

Discipline Specific Elective (DSE) Course 3c: Actuarial Statistics

Structure 1: PG Curricular Structure with only Course Work
Structure 2: PG Curricular Structure with Course Work + Research
Structure 3: PG Curricular Structure with Research only

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Prerequisite of the course (if any)
		Lecture (45 Hours)	Tutorial (00 Hours)	Practical (30 Hours)		
DSE 3c: Actuarial Statistics	4	03	00	01	NIL	Basic knowledge of probability

Course Objectives:

- To equip students with a comprehensive understanding of statistical methods and their applications in actuarial science.
- To learn modelling, analysis, and interpretation of data related to insurance, risk management, and financial forecasting.

Course Learning Outcomes:

After successful completion of this course, students will be able to:

- Learn the basic concepts and statistical methods used in actuarial science.
- Learn modeling future life time distribution of human life.
- Understand various type of life insurance contract.
- Understand law of premium and reserves computations.

Unit I (11 Hours)

Introductory Statistics and Insurance Applications: Discrete, continuous and mixed probability distributions, risk and insurance, insurance products, reinsurance and its different types. Utility functions, expected value principle, expected utility criterion, types of utility function, insurance and utility theory. Individual risk models for aggregate claims. Collective risk models for short term.

Unit II (11 Hours)

Age at death random variable, survival function, time until-death for a person, curate future lifetime, force of mortality, life tables, relation of life table functions to the survival function,

deterministic and random survivorship group, life table characteristics, recursion formulas, assumptions for fractional age, analytical laws of mortality, select and ultimate tables.

Unit III (12 Hours)

Nominal and effective rates of interest and discount, force of interest and discount, compound interest, accumulation factor, continuous compounding, present value of a future payment. Life Insurance models: Models for insurance payable at the moment of death and at the end of the year of death - level benefit insurance, endowment insurance, deferred insurance and varying benefit insurance. Life annuities: Various forms of annuities, continuous life annuities, discrete life annuities,

Unit IV (11 Hours)

Loss at issue random variable, fully continuous and fully discrete premiums, True mthly payment premiums, gross premiums. Calculation of prospective reserves using the future loss random variable, Recursions for reserves, fully continuous reserves, fully discrete reserves.

Essential Readings:

1. Deshmukh, S. and Prayag, V. (2025). *Actuarial Statistics: An Introduction Using R*, Universities Press.
2. Dickson, D.C.M., Hardy, M.R. and Waters, H.R. (2009). *Actuarial Mathematics for Life Contingent Risks*, Cambridge University Press.

Suggested Readings:

1. Booth, P.M (2004). *Modern Actuarial Theory and Practice*, Chapman & Hall.
2. Bowers, N.L., Gerber, H.U., Hickman, J.C., Jones, D.A. Jones and Nesbitt, C.J. (1997). *Actuarial Mathematics*, Society of Actuaries.
3. Gerber, H.U. (2011). *Life Insurance Mathematics*, Springer, Swiss Association of Actuaries.
4. Mario V. Wüthrich, Michael Merz (2023). *Statistical Foundations of Actuarial Learning and its Applications*, Springer.
5. Rotar, V.I. (2015). *Actuarial Models: The Mathematics of Insurance*, CRC Press.

List of Practicals:

1. Utility function.
2. Expected value principle.
3. Individual risk model
4. Collective risk model
5. Life insurance and life annuities.
6. Premium and reserves calculation