

CSE541 LOGIC for COMPUTER SCIENCE

Spring 2025

Professor Anita Wasilewska

Course Webpage:

<http://www3.cs.stonybrook.edu/~cse541>

Time: Tuesday, Thursday 6:30 pm - 7:50 pm

Place : Old CS 2129

Professor Anita Wasilewska

e-mail anita@cs.stonybrook.edu

Office phone (631) 632 8458

Office location: New Computer Science Department, NC208

Professor Office Hours: Tuesday, Thursday 4:00 pm - 5:00 pm and by Appointment.

I also read emails daily and respond within a day - two to students e-mails.

Teaching Assistants tba on BrightSpace

TAs office hours: tba

TA Office Location 2126 Old CS Building

Course Goal

The goal of the course is to make student understand the need of, and to learn the formality of logic. The book, and the course is developed to teach not only intuitive understanding of different logics, but (and mainly) to teach formal logic as scientific subject, with its language, definitions and problems.

I will progress relatively slowly, making sure that the pace is appropriate for the students in class. The book is written with students on my mind so that they can read and learn by themselves, even before coming to class. For sure, it is also essential to study after the class.

Course TEXTBOOK

Anita Wasilewska

LOGICS FOR COMPUTER SCIENCE: Classical and Non - Classical

Springer Nature Switzerland AG 2018 2018

SBN 978-3-319-92590-5 ISBN 978-3-319-92591-2 (e-book)

<https://www.springer.com/us/book/9783319925905>

VIDEO LECTURES

We have a YOUTUBE CHANEL: **Logic, Theory of Computation.**

https://www.youtube.com/channel/UCLZp06JC9yit6M_YW3XuvIw

The first 4 Lectures are for the Theory of Computation, the **Logic Lectures** follow. The YOUTUBE CHANNEL contains set of VIDEOS filmed in **Stony Brook TV Studio** that cover Chapter 1 to Chapter 11 of the BOOK. Please use them as a supplement to my Lectures when you study at home.

COURSE WEBPAGE contains two sets of **Lectures SLIDES**.

L1. CLASS Lectures that are complementing the **Video Lectures**. CLASS Lectures are more detailed and contain many more examples and problems than the Videos Lectures. There are 3 - 5 CLASS Lectures for one Chapter of the book. i.e for one VIDEO Lecture. The Class Lectures contain a lot **examples** and carefully written detailed **solutions** for many of the problems you need to study for the tests.

L2. VIDEO Lectures are created especially for the Book Chapters VIDEOS so students can follow the **Video Lectures**, chapter by chapter, with exactly the same slides in hand that were used in the the VIDEOS.

Important

Students are responsible to be study and know **chapters examples and problems solutions** that are **not included in the Lectures Slides**. Tests problems will be the problems and examples with detailed solutions in the **Book Chapters** and previous tests solutions posted on the course webpage. Use them for extra practice.

We will cover Chapters 1 - 11 of the Textbook,

TESTING

All tests are will given in CLASS. The PRELIMINARY schedule is posted below and on the course webpage. Changes will be posted on the course webpage and on BrightSpace

MAKE - UP EXAMS PPLICY

The Course Policy on **make-up exams**, is consistent with university policy on Student Participation in University Sponsored Events, the policy on Final Exams and the New York State Education Law regarding Equivalent Opportunity and Religious Absences as defined in the UNDERGRADUATE BULLETIN
<https://www.stonybrook.edu/sb/bulletin/current/>

We would provide **make-up tests** in a case of legally documented health problems.

Specific arrangements will be made on a case-by-case basis

GRADING PRINCIPLES

TESTS are "closed book" - no cell phones, no computers, desks must be empty - no extra papers, no any form of communication with other students.

Professor supervises all tests together with course **TAs**. Anybody **violating** these rules would have to immediately submit the test to the **Professor** and **leave** the class.

Student will get **0pts** for the TEST and will be reported, if needed, to the University **Academic Judiciary**, as stated and explained the Syllabus' Academic Integrity Statement

The consistency of your efforts and work is the most important for this course.

WORKLOAD

There will be **2 Quizzes, Midterm**, and a **Final** examinations. We will also have some **EQuizzes** - Extra Credit , One Problem Quizzes for **(15 extra points) total** with dates advertised as they come. The consistency of your efforts and work is the most important for this course.

None of the grades will be curved

Tests and **Quizzes** cover Lectures and Book Chapters only for the portion of material that was **covered** in class before the dates of tests. Tests problems will be taken mainly from examples, exercises and problems solved in the Book and will also be similar to problems from previous Tests as published on the course Webpage.

GRADING COMPONENTS

2 Quizzes - 20pts each, 40pts total

EQuizzes - 20 extra points total

Midterm - (80pts)

Final - (80pts)]

Midterm will cover material from all Lectures given in class before Midterm. Final will cover mainly material Lectured after Midterm but there will be 1-2 questions from Midterm material.

FINAL GRADE COMPUTATION

You can earn up to 200 points + x extra credit points = (200 + x) points during the semester.

Extra points are beneficial for students as they add to the TOTAL number of points.

None of the grades will be curved

The grade will be determined in the following way:

of earned points divided by 2 = % grade.

