A Short Course on "Convex Optimization and Its Applications to 6G Communications"

15th - 17th December 2026

Course Overview

Convex optimization is a fundamental tool for the analysis and design of modern wireless communication systems. This course introduces convex sets, convex functions, convex optimization problems, Lagrange duality, and optimality conditions, with emphasis on recognizing, formulating, and solving optimization problems arising in 6G wireless networks. Practical examples include power allocation, multiple access, and emerging antenna architectures. Applications to NOMA/NGMA and pinching-antenna systems illustrate how convex optimization and convex approximation can facilitate next-generation wireless system design.

Short Course on Convex Optimization Is Ideal For

- **PhD students and postdocs** working in wireless communications, signal processing, optimization, NOMA/NGMA, and emerging 6G technologies.
- **UG/PG students** seeking a strong foundation in convex optimization and its applications to modern wireless communication systems.
- **Faculty members and academic researchers** interested in optimization-based modelling, resource allocation, and next-generation wireless system design.
- **Industry engineers and R&D professionals** working on power allocation, beamforming, multiple access, QoS, and optimization problems in wireless networks.
- **Researchers in NOMA/NGMA and emerging antenna systems** interested in applying convex reformulation and approximation techniques to advanced communication-system design.

Course Pre-requisite: Participants should have basic knowledge of linear algebra, calculus, probability, digital/wireless communications, and basic MATLAB programming.

Benefits From This Course

By end of the course, participants will :

- Understand convex sets, convex functions, and convex optimization problems.
- Learn problem formulation, duality, and KKT optimality conditions.
- Apply optimization to power allocation, resource allocation, and 6G wireless networks.
- Explore optimization for NOMA/NGMA and pinching-antenna systems.
- Gain hands-on MATLAB/CVX experience in solving practical optimization problems.
- Develop skills in convex reformulation and successive convex approximation for advanced wireless-system design.

Course Coordinator and Instructor



Prof. Vimal Bhatia,
EE, IIT Indore,
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Registration Fees (incl GST):
Students of IIT Indore : Free
Students outside IITI : ₹ 2,000/-
Faculties and Industrial personnel outside IITI : ₹ 4,000/-
Last date for registration is 12th December 2026 and acceptance are on first-come-first basis.

Scan QR Code to Register

Course Instructors



Prof. Zhiguo Ding
(NTU Singapore)

Registration link
Register at: https://forms.gle/HLja5yPiHH28aZheA or scan QR code.
For more information, please contact at: vbhatia@iiti.ac.in
Website: https://sites.google.com/view/signalsoftware/sasg/

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SPARC
Scheme for Promotion of Academic and Research Collaboration

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Three Day Short Course on

Convex Optimization and Its Applications to 6G Communications

From : 15th December to 17th December 2026
Venue : IIT Indore or Online

Daily Schedule

Date	Time	Topics
15th December	Morning	1. **Course Inauguration** 2. **Introduction to Convex Optimization and 6G Wireless Networks:** • Optimization variables, objective functions, and constraints • Applications to power allocation, beamforming, resource allocation, multiple access, and emerging antenna systems
	Afternoon	1. **Convex Sets:** • Convex combinations, affine sets, hyperplanes, halfspaces, balls, cones, and PSD cones • Wireless feasible-region examples 2. **Convex Functions:** • Convex/concave functions and optimality conditions • Jensen's inequality and composition rules • Rate, power, and SINR examples
16th December	Morning	1. **Convex Optimization Problems:** • Linear, quadratic, SOCP, and semidefinite programming • Epigraph/equivalent transformations • Wireless problem reformulation and introduction to CVX
	Afternoon	1. **Duality and Optimality Conditions:** • Lagrangian, duality, Slater's condition, and KKT conditions • Applications to wireless resource allocation and power control 2. **Applications to NOMA/NGMA and Pinching-Antenna Systems:** • Power allocation, QoS, fairness, and sum-rate optimization • Antenna activation and positioning • Convex reformulation and successive convex approximation
17th December	Morning	1. **MATLAB/CVX for Convex Optimization:** Formulation and solution of linear, quadratic, and constrained convex optimization problems. 2. **Optimality Verification using KKT Conditions:** Numerical verification and interpretation of optimal solutions using MATLAB/CVX. 3. **NGMA/NOMA Power Allocation:** Optimization of transmit power under power-budget and user-QoS constraints.
	Afternoon	1. **Performance Analysis of NGMA Systems:** Study the impact of channel conditions, QoS requirements, and power budgets through simulations. 2. **Design of Pinching-Antenna Systems:** Develop an optimization-based pinching-antenna design. Investigate antenna activation/positioning and power allocation, and implement convex reformulation or successive convex approximation algorithms

Key Features

- Hybrid format: In-person + live virtual participation for broader participation from academia, research, and industry.
- Three-day intensive course: Structured sessions covering convex optimization fundamentals, duality, KKT conditions, and applications to 6G wireless networks.
- Application-focused learning: Dedicated coverage of NOMA/NGMA power allocation, QoS optimization, resource allocation, and pinching-antenna system design.
- Hands-on MATLAB/CVX training: Practical implementation of convex optimization, optimality verification, NGMA performance analysis, and successive convex approximation techniques.