



Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2023-2024

Course Handout Part II

Date: 11-08-2023

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : CS F214
Course Title : Logic in Computer Science
Instructor-in-Charge : Sameera Muhamed Salam
Instructors : Prof Tathagata Ray, Dr. Venkatakrisnan Ramaswamy
Chamber : H107

Scope and Objective of the Course:

Logic plays a fundamental role in computer science. The course covers topics in propositional logic – syntax, semantics, satisfiability and validity, predicate or first order logic – syntax, semantics, satisfiability & validity, completeness & compactness, Undecidability & incompleteness. The course also deals with verification by model checking, linear-time temporal logic (LTL) and computational tree logic (CTL). Other topics that will be briefly touched upon include program verification using Hoare logic and proofs of correctness. Modal logic and logic programming are also introduced.

The objective of the course is to

- Describe basic notions of logic that are important in computer science.
- Describe the significance of different logical representations such as propositional and predicate logic in computer science
- Impart proof writing skills
- Enable them to write proofs for program verification.

Textbooks:

1. Huth, Michael, and Ryan, Mark, **Logic in Computer Science**, 2e, Cambridge University Press, 2004.

Reference books

1. Ben-Ari, Mordechai, **Mathematical Logic for Computer Science**, 2e, Springer, 2003.
2. Enderton, Herbert B. **A Mathematical Introduction to Logic**, 2e, Academic Press, 2001.
3. John Kelly, **the Essence of Logic**, Prentice-Hall India, Eastern Economy Edition, 1997.
4. I. M. Copi, **Symbolic Logic**, Prentice-Hall India, reprint of 1979 edition by Macmillan.
5. Clocksin-mellish, **programming in prolog**, 5e, Springer, 2003.



Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1	Introduction to the course	Introduction: Course overview, Introduction to logic.	Chapter 1
2-10	Understanding Propositional Logic, Proof rules for inferring formulas, and Normal forms	Propositional logic: Declarative sentences, Deductive systems, Propositional logic as a formal language, Semantics, Normal forms	Chapter 1
11-20	Understanding Predicate Logic, differences with propositional logic, Proof theory, semantics of predicate logic.	Predicate logic: Limitations of propositional logic, Predicate logic as a formal language, Proof theory, Semantics, Satisfiability & validity, Completeness & compactness, Undecidability & incompleteness	Chapter 2
21-23	Learning logic programming using prolog	logic programming paradigm: Overview of logic programming paradigm, Propositional logic programming, First order logic programming, Prolog	Notes
24-28	Understanding total correctness proofs and verifying program correctness.	Various approaches to program verification: Overview of program verification, Framework for software verification, Hoare logic, Proofs of correctness	Chapter4.
29-34	Understanding linear-time temporal logic, Model Checking tools, planning problems.	Various approaches to verification: Need for verification, Approaches to verification, Verification by model checking, Temporal Logic, LTL, Limitations of LTL, CTL & CTL*	Chapter 3
35-40	Extending the modes of truth, How to represent the basic modal logic using Kripke's formulation.	Role of modal logic in computer science: History of modal logic Syntax & semantics, Kripke's Formulation of Modal Logic, Logic engineering, Knowledge in multi-agent systems	Chapter 5

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Midterm	90 Mins	25%	14/10 - 2.00 - 3.30PM	Closed Book
Quizzes(2)	Will be announced	10%	16/09 2 PM, 18/11 2 PM	Closed Book
Assignments		20%	On or before 02/12	Open Book
Comprehensive Exam	3 hrs	45%	21/12 FN	Closed Book



Chamber Consultation Hour: Tuesday 5.00 p.m. to 6.00 p.m.

Notices: All notices related to the course will be displayed on CSIS notice board only and will be announced in class.

Make-up Policy: Makeup is highly discouraged for this course. Makeup will be given only in genuine cases and that too with prior notification only (after following ID rules). In case of medical emergency, you have to produce a letter from chief warden approving it. In any case, the discretion to give makeup for tests lies with IC.

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

Dr. Sameera Muhamed Salam

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