The % grade is translated into a letter grade in a standard way i.e.

100 – 95 % is A, 94 – 90 is A–,

89 – 86% is B+, 85 – 83 % is B, 82 – 80 % is B–,

79 – 76 % is C+, 75 – 73 % is C, 72 – 70 % is C–,

69 – 60 % is D range and F is below 60%.

Records of students points are kept on BrightSpace. Contact course **TAs** for information about grading, grades changes, etc....

TESTS PRELIMINARY SCHEDULE

Changes, if any, will be posted on Brightspace and the course Webpage

EQuiz 1 Thursday, February 13 - extra credit Q1, more to be advertised in class

Quiz 1 Thursday, February 27 - regular Q1

MIDTERM Thursday, March 13

Spring Break March 17 - 21

Quiz 2 Thursday, April 17 - regular Q2

Last Class Thursday, May 8

FINAL - during the Finals Period May 13 - May 21

COURSE CONTENT

The course will follow the book very closely and in particular we will cover **some material** from the following chapters and subjects.

1. Paradoxes and Puzzles (Chapter 1). Book pages 1- 13.
2. Introduction to classical Logic (Chapter 2). Book pages 15- 63.
Propositional and predicate languages. AI languages. Basic propositional and predicate tautologies. Equational Laws for quantifiers.
3. Propositional Semantics: Classical and Many Valued (Chapter 3). Book pages 65- 143.
Formal propositional languages. Classical semantic: formal definitions of model, counter model, tautology. Equivalence of propositional languages, Some many valued semantics.
4. General Proof Systems: Syntax and Semantics (Chapter 4). Book pages 145 -177.
General definition and examples. Definition of a formal proof. Relationship between proof systems and their semantics. Definition of notions of *soundness* and *completeness* of a given proof systems relatively to given semantics. **Definition of a logic** as a complete proof system.
5. Hilbert Proof Systems: Completeness of Classical Propositional Logic (Chapter 5). Book pages 179 - 232.
Hilbert style proof systems for classical propositional logic. Proofs of the Deduction theorem, and two different proofs of the Completeness theorem.
6. Automated Proof Systems:Completeness of Classical Propositional Logic (Chapter 6). Book pages 233 - 302.
Automated Gentzen type proof systems: RS, RS1, RS2 for Classical logic. Examples of the automatic proof-search. Constructive proof of the Completeness Theorem. Original Sequent Gentzen proof systems GL, G, LK or Classical logic.. Completeness and Hauptatz Theorems.
7. Introduction to Intuitionistic and Modal logic (Chapter 7). Book pages 305 -316.
Hilbert and Gentzen style proof systems for Intuitionistic logic. Heuristic decision procedures. Relationship between Intuitionistic and Classical logics. Hilbert style proof systems for Modal logics S4 and S5. Relationships with Intuitionistic logic.
8. Classical Predicate Semantics and Proof Systems (Chapter 8). Book pages 349 - 397.
Formal Predicate Languages. Classical semantics. Predicate Tautologies, Hilbert proof systems. Completeness theorem.
9. Hilbert Proof Systems: Completeness of Classical Predicate Logic (Chapter 9). Book pages 401 -440.
Reduction of Predicate logic to Propositional logic. Proof of the Completeness Theorem.
10. Predicate Automated Proof Systems: Completeness of Classical Predicate Logic (Chapter 10). Book pages 441 - 485. Automated Gentzen type proof system QRS. Constructive proof of the Completeness Theorem.
11. Formal Theories and Gödel Theorems (Chapter 11). Book pages 489 -534.
Definition and examples of formal theories. Formal theory of Natural numbers PA (Peano Arithmetic). Consistency and Completeness of formal theories. Gödel Incompleteness Theorems.

SYLLABUS STATEMENTS

Basic Needs

If you are concerned about resources related to your basic needs, including access to nutritious food and stable housing, please contact the Student Support Team. They will be able to listen to your story, connect you with possible resources, and provide stigma-free support.

Academic Dishonesty

The following statement about academic dishonesty, is required to be included in syllabi for all undergraduate courses:

"Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at the academic judiciary website."

Be advised that any evidence of academic dishonesty will be treated with utmost seriousness. Those involved will be prosecuted to the fullest extent permitted by the University and College policies.

Student Accessibility Support Center Statement

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, 128 ECC Building, (631) 632-6748, or via e-mail at: sasc@stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Academic Integrity Statement Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Any suspected instance of academic dishonesty will be reported to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at <http://www.stonybrook.edu/uaa/academicjudiciary/>

Stony Brook University Syllabus Statement If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact Disability Support Services at (631) 632-6748 or <http://http://studentaffairs.stonybrook.edu/dss>. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website: <http://www.sunysb.edu/ehs/fire/disabilities.shtml>

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

SASC Student Accessibility Support Center

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Academic Technologies Statement

Academic Technologies has created optional statements that you can add to your syllabus that include support information for students who need to use tools that Stony Brook provides such as: Brightspace, Respondus Lockdown Browser, Digication, VoiceThread, and TurningTechnologies.

General IT help information is available at

<https://you.stonybrook.edu/academictechnologyservices/technology-statements-for-syllabi/>