

**OBJECTIVES:**

- To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory, and the main applications for which they are appropriate, including electronic trading markets.
- To formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in modeling applications.
- To draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues.
- To introduce contemporary topics in the intersection of game theory, computer science, and economics.
- To apply game theory in searching, auctioning and trading.

**UNIT I INTRODUCTION****8**

Introduction – Making rational choices: basics of Games – strategy – preferences – payoffs – Mathematical basics –Game theory –Rational Choice – Basic solution concepts-non-cooperative versus cooperative games – Basic computational issues – finding equilibria and learning in games-Typical application areas for game theory (e.g. Google’s sponsored search, eBay auctions, electricity trading markets).

**UNIT II GAMES WITH PERFECT INFORMATION****10**

Games with Perfect Information – Strategic games – prisoner’s dilemma, matching pennies- Nash equilibria- theory and illustrations – Cournot’s and Bertrand’s models of oligopoly- auctions- mixed strategy equilibrium- zero-sum games- Extensive Games with Perfect Information-repeated games (prisoner’s dilemma)- subgame perfect Nash equilibrium; computational issues.

**UNIT III GAMES WITH IMPERFECT INFORMATION****9**

Games with Imperfect Information – Bayesian Games – Motivational Examples – General Definitions –Information aspects – Illustrations – Extensive Games with Imperfect –Information – Strategies- Nash Equilibrium – Beliefs and sequential equilibrium – Illustrations – Repeated Games – The Prisoner’s Dilemma – Bargaining

**UNIT IV NON-COOPERATIVE GAME THEORY****9**

Non-cooperative Game Theory – Self-interested agents- Games in normal form – Analyzing games: from optimality to equilibrium – Computing Solution Concepts of Normal-Form Games – Computing Nash equilibria of two-player, zero-sum games –Computing Nash equilibria of two-player, general-sum games – Identifying dominated strategies

**UNIT V MECHANISM DESIGN****9**

Aggregating Preferences-Social Choice – Formal Model- Voting – Existence of social functions – Ranking systems – Protocols for Strategic Agents: Mechanism Design – Mechanism design with unrestricted preferences- Efficient mechanisms – Vickrey and VCG mechanisms (shortest paths) – Combinatorial auctions – profit maximization Computational applications of mechanism design – applications in Computer Science – Google’s sponsored search – eBay auctions – K-armed bandits.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon Completion of the course, the students will be able to**

- Discuss the notion of a strategic game and equilibria and identify the characteristics of main applications of these concepts.
- Discuss the use of Nash Equilibrium for other problems.
- Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real world situation.
- Identify some applications that need aspects of Bayesian Games.
- Implement a typical Virtual Business scenario using Game theory.

**REFERENCES:**

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2. M. Machler, E. Solan, S. Zamir, "Game Theory", Cambridge University Press, 2013
3. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani (Editors), "Algorithmic Game Theory" Cambridge University Press, 2007.
4. A. Dixit and S. Skeath, "Games of Strategy", Second Edition, W W Norton & Co Inc, 2004.
5. Yoav Shoham, Kevin Leyton-Brown, "Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations", Cambridge University Press 2008.
6. Zhu Han, Dusit Niyato, Walid Saad, Tamer Basar and Hjongnnes, "Game Theory in Wireless and Communication Networks", Cambridge University Press, 2012.
7. Y. Narahari, "Game Theory and Mechanism Design", IISC Press, World Scientific.

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**CP5071****ADHOC AND WIRELESS SENSOR NETWORKS****L T P C  
3 0 0 3****OBJECTIVES:**

- To learn about the issues in the design of wireless ad hoc networks.
- To understand the working of protocols in different layers of mobile ad hoc and sensor networks.
- To expose the students to different aspects in sensor networks.
- To understand various traffic generators and models for sensor networks.
- To understand various security issues in ad hoc and sensor networks and solutions to the issues.

**UNIT I                      FUNDAMENTALS AND ROUTING PROTOCOLS OF WIRELESS AD HOC NETWORKS                      9**

Introduction – Applications of Mobile Ad Hoc Networks (MANETs) – Medium Access Control Layer – Topology Control – Routing Protocols – Broadcasting – Multicasting – Internet Connectivity for MANETs – Security in MANETs - Scenario Based Performance Analysis of Various Routing Protocols in MANETs