NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF ECONOMICS AND STATISTICAL ENGINEERING

STATISTICAL ENGINEERING PROGRAM

ES412 – SAMPLING I

I. GENERAL INFORMATION

CODE	:	ES412 Sampling I
SEMESTER	:	4
CREDITS	:	4
HOURS PER WEEK	:	5 (3 Theory – 2 Practice)
PREREQUISITES	:	ES311 Statistics III, ES312 Probabilities I
CONDITION	:	Mandatory

II. COURSE OUTCOMES

To know, develop and apply the theory of the diverse techniques of sampling that allow the student to design a sample to know the characteristics of a certain population.

III. LEARNING UNITS

1. **INTRODUCTION**
   Basic notions of probabilities. Definition of some sampling terms. Main steps of a sample survey. Probabilistic sampling. Use of the normal distribution. Bias and its effects. The mean square error.

2. **SIMPLE RANDOM SAMPLING FOR MEDIA, PROPORTIONS AND RATIOS**
   Description of the simple random sampling. Selection of a simple random sample. Definitions and notations. Properties of estimators. Variances of estimators. Estimation of the standard error of a sample. Confidence limits. Estimation by the ratio method. Estimates of means and totals in sub-populations. Estimating the sample size to estimate a mean or proportion.

3. **STRATEGIC RANDOM SAMPLING**
   Description and notation. Linear unbiased estimators: application to totals, means and proportions. Estimating the variances of the estimators. Considerations on the number of strata and their limits. Sample bonding: uniform bonding, affixing of minimum variances and optimum bonding. Estimation of gain and precision from the sample. Determination of sample size. Subsequent stratification.

4. **SISTEMATIC SAMPLING**
   Introduction. Estimators and variances. Variance of the mean estimator as a function of the intra-sample correlation coefficient. Approximate calculation of sampling errors. Comparison with stratified sampling. Comparison with simple random sampling in random populations.

5. **INDIRECT METHODS OF ESTIMATION: ESTIMATORS OF RATIO**
   Bias of ratio estimator. Approximate bias expression. Approximate variance. Comparison of variances. Simple and combined estimators in stratified sampling. Estimators of Hartley and Ross.

6. **METHODS INDIRECTOR OF ESTIMATION: REGRESSION ESTIMATORS**
   The linear regression estimation. Regression estimates with b, pre-assigned. Minimum variance for constant b. Regression estimates when b is calculated from the sample. Sample estimation of variance. Comparison of variances. Regression estimators in stratified sampling. Comparison of minimum variances for the simple and combined estimators.

IV. BIBLIOGRAPHY

Abad – Servin. Introduction to sampling.
Cochran, V.G. Sampling techniques.
Desraj. Theory of sampling.
Azorin, Francisco and Sánchez Crespo, José. Methods and applications of sampling.