Course title: Basic Mathematics for Economics			
Course code: UEO 102	**No. of credits:** 4	**L-T-P:** 45-15-0	**Learning hours:** 60
Pre-requisite course code and title: UEO 103, Introductory Mathematical Methods for Economics or UDS 103, Mathematics for Data Science			
Department: Department of Policy and Management Studies			
Course coordinator: Dr. Malvika Tyagi	**Course instructor:** Dr. Priyanka Arora		
Contact details: priyanka.arora@terisas.ac.in			
Course type: Core	**Course offered in:** 2nd Semester		

Course description:
This course is a second course on mathematical methods for economics. The course will cover functions of more than one variable, vector spaces, convex analysis, unconstrained optimization, and constrained optimization with equality constraints.

Course objective:

1. To familiarize the students with the core concepts and techniques of mathematics that are used in economics.
2. To apply these techniques in economic applications.
3. To build analytical and technical skills and develop mathematical sophistication.

Course contents

S.N.	Topics	L	T	P
1	**Functions of multiple variables.** Introduction to functions of more than one variable, domain and range, graph and level curves, continuity, differentiability, partial derivatives and their properties, higher-order partial derivatives, Hessian matrix, Young's theorem, homogeneous functions, homothetic functions, Euler's theorem, linear approximations, implicit function theorem Economic applications including utility analysis, production analysis, and elasticity of substitution.	9	3	
2	**Vector spaces and quadratic forms.** Introduction to vector spaces, linear independence and dependence, inner products, norms, metric, eigen values. Introduction to quadratic forms, semi-definiteness and definiteness.	9	3	
3	**Convex analysis.** Convex sets, hyperplanes, cones, concave and convex functions, and their properties.	7	3	
4	**Unconstrained optimization with multiple variables.** Introduction to unconstrained optimization, first-order conditions, local optima, global optima, saddle points, second-order condition. Economic applications including profit maximization under perfect competition	10	3	

	and monopolist problem.			
5	**Constrained optimization with equality constraints.** Introduction to constrained optimization with equality constraints, theorem of Lagrange, first- and second-order conditions, method of Lagrange, Weierstrass theorem, comparative statics, Envelope theorem. Economic applications including utility maximization, cost minimization, cake-cutting problem, and exchange economy problem.	10	3	
	Total	**45**	**15**	

Pedagogical approach:
Classroom teaching and problem-solving sessions.

Evaluation criteria:
Minor 1: Written Examination - 30% [Syllabus: 1-2, Learning outcomes: 1-4]
Minor 2: Homework - 30%
Major: Written Examination - 40% [Syllabus: Complete course, Learning outcomes: 1-5]

Learning outcomes:
At the end of the course, the students will be able to:

1. Understand the ideas of core mathematical concepts. [Modules 1-5]
2. Apply the techniques learned during the course in economic problems. [Modules 4-5]
3. Provide economic interpretations of some of the key concepts and results. [Modules 4-5]
4. Graphically analyze economic and mathematical problems, wherever possible. [Modules 1,3]
5. Optimize functions of multiple variables. [Modules 4-5]

Core reading:

1. K. Sydsaeter and P. Hammond. "Mathematics for Economic Analysis" (2016) (SH)

Additional readings:

2. A. Chiang. "Fundamental Methods of Mathematical Economics" (2017)
3. M. Hoy, J. Livernois, C. McKenna, R. Rees, T. Stengos. "Mathematics for Economics" (2016) (HLKRS)

Module-wise chapters:

1. Module 1: SH: Chapter 15, Sections 15.1-15.7; Chapter 16
2. Module 2: SH; Chapter 14, Sections 14.1-14.5, Chapter 15, Section 15.8, HLKRS: Chapter 10
3. Module 3: SH: Chapter 17, Sections 17.5-17.8, 17.10
4. Module 4: SH: Chapter 17, Sections 17.1-17.4, 17.8, HLKRS: Chapter 12
5. Module 5: SH: Chapter 18, Sections 18.1-18.2, 18.4-18.7, HLKRS: Chapter 13

Course prepared by: Dr. Sanyyam Khurana

Student responsibilities:
Attendance, feedback, discipline: as per university rules.

Course reviewers:

1. Naveen Joseph Thomas. Associate Professor, Jindal School of Government and Public Policy, O.P. Jindal Global University.
2. Niti Khandelwal Garg. Associate Professor, Kirori Mal College, University of Delhi.