Department of Electrical and Computer Engineering
EEO218 Digital logic design
Syllabus
Last updated August 22, 2023

Important Note: Every effort will be made to avoid changing the course schedule, but the possibility exists that unforeseen events will make syllabus changes necessary. It is your responsibility to check BrightSpace (BSpace) for corrections or updates to the syllabus. Any changes will be clearly noted in course announcements or through Stony Brook email.

Part 1: Course Information

Course title: Digital Logic Design

Course catalog # and section: EEO218, Sec 31

Credit hours: 3

Semester: Fall 2023

General education designation(s) (SBC): N/A

Prerequisites: Physics II or equivalent

Instructor name: Dmitri Donetski

Instructor's Stony Brook email, phone number, and time zone: dmitri.donetski@stonybrook.edu, 631-632-8411 (office)

Office hours: Tuesdays and Thursdays, 1PM-3PM EST, in Zoom accessed with the following link:

https://stonybrook.zoom.us/j/93433786494?pwd=QnZVQUFqSktsZnpiTWQyWkFUM2J5dz09

Meeting ID: 934 3378 6494
Passcode: 892092

Course Description: The course covers binary numbers, Boolean algebra, standard building blocks (multiplexers, decoders. arithmetic circuits, flip-flops), analysis and design of sequential circuits, memory and programmable logic.

Goal: Development of general background in theory and practical skills necessary for taking advanced courses.

Required Course Materials:

A laptop or desktop with a webcam for videoposts in Voicethread (VT) on BSpace and taking tests with proctoring under Respondus browser.

Recommended Reading:

M. Morris Mano, Michael D. Ciletti, "Digital Design with an introduction to the Verilog HDL…", Pearson, 6th or 5th edition. 6th ed: 2018, ISBN-10: 0134549899, 0134529561, ISBN-13:

9780134549897, 9780134529561, 5th ed.: 2013, ISBN-10: 0132774208, ISBN-13: 9780132774208.

Additional reading/Bibliography:

1. F. Vahid, Digital Design with RTL Design, VHDL, and Verilog, 2nd ed, 2010, ISBN-13: 9780470531082, ISBN10: 0470531088
2. D.M. Harris, S.L. Harris, Digital Design and Computer Architecture, 2nd ed., 2012, ISBN-13: 9780123944245, ISBN-10: 0123944244
3. J. Wakerly, Digital Design: principles and practices, with Verilog, 5th ed., 2017, ISBN-13: 9780134460093, ISBN-10: 013446009X

Course Delivery Mode and Structure:

This is an online version of the 1st course on design of digital systems offered on campus. All materials (lectures, assignments, instructions) will be posted on BSpace. Lectures will be posted daily on VoiceThread (VT) media tool by the end of the day (see the tentative schedule). Each lecture material is broken into 2-4 units. Each lecture unit covers a single topic. The units are 20 - 40 min long. The units on VT can be accessed with links on BSpace. Students are encouraged to post public or private video questions and comments on VT directly in the lecture units. Active participation in lectures and posting regular questions in lecture units is encouraged by granting 5 points. Students are requested to post a brief video introduction about background in electronics and career goals.

Course assignments include Quizzes and Homeworks. There will be 10 quizzes offered. Quizzes are posted few days in advance of due dates (see the semester schedule). Quiz materials can be discussed on VT in lecture units and in office hours before quiz due dates. A brief (limited to 2-3 min) video response to quiz questions should be recorded on BSpace asynchronously by the end of a due day EST. Student video responses to quiz questions will be reviewed and graded. Video responses to quiz questions on BSpace on VT make up to 20 % of the total score and the final grade, respectively. 10 Homework assignments (problems) will be posted on BSpace. Solutions should be handwritten on paper showing student work. The scanned/photographed images should be consolidated into a single file (for example, in MSWord), saved in a PDF format and uploaded to BSpace for grading. One can use electronic drawing tools. **For full credit each HW should be uploaded as a single PDF file.** Late HW are accepted with a 50 % penalty. No credits for HWs will be given after posting solutions. HW scores will make up to 40 % of the total score.

There will be two midterms and a final exam with a 35 % contribution to the total score.

Students must be mindful of all course expectations, deliverables and due dates, especially because the online portion of the course requires significant time management. All assignments and course interactions will utilize internet technologies. See “Technical Requirements” section for more information.

How We Will Communicate:

Course-related questions should be posted on VT. For personal/private issues please e-mail me directly. While most messages are responded quickly, **please allow up to 48 hours for an email reply.** Your Stony Brook University email must be used for all University-related communications.

You must have an active Stony Brook University email account and access to the Internet. All instructor correspondence will be sent to your SBU email account. **Plan on checking your SBU email account regularly for course-related messages.** To log in to Stony Brook Google Mail, go to http://www.stonybrook.edu/mycloud and sign in with your NetID and password.

Regular announcements will be posted on BSpace and automatically sent by email.

