Birla Institute of Technology & Science, Pilani - K K Birla Goa Campus
First Semester: 2012-2013
Course Handout (Part II)

In addition to Part -I (See the current *Bulletin*) this portion gives further details pertaining to the course.

Course No. : **CS-IS F214**
Course Title: **Logic in Computer Science.**
Instructors: **RAMPRASAD JOSHI, Durgesh Samant.**
Course Description:

Introduction to study of logic as a branch of mathematics and computer science; Propositional Logic, Predicate Logic; Formulas, Models, Tableaux; Deductive Systems, Resolution, Binary Decision Diagrams; Axiomatic Systems, Soundness, Completeness; Logic Programming; Applications of Logic to Programming Languages, Semantics, Verification, and Formal Specification; Introduction to Temporal and Nonmonotonic Logics; Applications of Logic to Set Theory and Arithmetic; Connections between Logic, Computation, and Algebra; Introduction to Decidability and Computability Issues and Results.

1. Scope & Objective:

This course aims at introducing the student to a systematic study of logic encountered in computer science and finite mathematics. One semester study of the material should equip the student to verify, understand, and construct proofs, avoid fallacies, use automated and semi-automated reasoning and logic programming tools, study classical artificial intelligence, understand the issues of decidability and computability and the connections between algebra, logic, computation. It also aspires to kindle a longer lasting interest in the study of logic as a branch of philosophy. The course is a preparation for the more specific theory of computation, at the same time introducing tools and techniques that the latter brought to fruitful use in programming languages and verification.

2. Text Book:

T1.   Mordechai Ben-Ari. *Mathematical Logic* for *Computer Science* (2/e). Springer, Indian Reprint 2005.

3. Reference Books:

R1.   Yu. I. Manin. (Neal Koblitz, Translator, First Edition, and collaboration by B. Zilber). *A Course in Mathematical Logic for Mathematicians.* Springer, New York, 2009.

R2. Herbert B. Enderton. *A Mathematical Introduction to Logic* (2/e). Elsevier, Indian Reprint, 2012.

4. Course Plan:

Sr#	Module	Topic	Ref
1	I, Intro	Introduction: History, role, concerns and questions of logic	Notes, R1 Preface, R2 Preface
2	I	The need for formalization, differences between mathematical reasoning and daily reasoning	Notes
3,4	I	The importance of symbolic logic for computation, communication, sharing of information	Notes, Boole's "Laws of Thought"

5	I	Essential elements of formal languages	Notes
6	I	Propositional and predicate logics: introduction	T1 1.1-1.3
7-11	II, PropL	Propositional Logic: Basic definitions	T1 2.1-2.5
12-14	II	Propositional Logic: Semantic Tableaux	T1 2.6
14-15	II	Propositional Logic: Soundness, Completeness	T1 2.7
16-18	II	Propositional Logic: Deductive Systems	T1 3.1-3.7
19	II	Propositional Logic: Switching circuits, other implementations; Induction and Recursion revisited	Notes, R2 1.4
20-22	II	Propositional Logic: Resolution; Implementation in LISP and Prolog	Notes, T1 4
23-25	II	Propositional Logic: Binary Decision Diagrams, SAT Solvers	T1 5-6
26-28	III, PredL	Predicate Logic: Definition of first order languages, formulas, models, tableaux	R1 I, T1 7
29-31	III	Predicate Logic: Deductive Systems	T1 8
32-33	III	Predicate Logic: Resolution; Implementation	Notes, T1 10
34-35	III	Logic Programming; Introduction to Temporal Logic	Notes, T1 11, 13
36-40	IV, Computability	Undecidability, Computability, and the Relation between Logic, Computation, Algebra.	Notes, T1 12, R1 VI-VII

5. Evaluation Scheme:

#	Component	Weightage	Date	Time	Remark
1	Test-1	25%	17/09/12	1030-1130	Partly Open Book*
2	Test-2	25%	30/10/12	1030-1130	Partly Open Book*
3	Compre	40-50%	12/12/12	AN (1400-1700)	Partly Open Book*
4	Assignments & Tutorials	0-10%	Declared from time to time in class. Throughout the semester.		Open Book

*What material is allowed will be declared from time to time.

6. Chamber Consultation: Wednessday 1130-1300 hrs.

7. Announcements: Be alert in the class during lectures and tutorials. The course site on `photon` may also be used. Arrange for your own alerts when you are away from the campus. For assignments and other announcements about evaluation, the onus is on students to keep up-to-date information. No concessions for your lack of alertness will be given.

8. Make-up Policy: No make-up for family functions and other engagements which are planned by your family. Choose to attend only those functions, the dates of which are fixed taking *your* institute timetable into consideration. The timetable is decided and declared at the beginning of the semester, so **no** make-up requests for anything planned aside will be entertained. Only contingency cases will be considered.

Instructor-In-Charge, CS C362