- Rubinstein, R.Y. (1981): Simulation and the Monte Carlo Methods, Wiley.
- Venkataraman, M.K. (1998): Numerical Methods in Science and Engineering, The National Publishing Company, Chennai.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch University of Delhi, from time to time.

COMMON POOL OF GENERIC ELECTIVES (GE) COURSES

OFFERED BY DEPARTMENT OF STATISTICS
CATEGORY -IV

GENERIC ELECTIVE COURSE – 6a: SURVEY SAMPLING AND DESIGN OF EXPERIMENTS

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Survey Sampling and Design of Experiments	4	3	0	1	Class XII pass with Mathematics	knowledge of basics statistics

Learning Objectives

The learning objectives include:
- To learn about sample surveys, its need and objectives.
- To learn to draw appropriate sample and interpret the result.
- To learn to design and conduct experiments.
- To analyse and interpret the data.

Learning Outcomes:

After completing this course, students should have developed a clear understanding of:
- The basic concept of sample survey and its need.
- Simple random sampling.
- Stratified random sampling
- One-way and two-way analysis of variance.
- Basic concepts of design of experiments.
- Completely randomized design.
- Randomized design.
- Latin square design.

- Factorial experiments.

 Theory
UNIT I (11 hours)
Sample Surveys
Basic concepts of sample survey, concept of sampling, need for sampling, complete enumeration v/s sampling, principles of sampling theory, principal steps in a sample surveys, planning and organization of a sample survey, sampling and non-sampling errors.
Simple random sampling (SRSWR and SRSWOR): Definition and procedures of selecting a sample, properties of simple random sample, estimation of mean and sampling variance of sample mean.

UNIT II (12 Hours)
Stratified random sampling
Introduction, estimation of population mean and its variance, choice of sample sizes in different strata, comparison of stratified sampling under proportional and Neyman allocation with SRSWOR in terms of precision.

Unit III (12 Hours)
Analysis of variance and Design of experiments
One-way and two-way classified data with one observation per cell only. Design of experiments: Principles of Design of experiments, uniformity trails, completely randomized, Randomized block and Latin square designs.

Unit IV (10 Hours)
Factorial Experiments and Designs
Factorial experiments: 2^2 and 2^3, Factorial Design: construction and analysis.

PRACTICAL/LAB WORK – (30 hours)
List of Practical:

1. Select a SRS with and without replacement.
2. For a population of size 5, estimate population means, the population mean square and population variance. Enumerate all possible samples of size 2 by WR and WOR and establish all properties relative to SRS.
3. For SRSWOR, estimate mean, standard error, the sample size.
4. Stratified Sampling: allocation of sample to strata by proportional and Neyman's methods Compare the efficiencies of the above two methods relative to SRS.
5. Estimation of gain in precision in stratified sampling.
6. Analysis of Variance of one-way classified data
7. Analysis Variance of two-way classified data
8. Analysis of CRD
9. Analysis of RBD.
10. Analysis of LSD.
11. Analysis of 2^2 and 2^3 factorial in CRD and RBD.

 Practical work to be conducted using electronic spreadsheet / EXCEL/ Statistical Software Package/ SPSS/ calculators.

Essential Readings:

●Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005). Fundamentals of Statistics, Vol. II, 8th Ed., World Press, Kolkata.

●Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005). An Outline of Statistical Theory, Vol. II, 3rd Ed., World Press, Kolkata.

●Gupta, S.C. and Kapoor, V.K. (2008). Fundamentals of Applied Statistics, 4th Ed., Sultan Chand and Sons.

Suggested Readings:

● Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. and Ashok, C. (1984). Sampling Theory of Surveys with Applications, Iowa State University Press, Iowa, USA.

● Mukhopadhyay, P. (1998). Theory and Methods of Surveys Sampling, Prentice Hall of India.

● Montgomery, D.C. (2001). Designs and Analysis of Experiments, John Wiley and Sons, New York.

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GENERIC ELECTIVE COURSE – 6B: STATISTICS IN ACTUARIES

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Statistics in Actuaries	4	3	0	1	Class XII pass with Mathematics	Nil

Learning Objectives

The learning objectives include:
• To learn about Utility theory
• To learn the principles of premium calculations
• To understand the survival distribution and life tables
• To learn Life Insurance models and life annuities

Learning Outcomes:

After completing this course, students should have developed a clear understanding of:
● Statistics and Insurance applications
● Utility theory
● Principles of premium calculations
● Survival distribution and life tables
● Life insurance models and Life annuities.

SYLLABUS OF GE-6B

Theory

UNIT I (11 hours)
Introductory Statistics and Insurance applications
Introductory Statistics and Insurance applications: discrete, continuous, and mixed probability distributions. Insurance applications, sum of random variables. Utility theory: Utility functions expected utility criterion, types of utility function, insurance and utility theory.

UNIT II (12 Hours)
Principles of premium calculation
Principles of premium calculation: Properties of premium principles, examples of premium principles

Unit III (12 Hours)
Survival distribution and life tables
Survival distribution and life tables: Uncertainty of age and death, survival function, time-until-death for a person, curate future lifetime, the force of mortality, life tables with examples

Unit IV (10 Hours)
Life Insurance and annuities
Life insurance: Models for insurance payable at the moment of death, insurance payable at the end of the year of death, and their relationships. Life annuities: continuous life annuities, discrete life annuities.

PRACTICAL/LAB WORK – (30 hours)
List of Practical:
1. Risk computation for different utility models
2. Discrete and continuous risk calculations
3. Calculation of aggregate claims for collective risks
4. Calculation of aggregate claim for individual risks
5. Computing ruin probabilities and aggregate losses
6. Annuity and present value of contract
7. Computing premium for different insurance schemes
8. Practical based on life models and tables

  Practical work to be conducted using electronic spreadsheet / EXCEL/ Statistical Software Package/ SPSS/ calculators.

Essential Readings:
  ● Dixon C. M. D. (2005) Insurance Risk and Ruin (International Series on Actuarial Science), Cambridge University Press.
  ●Atkinson M.E. and Dickson, D.C.M. (2011): An Introduction to Actuarial Studies, Elgar Publishing.

Suggested Readings:
  ●Bowers N.L., Gerber H.U., Hickman J.C., Jones D.A., and Nesbitt C.J. (1997): Actuarial Mathematics, Society of Actuaries, Itasca, Illinois USA.

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