Maharaja Surajmal Institute of Technology, New Delhi-110058

Department of CSE

Report on the Lecture by Prof. Koyel Datta Gupta on "Formal Logic and Reasoning"

Name of Organization	MSIT Janakpuri Delhi
Name of the Expert	Prof. Koyel Dutta Gupta
Date and Time	09-12-2024, 9:30 AM - 10:30 AM
Target Audience	MSIT Faculty
Organized by	Dr. Sapna, Dr Sangeeta, Dr. Kavita Sheoran
Attended Participants	23

Introduction:

On December 9, 2024, a lecture on "Formal Logic and Reasoning" was delivered by Prof. Koyel Datta Gupta. The lecture aimed to provide an in-depth understanding of formal logic, its principles, and its applications in reasoning. Prof. Datta Gupta's insightful discussion included various aspects of formal logic and how it serves as a foundation for clear and precise thinking in multiple disciplines, such as mathematics, computer science, and philosophy.

Key Highlights of the Lecture:

a. Overview of Formal Logic: Prof. Datta Gupta began by explaining the concept of formal logic as a system of reasoning that uses symbols and formal rules to deduce conclusions from

premises. Unlike informal logic, which relies on natural language and subjective interpretation, formal logic emphasizes rigor and precision.

She discussed the importance of formal systems in various academic and professional fields, noting how they help in structuring arguments, validating claims, and testing the validity of statements and propositions.

b. Types of Logic: Prof. Datta Gupta explored different types of formal logic, focusing on the following key categories:

- **Propositional Logic:** This is the branch that deals with propositions and their logical connectives, such as "and," "or," "not," and "if...then."
- **Predicate Logic:** This type extends propositional logic by introducing quantifiers like "for all" (∀) and "there exists" (∃), allowing more complex structures to be expressed.

c. Logical Reasoning and Inference: Prof. Koyel emphasized how formal logic provides tools for valid reasoning. She elaborated on different types of inference, including:

- **Deductive Inference:** Where the conclusion necessarily follows from the premises. If the premises are true, the conclusion must be true.
- **Inductive Inference:** In contrast to deductive reasoning, inductive inference leads to conclusions that are likely but not guaranteed based on the premises.
- **Abductive Inference:** A form of reasoning that involves drawing the most plausible explanation for a set of observations, often used in scientific discovery and everyday reasoning.

d. Truth Tables and Logical Operations: The lecture included an interactive session where Prof. Gupta demonstrated how truth tables work in propositional logic. She explained how to evaluate the truth or falsity of logical statements by constructing truth tables for different logical connectives.

e. Formal Proofs: Prof. Datta Gupta walked the audience through the structure of formal proofs in logic. She explained how proofs serve as systematic arguments that establish the truth of a statement, starting from axioms and using rules of inference to derive conclusions. This was particularly useful for the students in understanding how formal proofs work in mathematics and computer science.

Applications of Formal Logic:

Prof. Koyel highlighted several real-world applications of formal logic and reasoning:

- **Computer Science & AI:** Logic is foundational in fields like artificial intelligence, programming languages, and software engineering, where logical proofs are used for verifying algorithms and ensuring correctness.
- **Mathematics:** Formal logic is integral to mathematics, especially in proof theory and set theory, where it is used to establish the validity of mathematical theorems.

Challenges in Formal Logic:

While formal logic provides a rigorous framework, Prof. Gupta acknowledged the challenges that come with its application:

- **Complexity in Human Reasoning:** While formal logic is precise, human reasoning often involves informal and heuristic methods, which may not always conform to logical structures.
- **Limits of Formal Systems:** She also discussed Gödel's incompleteness theorem, which shows that certain systems cannot prove all truths within their own framework, highlighting the inherent limitations of formal logic.

Conclusion:

Prof. Koyel Datta Gupta concluded the lecture by reiterating the importance of mastering formal logic as a powerful tool for clear thinking and rational argumentation. She encouraged

the attendees to engage with logical problems actively and apply the principles of formal reasoning in their academic and professional pursuits.

This lecture proved to be an enriching experience for the attendees, enhancing their understanding of formal logic and its crucial role in structured thinking and reasoning.

Team FDP/Seminar/Workshop