

<b>Course title:</b> Basic Mathematics for Economics				
<b>Course code:</b> UEO 102		<b>No. of credits:</b> 4	<b>L-T-P:</b> 45-15-0	<b>Learning hours:</b> 60
<b>Pre-requisite course code and title:</b> UEO 103, Introductory Mathematical Methods for Economics or UDS 103, Mathematics for Data Science				
<b>Department:</b> Department of Policy and Management Studies				
<b>Course coordinator:</b> Dr. Sanyyam Khurana			<b>Course instructor:</b>	
<b>Contact details:</b> sanyyam.khurana@terisas.ac.in				
<b>Course type:</b> Core			<b>Course offered in:</b>	
<b>Course description:</b> 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.				
<b>Course objective:</b>				
<ol style="list-style-type: none"> <li>1. To familiarize the students with the core concepts and techniques of mathematics that are used in economics.</li> <li>2. To apply these techniques in economic applications.</li> <li>3. To build analytical and technical skills and develop mathematical sophistication.</li> </ol>				
<b>Course contents</b>				
S.N.	Topics	L	T	P
1	<b>Functions of multiple variables.</b>  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	<b>Vector spaces and quadratic forms.</b>  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	<b>Convex analysis.</b>  Convex sets, hyperplanes, cones, concave and convex functions, and their properties.	7	3	
4	<b>Unconstrained optimization with multiple variables.</b>  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	<p><b>Constrained optimization with equality constraints.</b></p> <p>Introduction to constrained optimization with equality constraints, theorem of Lagrange, first- and second-order conditions, method of Lagrange, Weierstrass theorem, comparative statics, Envelope theorem.</p> <p>Economic applications including utility maximization, cost minimization, cake-cutting problem, and exchange economy problem.</p>	10	3	
	<b>Total</b>	<b>45</b>	<b>15</b>	
<p><b>Pedagogical approach:</b> Classroom teaching and problem-solving sessions.</p>				
<p><b>Evaluation criteria:</b> 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]</p>				
<p><b>Learning outcomes:</b> At the end of the course, the students will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the ideas of core mathematical concepts. [Modules 1-5]</li> <li>2. Apply the techniques learned during the course in economic problems. [Modules 4-5]</li> <li>3. Provide economic interpretations of some of the key concepts and results. [Modules 4-5]</li> <li>4. Graphically analyze economic and mathematical problems, wherever possible. [Modules 1,3]</li> <li>5. Optimize functions of multiple variables. [Modules 4-5]</li> </ol>				
<p><b>Core reading:</b></p> <ol style="list-style-type: none"> <li>1. K. Sydsaeter and P. Hammond. "Mathematics for Economic Analysis" (2016) (SH)</li> </ol> <p><b>Additional readings:</b></p> <ol style="list-style-type: none"> <li>2. A. Chiang. "Fundamental Methods of Mathematical Economics" (2017)</li> <li>3. M. Hoy, J. Livernois, C. McKenna, R. Rees, T. Stengos. "Mathematics for Economics" (2016) (HLKRS)</li> </ol>				
<p><b>Module-wise chapters:</b></p> <ol style="list-style-type: none"> <li>1. Module 1: SH: Chapter 15, Sections 15.1-15.7; Chapter 16</li> <li>2. Module 2: SH; Chapter 14, Sections 14.1-14.5, Chapter 15, Section 15.8, HLKRS: Chapter 10</li> <li>3. Module 3: SH: Chapter 17, Sections 17.5-17.8, 17.10</li> <li>4. Module 4: SH: Chapter 17, Sections 17.1-17.4, 17.8, HLKRS: Chapter 12</li> <li>5. Module 5: SH: Chapter 18, Sections 18.1-18.2, 18.4-18.7, HLKRS: Chapter 13</li> </ol> <p><b>Course prepared by:</b> Dr. Sanyyam Khurana</p>				
<p><b>Student responsibilities:</b> Attendance, feedback, discipline: as per university rules.</p>				
<p><b>Course reviewers:</b></p>				

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2. Niti Khandelwal Garg. Associate Professor, Kirori Mal College, University of Delhi.