

TRIBHUVAN UNIVERSITY
INSTITUTE OF SCIENCE AND TECHNOLOGY
SCHOOL OF MATHEMATICAL SCIENCES
Bachelor in Mathematical Sciences (B.Math.Sc.)

Course of Study

Code No.: MSAS 301

Full Mark: 75

Paper: Actuarial Models I

Pass Mark: 30

Nature: Theory

Credit: 3

Course Description:

The course is a grounding in the principles of modeling as applied to actuarial work focusing particularly on stochastic asset liability models and the valuation of financial derivatives. These skills are also required to communicate with other financial professionals and to critically evaluate modern financial theories.

Learning Objectives:

On successful completion of this subject, a student will be able to

1. Describe, interpret and discuss the theories on the behaviour of financial markets.
2. Discuss the advantages and disadvantages of different measures of investment risk.
3. Describe, and discuss the models underlying asset valuations.

Mode of Delivery:

The course will be taught by lecture (48 hrs), and problem solving and class discussion (24 hrs). The use of spreadsheet software for problem solving will be encouraged.

Contents:

Unit 1 Rational Expectations Theory

9 hrs

Forms of the efficient markets hypothesis and their consequences for investment management, Evidence for or against each form of the Efficient Markets Hypothesis, Utility theory, and its application in finance and insurance.

Unit 2 Behavioural Economics

6 hrs

Kahneman and Tversky's prospect theory, Critique of expected utility theory. Framing, heuristics and bias in the context of financial markets, features of behaviour in such markets (herd instinct, anchoring and adjustment, self-attribution bias, loss aversion, confirmation bias, availability bias, familiarity bias), Bernartzi and Thaler solution to the equity premium puzzle.

Unit 3 Measures of Investment Risk

12 hrs

Properties of risk measures, Relation with the form of an investor's utility function, Use of the risk measures in comparing investment opportunities, Influence of the distribution of returns and the thickness of tails on the assessment of risk, Measures taken by insurance companies to reduce or remove risk. Moral hazard and Adverse selection.

Unit 4 Stochastic Interest Rate Models

10 hrs

Simple stochastic models for investment returns, Stochastic interest rate model, deterministic model, Mean value and the variance of the accumulated amount of a single

premium identically distributed and for other simple models, Recursive relationships which permit the evaluation of the mean value and the variance of the accumulated amount of an annual premium for the model (in which the annual rates of return are independently and identically distributed) The distribution functions for the accumulated amount of a single premium and for the present value of a sum due at a given specified future time for the model in which each year the random variable $(1 + i)$ has an independent log-normal distribution, The probability that a simple sequence of payments will accumulate to a given amount at a specific future time for the above models.

Unit 5 Mean-variance Portfolio Theory and Asset Pricing Models

10 hrs

Mean-variance portfolio theory, Conditions under which application of mean-variance portfolio theory leads to the selection of an optimum portfolio, Application of the mean-variance portfolio theory in computing in the expected return and risk of a portfolio of many risky assets, Benefits of diversification using mean-variance portfolio theory. Sharpe-Lintner-Mossin Capital Asset Pricing Model (CAPM), Limitations of the basic CAPM and overcoming them. Use of the CAPM, Main issues involved in estimating parameters for asset pricing models.

References

1. *ActEd Study Material Subject CT8*, Actuarial Education Company, 2016
2. Baxter, Martin & Andrew Rennie, *Financial calculus; An introduction to derivative pricing*, Cambridge University Press, 1996.
3. Panjer, Harry H (ed), *Financial economics: with applications to investments, insurance and pensions*, The Actuarial Foundation, 2001.
4. Elton, Edwin J, Martin J Gruber, Stephen J Brown et al, *Modern portfolio theory and investment analysis* (8th edition), John Wiley, 2010.
5. Hull, John C, *Options, futures and other derivatives* (7th edition), Prentice Hall, 2008.
