COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES			
ACADEMIC UNIT	DEPARTMENT OF STATISTICS & ACTUARIAL – FINANCIAL MATHEMATICS			
LEVEL OF STUDIES	POSTGRADUATE PROGRAM Statistics & Actuarial – Financial Mathematics			
COURSE CODE	**331-0106**	**SEMESTER**	**A**	
COURSE TITLE	BAYESIAN STATISTICS			
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**	
		2	6	
COURSE TYPE	SPECIALISED GENERAL KNOWLEDGE			
PREREQUISITE COURSES:	NO			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK			
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES			
COURSE WEBSITE (URL)	http://www.samos.aegean.gr/samos_actuar/modules_eng.html			

(2) LEARNING OUTCOMES

Learning outcomes
Students will be able to: apply, implement and interpret a fully Bayesian approach to relevant statistical problems, and to understand Bayesian theory in real-world applications.
General Competences
Search for, analysis and synthesis of data and information, with the use of the necessary technology Decision-making Working independently and Team work Working in an interdisciplinary environment

(3) SYLLABUS

Bayes' rule for updating densities, prior and posterior densities, likelihoods, prior and posterior predictive densities, sequential analysis. The De Finetti representation theorem. Conjugate Bayesian analysis and the Exponential family of distributions. Subjective probability and Informative prior distributions. Objective and non-informative prior distributions. The Fisher information and the Jeffrey's priors.

Posterior Risk, Loss functions and Bayesian point estimators. Posterior means and the weighted squared error-loss. Posterior percentiles and the piecewise linear error-loss. The posterior mode and the zero-one error-loss. The case of multimodal posteriors. Interval estimators and the highest posterior density intervals.

The estimation of one – dimensional parameters. The case of the Bernoulli, Binomial and Negative-Binomial observations for an unknown probability of success. The case of the Exponential and Gamma observations for an unknown rate parameter. The case of the Normal observations for an unknown mean or an unknown variance. The case of Poisson observations.

The estimation of two – dimensional (and higher dimensional) parameters. The case of the of Gamma observations when the shape and the rate parameters are both unknown. The case of Normal observations for an unknown mean and an unknown covariance matrix.

Introduction to Markov Chain Monte Carlo (MCMC) methods with the R programming language

(https://cran.r-project.org/) . The Gibbs and the Metropolis-Hastings samplers. The JAGS R-package for MCMC analysis.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	• Synchronous and Asynchronous E-Learning. • Face-to-face learning.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	• Communication with students via eclass educational platform and via e-mail. • Educational material stored and presented into eclass educational platform.
TEACHING METHODS	

Activity	***Semester workload***
Lectures	24
Problem solving – projects – Lab work	52
Independent study	74
Course total (25 per ECTS)	***150***

STUDENT PERFORMANCE EVALUATION	Student evaluation is done in Greek through written examination and projects. For students with disabilities, evaluation takes place via oral exams.

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Gelman et al (2013). Bayesian Data Analysis. CRC Press LLC. 3rd ed.
2. Hoff, Peter D (2009). A First Course in Bayesian Statistical Methods. Springer Texts in Statistics.
3. Kruschke, Doing Bayesian Data Analysis: A Tutorial with R and Bugs, 2011. Academic Press / Elsevier.
4. Pfanzagl, J.; V. Baumann & H. Huber (1968). "Events, Utility and Subjective Probability". Theory of Measurement. Wiley. pp. 195–220.