COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF INFORMATION SCIENCES & TECHNOLOGY		
ACADEMIC UNIT	DEPARTMENT OF STATISTICS		
LEVEL OF STUDIES	1st Cycle (UNDERGRADUATE)		
COURSE CODE	**6168**	**SEMESTER**	**7th**
COURSE TITLE	**Methods of Bayesian Inference**		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	7
Workshops		
Labs		

COURSE TYPE	Elective – Scientific Field
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	
COURSE WEBSITE (URL)	https://www.dept.aueb.gr/en/stat/content/methods-bayesian-inference-7-ects

(2) LEARNING OUTCOMES

Learning outcomes
After successful completion of the course the students should be able to: • Understand the differences between classic and Bayesian approach • Know the basic principles of the Bayesian approach • Apply contemporary Bayesian analysis methods to real problems • Know the tools that will assist them in implementing these analyses
General Competences

(3) SYLLABUS

Review of the basic principles of Bayesian Statistics, starting with conditional distributions and Bayes' theorem: prior and posterior distributions, conjugate families of distributions, and basic methods of Bayesian inference. Introduction to Bayesian hypothesis testing, model comparison and selection, and the Bayes

factor. Particular emphasis is placed on multivariate distributions and conjugate models, including the multivariate normal distribution and the Wishart, inverse Wishart, multivariate Student's *t*, and Dirichlet distributions, as well as their applications to Bayesian inference for multivariate models. Bayesian inference for normal linear models is then examined, with emphasis on conjugate prior distributions. Finally, Markov chain Monte Carlo (MCMC) methods are introduced, with emphasis on the Metropolis–Hastings and Gibbs algorithms. Applications are presented to (generalized) linear models, multivariate data with missing values, change-point problems, and model-based clustering using finite mixture models.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	**YES**
TEACHING METHODS	*Activity* / *Semester workload* Lectures: 100 Lab Exercise: 25 Studying and Analyzing Bibliography: 25 Assignment: 25 **Course Total: 175**
STUDENT PERFORMANCE EVALUATION	**January Examination Period:** Midterm Examination: **50%** Written Assignment + Oral Examination/Presentation: **50%** **Resit & Supplementary Examination Period:** Written Examination: **100%**

(5) ATTACHED BIBLIOGRAPHY

- Παπασταμούλης Π. (2025). Μέθοδοι Μπεϋζιανής Συμπερασματολογίας. 2η έκδοση. Σημειώσεις μαθήματος, ΟΠΑ.
- Robert CP (2007): The Bayesian Choice – From Decision Theoretic Foundations to Computational Implementation. Springer Texts in Statistics.
- Ntzoufras, I. (2009). Bayesian Modeling Using WinBUGS. Wiley. Hoboken. USA.
- Carlin B. and Louis T. (2008), Bayes and Empirical Bayes Methods for Data Analysis. 3rd Edition, London: Chapman and Hall.
- Gelman A., Carlin J.B., Stern H.S., Dunson, D.B., Vehtari, A. and Rubin D.B. (2013). Bayesian Data Analysis. Third Edition. Chapman and Hall/CRC.