Uka Tarsadia University

B. Tech.

CSE / CSE (CC) / CE (SE)

Semester VII

Program Elective - VI

GAME THEORY

CE6017

EFFECTIVE FROM July-2024

Syllabus version: 1.00

Subject Code	Subject Title
CE6017	Game Theory

Teaching Scheme				Examination Scheme				
Hours		Credits		Theory Marks		Practical Marks		Total Marks
Theory	Practical	Theory	Practical	Internal	External	Internal	External	
4	0	4	0	40	60	0	0	100

Objectives of the course:

- To provide elementary knowledge and understanding of the modeling of strategic solutions with context to Game Theory.
- To interpret how the existence, stability and characteristics of an equilibrium outcome depend on parameters and elements of a strategic situation.
- To increase analytical thinking and tackle variety of real world problems.

Course outcomes:

Upon completion of the course, the student shall be able to,

CO1: Familiarize with game theory tools, equilibrium concepts.
CO2: Identify and understand pure strategy equilibrium in game theory contexts along with the decision making procedures.
CO3: Understand strategic decision-making with the imperfect information.
CO4: Understand the Nash Bargaining Solution within the Bargaining Model.
CO5: Develop skills to design mechanism related to auction applications.
CO6: Analyze the requirements of network based games including strategic network formation and network admission control.

Sr. No.	Topics	Hours
	Unit – I	
1	**Introduction:** What is game theory? The theory of rational choice. **Games with Perfect Information Strategic Games:** Examples of strategic games, Nash equilibrium and existence, Best response functions, Dominated actions, Cournot's model, Bertrand's model, Electoral competition – Median voter theorem, Auctions – Definitions and the role of knowledge.	10
	Unit – II	

2	**Mixed Strategy Equilibrium:** Decision making and utility theory, Mixed strategy equilibrium, Pure equilibrium, Extensive form game with perfect information, Stackelberg model of duopoly, Buying votes, Committee decision-making, Repeated games – The prisoner's dilemma, General result.	12
Unit – III		
3	**Strategic Games with Imperfect Information:** The Bayesian games, Cournot's duopoly with imperfect information, Radio spectrum, with arbitrary distribution of valuations extensive games with imperfect information, Signaling games.	8
Unit – IV		
4	**Bargaining:** Bargaining model with alternating offers – Nash bargaining solution, Relation of axiomatic and strategic model two illustrations – Trade in market, Bargaining in networks.	8
Unit – V		
5	**Auction and Mechanism Design with Applications:** Revenue equivalence, Risk averse bidders, Asymmetries among bidders, Mechanism, Optimal mechanism, Auction and mechanism design with applications - II, Efficient mechanism.	10
Unit – VI		
6	**Supermodular Game and Potential Game:** Supermodular Game and potential game, Wireless networks – Resource allocations, Admission control, Routing in sensor and Ad-Hoc networks, Modeling network traffic and strategic network formation – CDMA power control, Network admission control.	12

Text book:

1. Martin Osborne, "An Introduction to Game Theory", Oxford University Press, 2003.

Reference books:

1. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010.
2. Martin Osborne and Ariel Rubinstein, "A course in Game Theory", PHI, 2016.
3. Allan MacKenzie, "Game Theory for Wireless Engineers", Synthesis lectures on Communications, 2006.
4. Praji Dutta, "Strategies and Games, (SG)", MIT Press.

Course objectives and Course outcomes mapping:

- To provide elementary knowledge and understanding of the modeling of strategic solutions with context to Game Theory: CO1, CO2.

- To interpret how the existence, stability and characteristics of an equilibrium outcome depend on parameters and elements of a strategic situation: CO3, CO4.
- To increase analytical thinking and tackle variety of real world problems: CO5, CO6.

Course units and Course outcomes mapping:

Unit No.	Unit Name	Course Outcomes					
		CO1	CO2	CO3	CO4	CO5	CO6
1	Introduction and Games with Perfect Information Strategic Games	✓					
2	Mixed Strategy Equilibrium		✓				
3	Strategic Games with Imperfect Information			✓			
4	Bargaining				✓		
5	Auction and Mechanism Design with Applications					✓	
6	Supermodular Game and Potential Game						✓

Programme outcomes:

PO 1: Engineering knowledge: An ability to apply knowledge of mathematics, science, and engineering.

PO 2: Problem analysis: An ability to identify, formulates, and solves engineering problems.

PO 3: Design/development of solutions: An ability to design a system, component, or process to meet desired needs within realistic constraints.

PO 4: Conduct investigations of complex problems: An ability to use the techniques, skills, and modern engineering tools necessary for solving engineering problems.

PO 5: Modern tool usage: The broad education and understanding of new engineering techniques necessary to solve engineering problems.

PO 6: The engineer and society: Achieve professional success with an understanding and appreciation of ethical behavior, social responsibility, and diversity, both as individuals and in team environments.

PO 7: Environment and sustainability: Articulate a comprehensive world view that integrates diverse approaches to sustainability.

PO 8: Ethics: Identify and demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.

PO 9: Individual and team work: An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give/receive clear instructions.

PO 11: Project management and finance: An ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: recognition of the need for, and an ability to engage in life-long learning.

Programme outcomes and Course outcomes mapping:

Programme Outcomes	Course Outcomes					
	CO1	CO2	CO3	CO4	CO5	CO6
PO1						
PO2		✓	✓			
PO3					✓	
PO4				✓		✓
PO5	✓					✓
PO6						
PO7						
PO8						
PO9						
PO10						
PO11						
PO12						