



शिक्षा मंत्रालय
MINISTRY OF
EDUCATION



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GIAN Course on
CONVEXITY AND DUALITY IN OPTIMIZATION PROBLEMS
ARISING IN MICROECONOMIC THEORY

Course Code: 2700099

(August 18-28, 2025)

Department of Mathematics, Institute of Science
Banaras Hindu University, Varanasi 221 005, India

Overview

The aim of this short course is to show the role of convexity in production theory and consumer theory and the duality theorems it yields. In production theory, expenditure functions will be fully characterized, and their duality relationship with a certain class of quasiconcave production functions will be developed. In consumer theory, the utility maximization problem will be analyzed, and the duality relationship between direct and indirect utility functions will be shown. The course will conclude with a discussion on the monotonicity of demand, presenting old and new results on conditions on the consumer utility function that imply monotonicity of demand, which, in economic terms, means the law of demand, stating that the demand for a good decreases when its price increases; it is well known that this law fails in many natural situations.

Objectives

The primary objectives of the course are as follows:

1. Complete characterizations of the expenditure function for both utility representations and preference structures.
2. Duality between direct and indirect utility functions under minimal hypothesis.
3. Discussion on the monotonicity of demand, presenting old and new results on conditions on the consumer utility function in economic terms.

Modules	<p>A. Convexity, optimality and duality B. production theory and consumer theory C. duality relations under quasiconcavity D. Cost, production and demand functions</p> <p>Number of participants for the course will be limited to fifty (50).</p>
You Should Attend If...	<ul style="list-style-type: none">▪ B.Sc./B.Tech./M.Sc./M.Tech./Ph.D. students of Mathematical Sciences and allied disciplines working in the field of optimization and related topics.▪ Faculty members or research scientists interested to learn application of optimization in your profession.▪ Professionals from industry want to work with different aspects of convexity and duality in optimization techniques.

Fees	<p>The participation fees for taking the course is as follows:</p> <p>Participants from abroad: US \$300</p> <p>Professionals from Industry/ Research Organizations: INR 6,000</p> <p>Faculty from Academic Institutions: INR 4,500</p> <p>Postdoctoral Fellow/Research Associate: INR 3,000</p> <p>B.Sc./M.Sc./Ph.D. Students: INR 2,000</p> <p>The payment details will be shared after the confirmation of the participation.</p>
Accommodation	The participants will be provided with accommodation, if requested, on payment basis.
Certificate	Participation Certificate will be provided to all the registered participants.
Registration	<p>Last date for registration: July 31, 2025</p> <p>Registration Link: https://forms.gle/hawq3PeKzp1cdA3E9</p>
Contact details:	<p>Dr. Vivek Laha</p> <p>Course Coordinator</p> <p>Department of Mathematics, Institute of Science, Banaras Hindu University, Varanasi 221005, India</p> <p>E-mail: laha.vivek333@gmail.com, Mob.: +91 78001 40307</p>

The Faculty



Prof. Juan Enrique Martinez-Legaz is an emeritus professor at the Department of Economics of the Universitat Autònoma de Barcelona (UAB). He received his Ph.D. degree in Mathematics from the Universitat de Barcelona (UB) in 1981. After working as an associate professor at UB, he moved to UAB in 1990, where he was appointed full professor in 1993. He was the Editor-in-Chief of the journal Optimization (Taylor & Francis) during the period 2006-2012. He belongs to the editorial boards of several journals, including the Journal of Convex Analysis, the Journal of Global Optimization, the Journal of Optimization Theory and Applications, Minimax Theory and its Applications, Operations Research Forum, Optimization, and TOP-Transactions in Operations Research. His research interests include convexity and its generalizations, monotone operators, optimization theory, and mathematical economics. In 2011, he was appointed EUROPT Fellow as well as doctor honoris causa of the Universidad Nacional de Ingeniería (Lima, Peru). He has written more than 180 research articles and supervised 7 Ph.D. students of both Mathematics and Economics. He served as a member of more than 25 Editorial boards and 52 near about Conference Committees. He has organized 16 Conferences and Workshops and delivered 150 talks at various Conferences and Workshops. He was the Chairman of the Working Group on Generalized Convexity in the period 2000-2002. Juan Enrique Martínez Legaz is a member of MOVE since its creation in 2009.

Personal webpage: <http://pareto.uab.es/jemartinez/>

Google Scholar Link: <https://scholar.google.es/citations?user=uu3CxmQAAAAJ&hl=es>

The Course Coordinators



Dr. Vivek Laha is currently working as an Assistant Professor (Stage II) at the Department of Mathematics, Institute of Science, Banaras Hindu University (BHU), Varanasi, India. He completed his M.Sc. and Ph.D. in Mathematics from BHU in 2009 and 2014, respectively. His research interests lie in the fields of multiobjective optimization, vector variational inequalities, generalized convexity, nonsmooth analysis, mathematical programs with vanishing/equilibrium/switching constraints, semi-infinite optimization, robust optimization, etc. He has published research articles in several international journals of repute, co-authored various book chapters and co-edited a book published by Springer Verlag, Singapore. He has presented his research work in international events at various universities, including Future University Hakodate, Hakodate, Japan; National Taiwan University of Science and Technology (Taiwan Tech), Taipei, Taiwan; Vietnam Institute for Advanced Study in Mathematics (VIASM), Hanoi, Vietnam; Southampton University, UK; Heidelberg University, Germany; Polytechnic School of Engineering of Gijón, Gijon, Spain. He has received the NBHM Postdoctoral Fellowship, CSIR-UGC Senior and Junior Research Fellowships, CSIR Foreign Travel Grant, DST-Purse Foreign Travel Grant, SERB Travel Grant etc. He has been the principal investigator of a project sponsored by the UGC Start-up Grant. Recently, he has been awarded the Global Experience Faculty Program Fellowship by the Institute of Eminence, BHU to visit Universitat Autònoma de Barcelona, Spain to work on a joint research project with Prof. Juan Enrique Martinez-Legaz. He is an active member of the Working Group on Generalized Convexity, International Society on Multiple Criteria Decision Making, and the Bilevel Optimization Society.

Personal webpage: https://bhu.ac.in/Site/FacultyProfile/2_156?FA000107

Google Scholar Link: <https://scholar.google.co.in/citations?user=K83s9QQAAA&hl=en>



Prof. S.K. Mishra is currently working as a Senior Professor at the Department of Mathematics, Institute of Science, Banaras Hindu University, Varanasi, India. He is a leading expert in the field of optimization with ample teaching and research experience of more than 24 years. He has authored ten books, including textbooks and monographs, and has been on the editorial boards of several important international journals. He has guest edited special issues of the Journal of Global Optimization; Optimization Letters (both Springer Nature) and Optimization (Taylor & Francis). He has received INSA Teacher Award 2020 from Indian National Science Academy, New Delhi and DST Fast Track Fellow 2001 from Ministry of Science and Technology, Government of India. Prof. Mishra has published over 203 research articles in reputed international journals and supervised 22 Ph.D. students. He has visited around 15 institutes/ universities in countries such as France, Canada, Italy, Spain, Japan, Taiwan, China, Singapore, Vietnam, and Kuwait. His current research interest includes mathematical programming with equilibrium, vanishing and switching constraints, invexity, multiobjective optimization, nonlinear programming, linear programming, variational inequalities, generalized convexity, integral inequalities, global optimization, nonsmooth analysis, convex optimization, nonlinear optimization, and numerical optimization.

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