FIRST SEMESTER 2023-2024

COURSE HANDOUT

11.08.2023

In addition to Part-I (General Handout for all courses appended to the timetable), this portion gives further specific details regarding the course.

Course No.	**: BITS F314**
Course Title	**: Game Theory & Its Applications**
Instructor-in-charge	**: Vivekananda Mukherjee**

1. Scope and Objective: The breadth of Economics mesmerizes some and astonishes many. While studying such a vast subject that draws upon a plethora of branches of knowledge, one needs not just one or two skills but a set of skills that should be an eclectic blend of tools and techniques from various branches of knowledge. Game Theory is such a tool and stands as a beautiful mix of mathematics, economics, and psychology.

Game theory is concerned with strategic decision making and it is used to analyze strategic interactions in diverse settings. The foundation of Game Theory was laid by John von Neumann, who in 1928 proved the basic minimax theorem, and with the publication (co-authored with Oskar Morgenstern) of the Theory of Games and Economic Behavior in 1944, the field was established. Game Theory became central to the economics field with the coveted Nobel Memorial Prize in Economic Sciences going to John Nash. One of his contribution, Nash equilibrium, has found applications in really wide range of settings. Its applications are not just limited to economics or business studies, it is widely used in political science, international relations, biology, computer science, etc. Game theoretic analysis is used to explain our behavior in day- to-day life like traffic jams, couples planning an outing, etc.; firm's behaviors like marketing strategies, pricing and output (quantity as well as quality) decisions, etc.; countries' behaviors like arming, nuclear policies, peace talks, etc.

Games are a convenient way in which to model the strategic interaction among the self-interested agents. Broadly, Game Theory can be divided into cooperative and non-cooperative game theory. Typically, a game is cooperative if the players are allowed to communicate and make binding agreements, they work as coalitions. In the non-cooperative game theory, player can't make binding agreements, they act independently, and we only deal with self-enforceable contracts. The course deals with non-cooperative games only.

Objective:
1. The main objective of this course is to introduce Game Theory as a tool of logical thinking to the students.
2. Students will learn the basics of game theory and strategic behavior with real life applications.
3. We will be Illustrating with the help of examples how the theory can be applied in various contexts.
4. Game Theory would equip the students with an understanding and analytical perspective toward real life situations like market behavior, voting patterns and outcome, investment decisions etc.
5. World is becoming more and more complex. To analyze and understand such a complex world, student need better analytical tools and game theory is one such tool. The learnings can be applied to areas such as competitive policy, designing and implementing incentives, regulations, auctions etc., just to name a few.

2. Text Book:

   i.   **Gibbons, R. (1992): Game Theory for Applied Economists, Princeton University Press.**

   ii. **Osborne, M. J. (2004): An Introduction to Game Theory, Oxford University Press, India.**

3. Reference Books:

   i.   **Osborne M. J. and A. Rubinstein (1994): A Course in Game Theory, The MIT Press, Cambridge: MA.**

   ii. **Dixit, A. and B. Nalebuff (1993): Thinking Strategically, W. W. Norton & Company.**

   iii. **Aliprantis Charalambos D. and Subir K. Chakrabarti (2000): Games and Decision Making, Oxford University Press.**

   iv. **Samuel Bowles (2005): Microeconomics: Behavior, Institutions, and Evolution, Oxford University Press.**

   v.   **Charles A. Holt (2019): Markets, Games, and Strategic Behavior: An Introduction to Experimental Economics, Princeton University Press.**

4. Course Plan:

Topic	No. of Lectures	Learning Objectives	Topics to be Covered	Chapter in the Text Book
1	01-03	Introduction	1. What is Game Theory? 2. Theory of rational choice	Chapter 1 (TB ii), Notes
2	04-21	Simultaneous move games of complete information	1. Normal form representation of games 2. Solution Concepts: Iterated elimination of strictly dominated strategies, Nash equilibrium 3. Mixed strategies 4. Applications	Chapter 1 (TB i) Chapter 2,3,4 & 12 (TB ii), Notes
3	22-34	Sequential move games of complete information	1. Extensive form representation of games 2. Games of perfect information 3. Games of imperfect information 4. Solution Concepts: backward induction, Nash equilibrium, sub-game perfect Nash equilibrium 5. Repeated games: finitely and infinitely repeated games 6. Applications	Chapter 2 (TB i) Chapter 5,6,14 & 15 (TB ii), Notes
4	35-42	Games of incomplete information	1. Simultaneous move games: Bayesian Nash equilibrium 2. Sequential move games: Perfect Bayesian equilibrium 3. Applications	Chapter 3 &4 (TB i) Chapter 9 (TB ii), Notes

5. Learning Outcomes:

Topic 1: Introduction
The students are introduced to the idea of rational thinking in the case of strategic interaction. They will be exposed to modeling of games.

Topic 2: Simultaneous move games of complete information
The students learn the representation of simultaneous move games of complete information. The solution concepts are introduced for solving this type of game. Applications are discussed as illustrations.

Topic 3: Sequential move games of complete information
The students learn the representation of simultaneous move games of complete information. Different variants of such games like the games of perfect and imperfect information, repeated games are discussed. The solution concepts are introduced for solving this type of game. Applications are discussed as illustrations.

Topic 4: Games with Incomplete Information
The games of incomplete information both in the simultaneous move and sequential move setting are introduced. Students learn about the solution concepts for solving these games.

6. Evaluation scheme:

Component	Duration	Weightage (%)	Date and Time	Nature of Component
Mid-semester exam	90 minutes	30	11/10 - 11.30 - 1.00PM	**CB**
Quiz		30		**OB**
Comprehensive examination	180 minutes	40	12/12 AN	**CB**

7. Chamber Consultation Hour: To be announced in the class

8. Notices: Notices, if any, would be put on CMS.

9. Make-up Policy: Make-up will be granted only on genuine grounds and if prior permission is taken through official email only. Request for make-up after the test/exam would not be entertained at all.

10. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-Charge
BITS F314

innovate   achieve   lead