance.* North-Holland, Amsterdam. 232 pages. ISBN: 0 444 87846 7

C2   Living Benefits

Aim: To instil the ability to apply, in simple situations, the principles of actuarial planning and control needed for the operation on sound financial lines of providers of health insurance/living benefits.

(a) Principal terms.

(b) Different models for financing health care.

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(c) The main features of mixed public/private financial health care systems.

(d) Main features of the major types of health insurance product, including:

sickness insurance

critical illness insurance

long-term care insurance

medical expenses insurance

disability insurance

(e) The principles of health insurance markets.

(f) Principles of accounting for health insurance.

(g) Major areas of risk and uncertainty in health insurance.

(h) Principles of investment for health insurers' assets.

(i) Valuation data and verification procedures.

(j) Analysis of the experience of a health insurer.

(k) Pricing of health insurance products.

(l) Valuation of the liabilities for the purposes of:

the establishment of reserves for the accounts

the determination of solvency.

(m) Interpretation of the accounts of a health insurer.

(n) Establishing the impact of the liabilities of a health insurer on the choice and management of assets.

(o) Modelling of the uncertainty in claim frequency and amount.

(p) Experience rating for health insurance

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(q) Evaluation of the capital requirements of a health insurer for the purpose of determining the strategy for growth in business.

Suggested reading:

Bohn, Klaus (1980) *Die Mathematik der deutschen Privaten Kranken-versicherung.*Schriftenreihe Angewandte Versicherungsmathematik Verlag Versicherungswirtschafte.v., Karlsruhe

Crenca, Giampaolo (1991) *Le assicurazioni malattia.* Edizioni Buffetti

Dienst, Hans-Rudolf (1995) *Zur aktuariellen Problematik der Invaliditätsversicherung: unter Verwertung internationaler Erfahrungen.* Verlag Versicherungswirtschaft, Karlsruhe. 160 pages. ISBN: 3-88487-483-7

Haberman, S; Pitacco, E (1998) *Actuarial models for disability insurance.* Chapman & Hall, London

O'Grady, Francis T (ed) (1988) *Individual health insurance.* Society of Actuaries, Schaumburg, IL

Pitacco, Ermanno (1995) *Modelli attuariali per le assicurazioni sulla salute.* EGEA, Milano

Soule, C E (1994) *Disability income insurance: the unique risk.* 3rd ed, Business One

Irwin, Homewood, IL. 300 pages. ISBN: 1556239580

Sigma No 2/1998; Health Insurance in the United States: An Industry in Transition; Swiss Reinsurance Company Economic Research; 1998; Zurich

Sigma No 6/1998; Life and health insurance markets benefit from reforms in state pension and health systems; Swiss Reinsurance Company Economic Research; 1998; Zurich

S.T. Sonnefeld, D.R. Waldo, J.A. Lemieux, D.R. McKusick; Projections of national health expenditures through the year 2000; Health Care Financing Review, Volume 13, Number 1; 1991

R.H. Arnett III, D.R. McKusick, S.T. Sonnefeld, C.S. Cowell; Projections of health care spending to 1990; Health Care Financing Review; Volume 7, Number 3; 1986

Swiss Re Life & Health, Profitable Health Insurance, Seminar 2-3.9.1999.

C3   Pensions

Aim: To instil the ability to apply, in simple situations, the principles of actuarial planning and control needed for the operation on sound financial lines of providers of pensions of all types.

