

Module Code	TGI_M05
Module Title	Optimization based congestion control and networking
Host Institution/ Contact	NUI Maynooth, Oliver Mason
Pre-requisites	First courses in convex optimization, linear systems and probability. However, all of the important mathematical concepts will be reviewed in class.
ECTS	5
Chief Examiner	Prof R. Srikant, University of Illinois at Urbana-Champaign
Teaching Staff	
Delivery	Teaching methods: 24 hours of lectures, together with guided study assignments
Aims	<ul style="list-style-type: none"> • To present the basic concepts of communication networks analysis and algorithms using optimization, control and stochastic network techniques, and to provide students with the background required to pursue independent research in these topics. <p>Target audience: first and second year PhD students in Engineering and the Mathematical Sciences.</p>

Syllabus	<ol style="list-style-type: none"> 1) A Quick Review of Convex Optimization 2) Network Utility Maximization 3) Notions of Fairness 4) A Quick Review of Dynamical Systems and Stability Theory 5) Primal/Dual Congestion Control Algorithms 6) Relationship to Network Protocols 7) TCP Protocols and Non-Negative Matrices 8) A Quick Review of Discrete-Time Markov Chains 9) Large Deviations and Effective Bandwidths 10) Switch Scheduling: Throughput-Optimal Algorithms and Complexity Issues 9) Cellular Networks: Opportunistic Scheduling and Throughput Optimality 10) Distributed Scheduling Algorithms for Ad Hoc Wireless Networks 11) Back to Network Utility Maximization: Decomposition, Layered Architecture and Cross-Layer Design
Assessment	<p>Assessment: one 2-hour examination</p>
Bibliography	<p>R. Srikant and L. Ying, "Communication Networks" Lecture Notes, 2010.</p>