COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF INFORMATION SCIENCES & TECHNOLOGY
ACADEMIC UNIT	DEPARTMENT OF STATISTICS
LEVEL OF STUDIES	1st Cycle (UNDERGRADUATE)
COURSE CODE	6144

COURSE CODE	6144	**SEMESTER**	5th

COURSE TITLE	**Theoretical Statistics**

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	8
Workshops		
Labs	2	

COURSE TYPE	Elective - General Background
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	https://www.dept.aueb.gr/en/stat/content/theoretical-statistics-8-ects

(2) LEARNING OUTCOMES

Learning outcomes
After completing the course, the students ideally should be able to: Implement the standard methods to derive estimates for unknown parameters of a population with a known distribution. Evaluate and compare estimates with respect to standard criteria. Construct confidence intervals for the unknown parameters. Construct statistical tests for hypothesis testing about unknown parameters.
General Competences
• Search, analysis and synthesis of data and information, using the necessary technologies • Adaptation to new situations • Decision-making • Autonomous work • Teamwork • Project planning and management • Respect for diversity and multiculturalism • Respect for the natural environment • Demonstration of social, professional and ethical responsibility and sensitivity to gender issues • Exercise of criticism and self-criticism

(3) SYLLABUS

Terminology and definition of basic introductory concepts of parametric statistical inference (random sample, sampling space, parametric space, sample distribution, estimating statistical function). Point estimation in decision making theory (loss function, risk function). Criteria for estimator evaluation: Unbiasedness, Minimum Variance, Sufficiency, completeness, maximum Likelihood, efficiency. Methods of finding unbiased estimators of uniformly minimum variance. Fisher information, Cramer-Rao-Frechet inequality. The exponential family of distributions. Lehmann-Scheffe theorem. Maximum Likelihood Estimators (MLE). Invariance and asymptotic properties of the MLE. The concept of estimating parameters with confidence intervals. Methods of constructing confidence intervals. Pivotal quantity and the general method. Optimal confidence intervals. Asymptotic confidence intervals. Introduction to theory of parametric statistical hypothesis testing (defining the parametric hypothesis, types of errors, control function, power function). Evaluating statistical tests based on the power function. The Neyman-Pearson lemma and its applications in finding a uniformly powerful statistical test of simple hypotheses. Composite hypothesis testing. Likelihood Ratio test (LRT) and asymptotic LRT.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	In Teaching and communicating with the students, eclass.

TEACHING METHODS	Activity	Semester workload
	Lectures	52
	Tutorial	12
	Assignment	68
	Self Study	68
	Course Total	**200**

STUDENT PERFORMANCE EVALUATION .	Written examination at the end of the semester Information is available at eclass and at the study guide.

(5) ATTACHED BIBLIOGRAPHY

- Φερεντίνος Κ. και Παπαϊωάννου Τ. (2000) Μαθηματική Στατιστική, 2η Έκδοση, Εκδόσεις Σταμούλη, Αθήνα.
- Κολυβά-Μαχαίρα Φ., Μαθηματική Στατιστική, Εκδόσεις Ζήτη, 1998.
- Φουσκάκης Δ., Ανάλυση Δεδομένων με τη Χρήση της R., Εκδόσεις Τσότρας, 2013.
- CrawleyM.J., Στατιστική Ανάλυση με το R., BrokenHillPublishers, 2013.
- Ρούσσας Γ. (1994) Στατιστική Συμπερασματολογία, Τόμος I - Εκτιμητική, 2η Έκδοση, Εκδόσεις Ζήτη, Θεσσαλονίκη.
- Ρούσσας Γ. (1994) Στατιστική Συμπερασματολογία, Τόμος II – Έλεγχοι Υποθέσεων, 2η Έκδοση, Εκδόσεις Ζήτη, Θεσσαλονίκη.
- Bickel P.J. and Doksum K.A. (2007): Mathematical Statistics, vol.I, 2nd Edition – Updated Printing, Pearson Prentice Hall.
- Casella G. and Berger R. (2002): Statistical Inference, 2nd Edition, Duxbury.
- Mood A.M., Graybill F.A. and Boes D.C. (1974): Introduction to the Theory of Statistics, 3rd Edition, McGraw-Hill Book Company.