SUBJECT PROGRAM

I. IDENTIFICATION OF THE SUBJECT

Subject: **Computational Statistics**		Acronym: **INF-280**	Approval date 10/11/2016 (CC.DD. Agreement 13/2016)		
UTFSM Credits: **3**	Prerequisites: **MAT023 + IWI-131**	Exam: **Does not have**	Faculty		
SCT Credits: **5**			**Computer Science Department**		
Lecture Hours Weekly: **3**	Weekly Assistantship Hours: **1.5**	Weekly Laboratory Hours: **1.5**	Semester in which it is taught		
			Odd _	Pair	Both
Formative axis: **Engineering Sciences Computing for complex problems in Industry**					
Total time dedicated to the subject: **163 chronological hours**					

Subject Description

The student begins the development of data analysis, interpretation and modeling skills, applying basic methods of collection, synthesis and description of data groups, and the concepts of variation and uncertainty. Select analysis methods based on computer simulations or classical approaches. Interprets and communicates the results obtained from the problem that gave rise to the study.

Entry requirements

- Apply knowledge of real, univariate and multivariate calculus.
- Understand basic concepts of linear algebra.
- Program using a computer language.

Contribution to the graduation profile

Specific Competence

- Make decisions under uncertainty, risk and uncertainty, basing them with the application of quantitative techniques.

Transversal Competencies

- Communicate oral and written information effectively within the organizations in which one works, as well as with entities in the environment.
- Act with autonomy, flexibility, initiative, and critical thinking when facing professional problems.
- Develop their work with solid criteria that allow you to ensure quality from a systemic perspective.
- Manifest behaviors and attitudes of social responsibility and tolerance, valuing ethical principles.

Learning outcomes expected to be achieved in this subject

- **Use** appropriate statistical language, **communicating** the bases and results of a study or decision.
- **Distinguishes** the concepts of uncertainty and variation, **recognizing them** as an inherent characteristic of complex problems in science, engineering and business.
- **Analyzes** data, **applying** graphic and analytical techniques according to the patterns and regularities existing in various random phenomena.
- **Build** classical and computational statistical models, **considering** techniques for data analysis.
- **Makes decisions** under conditions of uncertainty, **relying** on statistical models.
- **Apply** the main computational statistical methods, **carrying out** laboratory experiments.

Thematic contents

- Data analysis according to the level of information; nominal, ordinal and interval, univariate and multivariate, structured and unstructured, data mixture position and scale measurements, graphical methods, box-plot, data visualization.
- Concepts of probability theory, univariate, multivariate probability distribution, marginal probability density, conditional, independence, covariance and correlation.
- Multivariate normal distribution and multinomial distribution, vector of means, variance and covariance matrix, identities and inequalities, mixtures of distribution properties.
- Calculus of random variables and vectors, convergence, weak law of large numbers, limiting distributions, measures of divergence in distributions, Glivenko and Cantelli theorem.
- Parametric inference, point estimation, point estimation methods, evaluation of estimators, bias-variance dilemma, interval estimation, evaluation of estimators, asymptotic intervals.
- Computational aspects of estimation: statistical inference, maximum likelihood estimation and the expectation maximization (EM) algorithm.
- Other types of inference, Bootstrap inference, Bootstrap standard error.
- Bootstrap confidence intervals.
- Synthetic data generation; random variables.
- Design of computer simulations.

Teaching and learning methodology

- Expository classes.
- Flipped classes (review of material prior to class).
- Data model laboratories using the R language

Evaluation and grading of the subject (Adjusted to Institutional Regulations-Regulations. No. 1)

Approval and qualification requirements	The Evaluation and qualification process consists of: • Exams (CE): **3** • Controls (CO): **At least 3 during the semester.** • Laboratory experiences (LA): **5** **NF = EC*65% + CO*10% + LA*25%**

Learning resources:

Virtual platform.

Bibliography:

Guide Text	• Devore, J., L., (2008). Probability and statistics for engineering and science. Seventh edition.
Complementary or Optional	• James, G., Witten, D., Hastie, T., Tibshirani, R. (2014). An Introduction to the Statistical CRC-Learning with Applications in R. Ed. Springer-Verlag. • Chernick, M., R., (2011) Bootstrap Methods. J. Wiley Press. • Ross, S., M., (2010). Probability and Statistics for Engineers Ed. Mac Graw-Hill.

II. CALCULATION OF NUMBER OF HOURS OF DEDICATION - (SCT-Chile) - SUBJECT SUMMARY TABLE

ACTIVITY	Number of hours of dedication		
	Number of hours per week	Number of weeks	Total number of hours
PRESENCE			
Lecture or theoretical classes	3	16	48
Assistantship/Exercises	1.5	14	twenty-one
Industrial visits (from Field)			
Laboratories / Workshop	1.5	10	fifteen
Evaluations (exams, others)	3	3	9
Others (specify)			
NO PRESENCE			
Assistantship			
Individual and group tasks	2	14	28
Personal Study (Individual or group)	3	14	42
Project			
TOTAL (HOURS)			**163**
Total number of TRANSFERABLE CREDITS			**5**