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| <b>LNMIIT, Jaipur</b><br><b>Department of Computer Science &amp; Engineering</b> | <br><b>LNMIIT</b><br>The LNM Institute of<br>Information Technology |
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|--|---|--------------------------------|---------------------------------|-----------------------------------|
| <b>Programme:</b><br>B.Tech. (CSE)         | <b>Course Title:</b><br>Introduction to Game Theory |                                |                                 | <b>Course Code:</b><br>CSE-XXX    |
| <b>Type of Course:</b><br>Program Elective | <b>Prerequisites:</b><br>DMS                        |                                |                                 | <b>Total Contact Hours:</b><br>40 |
| <b>Year/Semester:</b><br>3/Even            | <b>Lecture Hrs/Week:</b><br>3                       | <b>Tutorial Hrs/Week:</b><br>0 | <b>Practical Hrs/Week:</b><br>0 | <b>Credits:</b><br>3              |

### Learning Objective:

Game theory is a way to mathematically model and analyze situations and evaluate different strategies in those situations. This course introduces game theory to the students. Participants learn the fundamental concepts of game theory. They learn about different types of games. They learn about different possible strategies. They learn about different types of equilibria. They learn how to map a real life scenario on to an appropriate game and find the equilibrium. They learn about different applications of game theory.

### Course outcomes (COs):

| On completion of this course, the students will have the ability to: |  | Bloom's Level |
|--|--|---------------|
| <b>CO-1</b>  | Understand what are games, strategy and equilibrium.   | 1, 2          |
| <b>CO-2</b>  | Understand different strategies  | 1, 2          |
| <b>CO-3</b>  | Understand well-known games.   | 1, 2          |
| <b>CO-4</b>  | Apply game theory on real life problems.   | 3             |
| <b>CO-5</b>  | Analyze the given situation to identify the potential games that are appropriate.                  | 4             |
| <b>CO-6</b>  | Identify the apt game to represent a given situation by comparing and contrasting different games. | 4             |

| Topics  | Contact Hours |
|---|---------------|
| <b>UNIT – I</b><br><b>Introduction</b>                  | 2             |
| 1.1 Introduction to the course and course outline       |               |
| 1.2 An outline of the history of game theory            |               |
| 1.3 John von Neumann and the theory of rational choice  |               |
| <b>UNIT – II</b><br><b>Preliminaries</b>                | 8             |
| 2.1 Strategic form games                                |               |
| 2.2 Preferences, Utilities, Rationality, Intelligence   |               |
| 2.3 Classification of games                             |               |
| 2.4 Illustrative examples of extensive form games       |               |
| 2.5 Transforming extensive form to strategic form games |               |

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| <b>UNIT – III</b>  |  |  |
| <b>Strategic form games</b>  |  |  |
| 3.1 Matching pennies with simultaneous moves   |  |  |
| 3.2 Rock-paper-scissors games  |  |  |
| 3.3 Bach or Stravinsky games   |  |  |
| 3.4 Prisoner's dilemma game  |  |  |
| 3.5 Company's dilemma game   |  |  |
| 3.6 Non-symmetric company's dilemma  |  |  |
| 3.7 Duopoly pricing game   |  |  |
| 3.8 Tragedy of the commons   |  |  |
| 3.9 Bandwidth sharing game   |  |  |
| 3.10 Sealed bid auction  |  |  |
| <b>UNIT – IV</b>   |  |  |
| <b>Dominant Strategy and pure strategy Equilibria</b>  |  |  |
| 4.1 Strong dominance, Weak dominance, Very weak dominance, Illustrations of dominant strategy equilibria                                   |  |  |
| 4.2 The notion of Nash equilibria, Illustrative examples of pure strategy Nash equilibrium, Games without a pure strategy Nash equilibrium |  |  |
| 4.3 Interpretations of Nash equilibrium, Existence of multiple Nash equilibria   |  |  |
| <b>UNIT - V</b>  |  |  |
| <b>Applications</b>  |  |  |
| 5.1 Strategic trade policy, Optimal Export subsidies, Subsidy wars   |  |  |
| 5.2 Property rights and efficiency, Undefined property rights, Well-defined property rights  |  |  |
| 5.3 Voting games, The naïve voting model, The strategic voting model, Other equilibria, The limits of rationality                          |  |  |

**References:**

**Text Book:**

1. Narahari, Yadati. *Game theory and mechanism design*. Vol. 4. World Scientific, 2014.
2. Osborne, Martin J. *An introduction to game theory*. Vol. 3. No. 3. New York: Oxford university press, 2004.
3. Bierman, H. Scott, and Luis Florentin Fernandez. "Game theory with economic applications." (1998).

**Books for General Reading:**

1. Rasmusen, Eric. *Games and information, an introduction to game theory*. Rasmusen, Erasmuse@indiana. edu., 2005.
2. Siegfried, Tom. *A beautiful math: John Nash, game theory, and the modern quest for a code of nature*. National Academies Press, 2006.
3. Sachs, Joel L., et al. "The evolution of cooperation." *The Quarterly review of biology* 79.2 (2004): 135-160.

| Evaluation Method |               |
|-------------------|---------------|
| Item              | Weightage (%) |
| Quiz/Assignments  | 20            |
| Midterm           | 30            |
| Final Examination | 50            |

\*Please note, as per the existing institute's attendance policy the student should have a minimum of 75% attendance. Students who fail to attend a minimum of 75% lectures will be debarred from the End Term/Final/Comprehensive examination.

#### CO and PO Correlation Matrix

| CO   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|
| CO 1 | 3    | 2    |      |      |      |      |      |      |      |       |       | 3     |       |       | 1     |
| CO 2 | 3    | 2    |      |      |      |      |      |      |      |       |       | 3     |       |       | 1     |
| CO 3 | 3    | 2    |      |      |      |      |      |      |      |       |       | 3     |       |       | 1     |
| CO 4 | 3    | 3    | 3    | 3    |      |      |      |      |      |       |       | 3     |       |       | 3     |
| CO 5 | 3    | 3    | 3    | 3    |      |      |      |      |      |       |       | 3     |       |       | 3     |
| CO 6 | 3    | 3    | 3    | 3    |      |      |      |      |      |       |       | 3     |       |       | 3     |

**Last Updated On: 23-12-2021**

**Updated By: Nirmal Kumar S**

**Approved By:**