(a) Principal terms

(b) Benefit types

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(c) The needs and roles of the various parties that may be involved

(d) Methods of financing provision

(e) The regulatory environments in which benefits may be provided

(f) Risks and uncertainties

(g) Re-insurance as a means of risk management

(h) Actuarial models to project income and outgo

(i) Principles of financing, including asset and liability relationships

(j) Determining assumptions for valuing future benefits and contributions

(k) Placing values on assets, future benefits and future contributions for the purpose of:

- financing

- the establishment of provisions and reserves for the accounts

- the estimation of solvency

- the determination of benefits including guarantees and options

(l) Monitoring and analysing experience

(m) Calculation and distribution of surplus

Suggested reading:

Faculty & Institute of Actuaries *Core Reading for Subject 304*
Aitken, W H (1994) *Pensions Funding and Valuation.* Actex
Allen, E T; Melone, J J; Rosenbloom, J S; Vanderhei, J L (1997) *Pension planning: pension, profit-sharing and other deferred compensation plans*. McGraw-Hill
Anderson, A W (1990) *Pension mathematics for actuaries.* Actex
Bennett, P (1994) *Pension fund surpluses.* 2nd ed*,* Longman
Berin, B N (1989) *The fundamentals of pension mathematics.* Society of Actuaries, Schaumburg, IL

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Bleakney, T P; Pacelli, J *Benefit design in public employee retirement systems*. Government Finance Officers Association

Carne, S A; Ward, G (1987) *The work of a pension scheme actuary*. Auditing Practices Committee of the Consultative Committee of Accountancy Bodies

Collinson, D (1993) *Actuarial methods and assumptions used in the valuation of retirement benefits in the EC*. Groupe Consultatif [Information now rather dated. Undergoing revision]

Daykin, C D (1993) *Retirement provision in the countries of the EC*. Groupe Consultatif [Information now rather dated. Undergoing revision]

Daykin, C D 'Analysis of methods of financing income for retirement' Paper presented at the Social Security Association International Conference, Bristol, 11-14 November 1990

Daykin, C D; Lewis, D 'A crisis of longer life: reforming pension systems'. To appear in *British Actuarial Journal*

Exley, C J; Mehta, S J B; Smith, A D 'The financial theory of defined benefit pension schemes' *British Actuarial Journal* (1992) 3: 835-966

Farrimond, W; Mayer, D (1994) *Actuarial cost methods, a review*. American Society of Pension Actuaries

Haberman, S; Booth, P; Chadburn, R; Cooper, D; James, D (1998) *Modern actuarial theory and practice*. Chapman & Hall, London

Lecina, J M (1990) *Los planes de previsión: un tratamiento actuarial*. Caixa de Catalunya, Barcelona

Long, C A (1989) *The actuary in practice*. Tolley

Mansfield, C B; Cunningham, T W *Pension funds: a common-sense guide to a common goal*. Business One Irwin

MacDonald, J B *Differences in valuation methods and assumptions between social insurance and occupational pensions plans*. Society of Actuaries, Schaumburg, IL

McGill, D M (1996) *Fundamentals of private pensions*. 7th ed, University of Pennsylvania Press

Pensions Management Institute (1997) *Pensions terminology: a glossary for pension schemes*. 5th ed, Pensions Management Institute

Rejda, G E (1993) *Social insurance and economic security*. 5th ed, Prentice-Hall

Rosenbloom, J S; Hallman, G V (1986) *Employee benefit planning*. Prentice-Hall

Steuerle, C E; Bakija, J M (1994) *Retooling social security for the 21st century*. Urban Institute Press, London

Thornton, P N; Wilson, A F 'A realistic approach to pension funding' *Journal of the Institute of Actuaries* (1992) 119: 229-312

Towers Perrin *Handbook of executive benefits*. Irwin Professional Publishing

Turner, J A; Watanabe, N (1995) *Private pension policies in industrialized countries: A comparative analysis*. Upjohn Institute for Employment Research

William M Mercer *International benefit guidelines*. Published annually

World Bank (1994) *Averting the old age crisis: policies to protect the old and promote growth*. Oxford University Press

C. D. Daykin, T. Pentikäinen, M. Pesonen, Practical risk theory for actuaries, Chapman and Hall, London, 1994.

S. N. Iyer, Actuarial mathematics of social security pensions, ILO, Geneve, 1999.

E. M. Lee, An introduction to pension schemes, Institute and Faculty of Actuaries, Oxford, 1986.

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