Course	**ESSENTIAL MATHEMATICS FOR POLITICAL SCIENCE**			
	Type	Semester	ECTS	Code
	(E)	IV	4	
Course instructor **Course assistant** **Course tutor**				
Goals and objectives	Mathematics for Political Science is a field that has been developed and applied since the very dawn of both disciplines, Mathematics and Political Science. Its introduction in the Political Science curricula with the UBT reflects our growing awareness of the role of quantitative methods in developing and applying social knowledge. Therefore, we will try to take a somehow more informal approach, and present a review of the basic mathematical concepts that underlie most quantitative analysis in the social sciences. After an analytic geometry, we will continue with algebra, reviewing sets and combinations, culminating with matric algebra. Then we will discuss scalar calculus, including limits and continuity, as well as an introduction to differential calculus and later vector calculus. We will continue with probability theory and its applications, including random variables and probability functions. We culminate this course with a mathematical discussion of multivariate functions and stochastic processes. All in all, a successful completion of this course will make way easier for students to take a course in statistical methods for social sciences. We apply every single mathematical case in real social settings with a total of 83 examples driven from sociology, political science, anthropology, psychology, public policy, communications and geography. Many of our examples are built on real data from Kosovo, the region and the world. The goal is not only to teach students to apply mathematic principles and practices, but also to introduce the way that social science researchers use these tools. This is an approach that will give this course the needed relevance.			
Learning outcomes	Upon successful completion of this course 1. Students will be able to have the sufficient skills to successfully tackle exercises in an undergraduate course in statistics as well as graduate courses in econometrics, statistics and game theory. 2. Students would be inspired and enabled to write diploma thesis with mathematical and/or statistical modelling. 3. Students will be able to follow up graduate studies with methodologically quantitative departments. 4. Students will be inspired and enables to undertake future studies in data-oriented disciplines and research related to political big data. 5. Students will be able to apply mathematical methods to respond social queries; 6. Students will be able to apply some simple forms of mathematical modelling in social settings; 7. Students will appropriate a stronger sense of social research as SCIENCE rather than as PHILOSOPHY.			
	Weekly plan			**Week**
	Week 1. The basics: Essential arithmetic principles; indexing and referencin specific mathematical use of terms, functions and equations, applying functions an the equation of a line; factorial functions, modulo functions, polynomial function logarithms and exponents; applications.			1

Content	**Week 2.** Analytic geometry: Radial measurement and polar coordinate trigonometry; radian measures for trigonometric functions; conic sections and som analytical geometry; applications. • Turn in homework 1	2
	Week 3.Linear algebra: Working with vectors; vector norms; matrixes, simple an special; controlling the matrix; matrix transportation; special matrix form vectorization of matrixes; applications. • Turn in homework 2	3
	Week 4.Linear algebra continued: Matrix structure; space and time; the trace an determinants of matrix; matrix rank; matrix norms; matrix inversion; linear systems equations; eigen-analysis of matrices; quadratics forms and description applications. • Turn in homework 3	4
	Week 5. Elementary scalar calculus: limits and lines; understanding rates, change and derivatives; derivative rules for common functions; basic algebraic rules f derivatives; derivatives of logarithms and exponents; L'Hospital's rule; application Rolle's theorem and mean value theorem; • Turn in homework 4	5
	Week 6. Understanding areas, slices and integrals; rienamm integrals; th fundamental theorem of calculus; integration polynomials with antiderivative indefinite integrals; integrals involving logarithms and exponents; integration by part • Turn in homework 5	6
	Week 7. Calculus of trigonometric functions; derivatives of trigonometric function integrals of trigonometric functions; applications. Midterm exam	7
	Week 8. Additional topics in scalar and vector calculus: partial derivatives derivatives and partial derivatives of higher order; maxima, minima and root finding evacuating zero-derivative points; root finding with Newton-Raphson. • Turn in homework 6	8

	Week 9. Multidimensional integrals; finite and infinite series; convergence; the calculus of vector and matrix forms; vector function notation; differentiation and integration of a vector function; constrained optimization; applications. • Turn in homework 7	9
	Week 10. Probability theory: counting rules and permutations; the binomial theorem and Pascal's Triangle; sets and operations on sets; general characteristics of sets; the empty set; operations on sets; the probability function; calculations with probabilities; conditional probability and Bayes Law; Simpson's paradox; independence; odds; applications. • Turn in homework 8	10
	Week 11. Random variables: levels of measurement; distribution functions; randomness of variables; probability mass functions; Bernoulli Trials; Binomial experiments; Poisson counts; the culminative distribution function, discrete and continuous; • Turn in homework 9	11
	Week 12. Probability density functions; exponential and gamma PDFs; normal PDF; the uniform distribution; measures of central tendency, mean, median and mode; measures of dispersion, variance, standard deviation and MAD; • Turn in homework 10	12
	Week 13. Correlation and covariance; expected value; some handy properties and rules; inequalities based on expected values; moments of distribution; applications.	13
	Course Summary: Reflection, Review,	14
	• Final exam	15

Teaching methods	**Activity**			**Weight (%)**
	9. Lectures			20%
	10. Seminars			20%
	11. Lab work			20%
	12. Problem-based learning			40%
Evaluation methods	**Grading breakdown**	**Number**	**Week**	**Weight (%)**
	- Midterm exam	1	7	25%
	- Final exam	1	14	25%
	- Homework	10	2, 3, 4, 5, 6, 8, 9, 10, 11, 12	50%
	Tools			**Number**
	- Classroom			1

Sources and concretization means	- Laboratory - Moodle - Software MATLAB - Projector		1
Load and activities	**Type of activity**	**Week hours**	**Total weight**
	13. Lectures	2	30
	14. Seminars	1	15
	15. Lab work		
	16. Independent study	--	30
	17. Exams		
	18. Homework	--	25
Literature/references	Jeff Gill. 2006. *Essential Mathematics for Political and Social Research.* Cambridge: Cambridge University Press.		
Contact			