

Module Title:

Design of sampling strategies and techniques

Module Code:

AM0801

Maximum Number of Students:

25

Total ECTS Credits

2

Notional Learning Hours

(a) Contact Time - 12 h
 (b) Private Study - 38 h

Format of Teaching:

Lectures 10 h
 Laboratories or Practicals -
 Other (PC seminars) 2 h

Teaching Strategy:

Please show how the contact hours are to be allocated in terms of the type of class involved.

Formal lectures in 60/90 min sessions.

PC seminars: based on practical exercises linked to the quantitative aspects of sampling error estimation. General software (EXCEL) and specific sampling software (Vario) will be used.

Convener:

Anna de Juan
 Miquel Vidal

University / Department:

University of Barcelona / Analytical Chemistry Department

Language of Tuition:

English

Module Description - The Purpose or Aims:

- To impart knowledge, understanding and problem solving capabilities regarding the Theory of Sampling (TOS).
- To describe the general principles of representative sampling of both 0-dimensional and 1-dimensional lots
- To impart knowledge on the characterization of lot variabilities and variographic analysis.
- To introduce the complexity and practical guidelines for sampling 2- and 3-dimensional lots.

Specific Learning Outcomes for this module: (contributing to general learning outcomes GLO 1 – GLO 10)

Learning Outcomes should provide statements which articulate what the student has achieved upon completion of the course. What will a student know, understand or be able to do?

- SLO1. Understanding of the lot dimensionality, heterogeneity and other fundamental concepts of the theory of sampling, TOS
- SLO2. Understanding and ability to use the seven sampling unit operations
- SLO3. Understanding of sampling errors for both 0- and 1-dimensional lots
- SLO4. Understanding of the complexity of sampling 2- and 3-dimensional lots
- SLO5. Capacity to design and carry out replication experiments and to perform variographic analysis to estimate the error associated with any sampling operation
- SLO6. Ability to do a critical study of sampling protocols and equipment
- SLO7. Ability to design a sampling plan

Summary of Course Content:

Topics that will be discussed include:

1. Basic sampling concepts and TOS terminology. Lot dimensionality. Seven Sampling Unit Operations (SUO).
2. Sampling in 0-dimension lots. Heterogeneity concept. Definition and estimation of sampling errors. Replication experiments. Sample mass reduction.
3. Sampling in 1-dimension lots. Heterogeneity in dynamic systems. Variographic studies.
4. Sampling in 2- and 3-dimension lots.
5. Sampling plan design and quality assurance in the sampling process.

Transferable Skills Taught:

Please list in numerical order the key skills taught e.g. communication, information technology, interpersonal skills, teaching/study skills. Please relate these to benchmark statements.

Ability to communicate with specific terms related to the theory of sampling.
Ability to work in small groups and to elaborate written reports.
Knowledge on how to find information on available sampling guidelines and equipments.

Assessment Methods:

Details of assessment methods should include forms of assessment and the contribution of each to the summative assessment of the module. The relationship to the learning outcomes of the module should be explicit and the numbers of the various learning outcomes should be attached to the assessment methods listed. Please list in numerical order

1. Written examination (60 %). Evaluation of SLO1 – SLO6
2. Work assignment (40 %). Evaluation of SLO6- SLO7.

Assessment Criteria:

Details of assessment methods should include forms of assessment and the contribution of each to the summative assessment of the module. The relationship to the learning outcomes of the module should be explicit and the numbers of the various learning outcomes should be attached to the assessment methods listed. Please list in numerical order.

Threshold:

SLO1, SLO2, SLO3, and SLO4: Basic knowledge on the fundamental concepts of the theory of sampling, sampling unit operations and sampling errors of lots of any dimension.

SLO5: Basic knowledge on replication experiments and variograms.

SLO6 and SLO7: Basic ability to analyse sampling protocols, equipments and sampling plans

Good:

SLO1, SLO2, SLO3, and SLO4: Ability to apply the fundamental concepts of the theory of sampling, and sampling unit operations, to perform simple calculations dealing with the sampling errors of 0-D and 1-D lots, and to understand the complexity related to 2-D and 3-D lots

SLO5: Ability to design replication experiments and to apply variograms to estimate the errors associated with any sampling step

SLO6 and SLO7: Ability to assess sampling protocols, equipments and sampling plans, with the ability to design and/or suggest alternatives.

Excellent:

SLO1-SLO7: Ability to correctly solve a case study: ability to design a complete sampling plan, taking into account the objectives and information sought, the lot characteristics, the strategy, procedure and equipment, the estimation of the sampling error and other external constraints

Resource Implications of Proposal and Proposed Solutions:

- PC classroom
- Lectures will be based on teaching material that students will have beforehand (Powerpoint slides; research articles ...).
- Recommended reading material:

1. P. Gy. 'Sampling for analytical purposes'. Wiley (1988).
2. Petersen, L, Minkkinen, P. & Kim H. Esbensen (2005). Representative Sampling for reliable data analysis: Theory of Sampling. *Chemometrics and intelligent laboratory systems*, vol. 77, issue 1-2, p. 261-277.
3. Petersen, L, C. Dahl, K.H. Esbensen (2004). Representative mass reduction in sampling – a critical survey of techniques and hardware. *Chemometrics and Intelligent Laboratory Systems*, vol. 74, Issue 1, p. 95-114.
4. Petersen L. & K. H. Esbensen (2005). Representative Process Sampling for Reliable Data Analysis – a Tutorial. *Journal of Chemometrics*, vol. 19, Issue 11-12. p. 625-647.
5. Esbensen, K.H, H.H.Friis-Petersen, L. Petersen, J.B. Holm-Nielsen & P.P.Mortensen (2007). Representative process sampling – in practise: Variographic analysis and estimation of Total Sampling Errors (TSE). *Chemometrics and Intelligent Laboratory Systems*, doi:10.1016/j.chemolab.2006.09.011.
6. Holm-Nielsen, J.B, C.K. Dahl & K.H. Esbensen (2006). Representative sampling for process analytical characterisation of heterogeneous bio-slurry systems - a reference study of sampling issues in PAT. *Chemometrics and Intelligent Laboratory Systems*, vol. 83, 114-126

Pre-Requisites:

Any module(s) which must have been taken prior to the current module, or any specific background required to take this module.

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