Specification of the course for the Book of courses

Study program	Applied statistics	
Title of the course	**Theory of modeling and Monte Carlo method**	
Teachers (for lectures)	Branimir Todorović	
Teacher/fellow teacher (for exercises)	Dejan Mančev	

ESPB	6	**Status of the course (obligatory (O) /elective (E))**	E (O in Module Engineering)

Conditions	
Aim of the course	The goal of course is the introduction and understanding of the principles, techniques and methodologies of complex computational methods in statistics, particularly Monte Carlo method.
Course outcomes	Students will know and be able to use complex computer techniques in statistical conclusions which include Monte Carlo method, Markov chains, bootstrep methods, EM algorithms.

Content of the course

Theoretical classes	Monte Carlo experiment: evaluation using a (pseudo) random samples obtained by computer experiments, bias and variance assessment, variance reduction, control variables, the causality, the significance of the sample; generators of pseudo-random numbers with uniform and non-uniformly distributed. Simulation of stochastic processes, generate trajectories of Markov processes and discrete event systems; properties assessment using simulations, the variance of ratings and reduction of variance, Markov chain Monte Carlo and simulations. Bootstrapping and computer intensive techniques. Bootstrapping for assessing standard errors and confidence intervals, hypothesis testing and prediction errors.
Practical classes	Practical classes include practicing content of theoretical training, using appropriate software environment.

References		
	1	M. H. Kalos and P. A. Whitlock: Monte Carlo Methods (2nd ed.), Wiley-VCH, 2008
	2	C. P. Robert and G. Casella: Introducing Monte Carlo Methods with R, Springer, 2010
	3	J. S. Liu : Monte Carlo Strategies in Scientific Computing, Springer, 2001
	4	W.R. Gilks, S. Richardson and D. J. Spiegelhalter: Markov Chain Monte Carlo in Practice, Chapman and Hall/CRC Interdisciplinary Statistics, 1995

The number of contact hours per week during the semester / trimester / year				
Lectures	**Exercises**	**DON**	**Research work**	**Other classes**
2	2	----	------	------

Teaching methods	Lectures, exercises, writing the seminar papers, individual work

Evaluation of knowledge (maximum score 100)			
Pre exam duties	**points**	**Final exam**	**points**
Activity during lectures	5	**Oral exam**	40
Activity during exercises	5		
colloquia	20		
seminars	30		