

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

Course of Study

Code No.: MSMT 351

Paper: **Financial Mathematics II**

Nature: Theory

Full Mark: 75

Pass Mark: 30

Credit: 3

Course Description:

This course is the continuation of Financial Mathematics I. This is a grounding in the principles of modeling as applied to actuarial work – focusing particularly on deterministic models which can be used to model and value known cashflows as well as those which are dependent on death, survival, or other uncertain risks.

Learning Objectives:

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

1. Describe, interpret and discuss the theories on interest rates.
2. Describe, interpret and discuss mathematical techniques used to model and value cashflows which are contingent on mortality and morbidity risks.

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 Assurance and Annuity Functions

12hrs

Cash flows dependent upon the death or survival of either or both of two lives, functions dependent upon a fixed term as well as age, Valuing cash flows that are contingent upon multiple transition events, Health insurance, Simple health insurance premium and benefit structures, Valuation of a cash flow, contingent upon multiple transition events, using a multiple-state Markov Model, Expected present values of cash flows that are contingent upon multiple transition events, including simple health insurance premiums and benefits and calculated these in simple cases.

Unit 2 Expected Cash Flows Contingent Upon Multiple Decrement Events

6hrs

A multiple decrement model as a special case of multiple-state Markov model, Forces of transition, Dependent probabilities for a multiple decrement model in terms of given forces of transition.

- Unit 3 Premiums** **10hrs**
 Random future loss under an insurance contract, Principle of equivalence, Premiums, Premiums for the insurance contract benefits under various scenarios, Net premiums valuation, Gross premiums valuation,
- Unit 4 Reserving** **11hrs**
 Reserves, Prospective and retrospective reserves, Recursive relationships between successive periodic gross premium reserves, death strain at risk, calculation of single policy or portfolio of policies, expected death strain, actual death strain, mortality profit, Thiele's differential equation
- Unit 5 Cashflow Projection and Profit Test** **9hrs**
 Projection of expected future cash flows for various types of insurance (whole life, endowment assurance and term assurances, annuities, unit-linked contracts, and conventional / unitised with-profits contracts), Profit test model and its use, cash flow projection model and profit test model, unit-linked contracts and a profit test model.

References

1. *ActEd Study Material Subject CT1*, Actuarial Education Company, 2016
2. Kellison *The Theory of Interest*, Irwin Mc-Graw Hill, 2006
3. Bowers, L. Newton, *Actuarial Mathematics*, Society of Actuaries, 2006
4. McCutcheon, J. J.; Scott, W. F. Heinemann, *An Introduction to the Mathematics of Finance*, Institute and Faculty of Actuaries' Online Publications Shop, 1986
5. Mark S. Joshi, *The Concepts and Practice of Mathematical Finance*, Cambridge University Press, 2008
6. Paul Wilmott, Sam Howison and Jeff Dewynne *The Mathematics of Financial Derivatives*, Cambridge University Press, 1995
7. S. M Ross, *An introduction to Mathematical Finance*, Cambridge University Press
