

Course No.	Course Name	L-T-P -Credits	Year of Introduction
CS367	Logic for Computer Science	3-0-0-3	2015
Pre-requisites <ol style="list-style-type: none">1. BE101-05 Introduction to Computing and Problem Solving2. CS205 Data Structures			
Course Objectives <ol style="list-style-type: none">1. <i>To introduce the concepts of mathematical logic and its importance.</i>2. <i>To discuss propositional, predicate, temporal and modal logic and their applications.</i>			
Syllabus <p>Propositional Logic, Resolution, binary decision diagrams, Predicate logic, resolution, temporal logic, deduction, program verification, modal logic.</p>			
Expected Outcome <p>Student is able to</p> <ol style="list-style-type: none">1. <i>Explain the concept of logic and its importance.</i>2. <i>Understand fundamental concepts in propositional logic and apply resolution techniques.</i>3. <i>Understand fundamental concepts in predicate logic and apply resolution techniques.</i>4. <i>Understand fundamental concepts in temporal logic and apply resolution techniques.</i>5. <i>Understand the concept of program verification and apply it in real-world scenarios.</i>6. <i>Understand fundamental concepts in modal logic.</i>			
Text Books <ol style="list-style-type: none">1. Modechai Ben-Ari, Mathematical Logic for Computer Science, Springer, 3/e, 2102.2. Arindhama Singh, Logics for Computer Science, Prentice Hall India, 2004.			
Reference <ol style="list-style-type: none">1. Michael Huth, Mark Ryan, Logic in Computer Science: Modeling and Reasoning about Systems, Cambridge University Press, 2005.			

Course Plan			
Module	Contents	Hours	Sem. Exam Marks %
I	<p>Introductory Concepts: Mathematical Logic, Propositional Logic, First Order Logic, Modal and Temporal logic, Program Verification. (Reading: Ben-Ari, Chapter 1)</p> <p>Propositional Logic: Formulae and interpretations, Equivalence, Satisfiability & Validity, Semantic Tableaux, Soundness and Completeness. (Reading: Ben-Ari, Chapter 2 except 2.4, Additional Reading : Singh, Chapter 1)</p>	06	15%
II	<p>The Hilbert Deductive System, Derived Rules, Theorems and operators, Soundness and Completeness, Consistency. (Reading: Ben-Ari, Chapter 3 except 3.7 and 3.8, Additional Reading : Singh, Chapter 1)</p> <p>Resolution in Propositional Logic: Conjunctive Normal form, Clausal form, resolution rule. (Reading: Ben-Ari, Chapter 4.1, 4.2, 4.3, Additional Reading : Singh, Chapter 1)</p>	06	15%
FIRST INTERNAL EXAM			
III	<p>Binary Decision Diagrams: Definition, Reduced and ordered BDD, Operators. (Reading: Ben-Ari, Chapter 5.1 - 5.5)</p> <p>Predicate Logic: Relations, predicates, formulae and interpretation, logical equivalence, semantic tableaux, soundness. Reading: Ben-Ari, Chapter 7.1-7.6, Additional Reading : Singh, Chapter 2)</p>	07	15%
IV	<p>The Hilbert deduction system for predicate logic. Functions, PCNF and clausal form, Herbrand</p>	08	15%

	model.Resolution in predicate logic: ground resolution, substitution, unification, general resolution. Reading: Ben-Ari, Chapter 8.1-8.4, 9.1, 9.3, 10.1-10.4, Additional Reading : Singh, Chapter 2, Chapter 3)		
SECOND INTERNAL EXAM			
V	Temporal logic: Syntax and semantics, models of time, linear time temporal logic, semantic tableaux. Deduction system of temporal logic. (Reading: Ben-Ari, Chapter 13.1-13.5, 14.1-14.2)	07	20%
VI	Program Verification: Need for verification, Framework for verification, Verification of sequential programs, deductive system, verification, synthesis. (Reading: Ben-Ari, Chapter 15.1-15.4, Additional Reading : Singh, Chapter 5) Modal Logic: Need for modal logic, Case Study: Syntax and Semantics of K, Axiomatic System KC, (Reading: Singh, Chapter 6.1-6.3)	08	20%
END SEMESTER EXAM			

Assignments

Some of the assignments can be given on an interactive theorem prover like Isabelle or Coq.

Question Paper Pattern

1. There will be *five* parts in the question paper - A, B, C, D, E
2. Part A
 - a. Total marks : 12
 - b. Four questions each having 3 marks, uniformly covering modules I and II;
Allfour questions have to be answered.
3. Part B
 - a. Total marks : 18

