Applied Game Theory Syllabus

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Title	***APPLIED GAME THEORY***
Course Website	***http://home.iitk.ac.in/~adityaj/EE698A_2012/***
Objectives	Game theory is a branch of Mathematical Economics that studies strategic interactions amongst rational decision makers. Traditionally, game theoretic tools have been applied to solve problems in Economics, Business, Political Science, Biology, Sociology, Computer Science, Logic, and Ethics. In recent years, applications of game theory have been successfully extended to several areas of engineered / networked system such as wireline and wireless communications, static and dynamic spectrum auction, social and economic networks. This course is intended to provide students with a comprehensive treatment of game theory with specific emphasis on applications in Economics and Engineering.
Aim	The aim of this course is to introduce students to the novel concepts of Game Theory with special emphasis on its applications in diverse fields and current research.
Grades and Evaluation	Grades will be based on participation and your performances in two quizzes, one mid-term, and one final exam [Quiz (2): 20%, Tut: 15%, Midterm: 25%, Final: 40%]. Your participation grade will depend on your performances in tutorials. You will be given weekly assignments. We encourage you to work with your group members and other students. At the same time, it is important for you that you master the material.
Contents	Introduction: Chap 1 in IGT[1]
	Games with Perfect Information: Chap 2, 3.1, and 3.2 in IGT 1. Strategic Games Sec 2.1-2.5 in IGT, 2.1:Concepts, 2.2-2.5:Examples. 2. Nash Equilibrium and Existence Properties Sec 2.6 to 2.9 in IGT. 3. Market Equilibrium and Pricing: Cournotand BertrandGame[b] Sec 3.1-3.2 in IGT Games with Perfect Information Continued : Chap 3.3 in IGT 4. Electoral Competition: Median Voter Theorem Sec 3.3 in IGT 5. Auctions: Definitions and The role of Knowledge Sec 3.5 in IGT and Chap 2 in AT[2]

	Decision Making and Utility Theory: Chap 27 in SG[3]
	Mixed Strategy Equilibrium: Chap 4 in IGT
	Extensive Form Game with Perfect Information: Chap 5 and 6 in IGT 1. Theory 2. Stackelberg Model of Duopoly 3. Buying Votes 4. Committee Decision-Making
	Repeated games: Chap 14 and 15 in IGT 1. The Prisoner's Dilemma 2. General Result
	Supermodular Game and Potential Game: Website 1[4] and GTWE[5] 1. Supermodular Game and Potential Game 2. Wireless Networks: Resource Allocations, Admission Control, Routing in Sensor and Ad-Hoc Networks, Modeling Network Traffic and Strategic Network Formation. a. CDMA Power Control b. Network Admission Control
	Strategic Games With Imperfect Information: Chap 9 from IGT 1. Bayesian Games 2. Cournot's Duopoly with Imperfect Information 3. Radio Spectrum, With Arbitrary Distribution of Valuations
	Extensive Games With Imperfect Information: Chap 9 from IGT 1. Theory 2. Signaling Games
	Bargaining : Chap 16 in IGT 1. Rubinstein Bargaining Model with Alternating Offers 2. Nash Bargaining Solution 3. Relation of Axiomatic and Strategic Model 4. Two Illustrations: a. Trade in market b. Bargaining in Wireless Network

	Auction and Mechanism Design with Applications - I Chap 3,4, and 5 in AT 1. Revenue Equivalence: Chap 3 in AT 2. Risk Averse Bidders: Chap 4 in AT 3. Asymmetries among Bidders: Chap 4 in AT 4. Mechanism: Chap 5 in AT 5. Optimal Mechanism: Chap 5 in AT Auction and Mechanism Design with Applications - II 6. Efficient Mechanism: Vickrey-Clarke-Groves Auction: IITD Website[6], Sec 23.8 and 23.9 in HV[7] 7. Dynamic Spectrum Auction in Cognitive Radio Networks: Gandhi[8] 8. Mechanisms in Networking: Chap 19 and 20 in EK[9]
References	1. (IGT) Martin Osborne, *An Introduction to Game Theory*, Oxford University Press, 2003 2. (AT) Vijay Krishna, *Auction Theory*, Academic Press. 3. (SG) PrajitDutta, *Strategies and Games*, MIT Press 4. (Website 1) http://www.ece.stevens-tech.edu/~ccomanic/ee800c.html 5. (GTWE) Allan MacKenzie, *Game Theory for Wireless Engineers*, Synthesis lectures on Communications, 2006 6. (IITD Website) 7. (HV) Hal Varian, *Microeconomic Analysis*, Norton 8. (Gandhi) Gandhi et.al.,Towards Real-Time Dynamic Spectrum Auctions by Gandhi