Regular communication is essential in online classes. Logging in once a day, checking the discussion board and participating with your peers ensures that you are able to remain an active member of the class and earn full points.

Technical Requirements:

This course uses BrightSpace for the facilitation of communications between faculty and students, submission of assignments, posting grades and collecting feedback.

If you are unsure of your NetID, visit https://it.stonybrook.edu/help/kb/finding-yournetid

https://it.stonybrook.edu/help/kb/finding-your-netid-and-passwordandpassword for more information. You are responsible for having a reliable computer and Internet connection throughout the term. **Caution!** You will be at a disadvantage if you attempt to complete all coursework on a smart phone. It may not be possible to submit the files required for your homework assignments.

Students should be able to use email, a word processor, spreadsheet program, and presentation software to complete this course successfully. The following list details a minimum recommended computer set-up and the software packages you will need to have access to and be able to use:

- PC with Windows 10 (recommended)
- Macintosh (with 8 GB RAM or higher to run Windows under VM or Parallels for EEO219)
- Intel Core i5 or higher
- 250 GB Hard Drive
- Latest version of Chrome or Firefox; Mac users may use Chrome or Firefox. (A complete list of supported browsers and operating systems can be found on the My Institution page when you log in to Blackboard.)
- High speed internet connection
- Word processing software (Microsoft Word is available to SBU students)
- Headphones/earbuds and a microphone (recommended)
- Webcam with a microphone (required)
- Printer (optional)
- Ability to download and install free software applications and plug-ins (note: you must have administrator access to install applications and plug-ins).

Technical Assistance:

If you need technical assistance at any time during the course or to report a problem with Blackboard you can:

- Phone: 631-632-9800 (client support, Wi-Fi, software and hardware)
- Submit a help request ticket: https://it.stonybrook.edu/services/itsm
- If you are on campus, visit the Walk-Up Tech Support Station in the Educational Communications Center (ECC) building.

Part 2: Course Learning Objectives and Assessments

Upon completion of the course, students will be able to:

1. understand fundamentals of analysis and design of digital circuits constructed from logic gates and standard building blocks;

2. read schematic and understand digital circuit functionality: obtain state diagram and output signal waveforms describing circuit behavior, estimate signal propagation delays and maximum clock frequency of synchronous circuits;

3. design combinational and sequential digital circuits from logic gates and standard building blocks using conventional methods.

How to Succeed in this Course:

- Create your study schedule ahead of deadlines and do your best effort to follow it. **Communicate with the instructor, ask questions.**
- Allocate more time than you expect you will need for course activities. How much time should students devote to an online course? Time on task information, see NY State Education Department: http://www.nysed.gov/college-university http://www.nysed.gov/college-university-evaluation/distance-education-programpoliciesevaluation/distanceeducation-program-policies

Part 3: Course Schedule (subject to changes)

	Mondays Quizzes due	**Fridays HW due**	Lecture topics in EEO218	Prelabs (simulations) and Lab experiments in EEO219	Pages, 6th ed.
1	**Lecture 1 8/28**	**Lecture 2 9/1**	Binary numbers, base conversion. Addition and subtraction. 2's complements. Logic operations and gates.	Installation of the Active-HDL. Ordering the lab kit and the logic analyzer/pattern generator	1-37
2	**No Lecture**	**Lecture 3 9/8 HW1**	Boolean algebra. Standard forms. Two-level implementations. Critical path, racing, static glitches	Prelab for Lab 1. Simulation in Active-HDL from Aldec	40-76

3	**Lecture 4** **9/11** **Quiz 1**	**Lecture 5** **9/15** **HW2**	Logic maps. Minimization. Form conversion. AOI and OAI implementations. Incompletely specified functions. Binary codes. Code converters	Lab 1. Board and logic analyzer. Propagation delays.	83-120
4	**Lecture 6** **9/18** **Quiz 2**	**Lecture 7** **9/22** **HW3**	Multiplexers, demultiplexers. Transmission gate. Implementation of switching functions with mutliplexers.	Lab 2. Two-level implementations	175-189, 625-637
5	**Lecture 8** **9/25** **Quiz 3**	**Lecture 9** **9/29** **HW 4**	Decoders, encoders. Implementation of switching functions with decoders. Reflective Gray codes. Parity bits. Codes for error detection and correction.	Lab 3. Design with multiplexers	121--140
6	**Lecture 10** **10/2** **Quiz 4**	**Midterm 1** **10/6**	Review. Design problems.	Lab 4. Design with decoders	156-170
7	**No Lecture**	**Lecture 11** **10/13**	Adders. Subtractors. Overflow detection.	No lab	Ch. 1-4 review
8	**Lecture 12** **10/16** **Quiz 5**	**Lecture 13** **10/20** **HW5**	CMOS static, dynamic, PTL implementations. Introduction to Verilog HDL. SR- and D—latches. Critical racing.	Lab 5. Encoder for flash ADC	246 -260
9	**Lecture 14** **10/23** **Quiz 6**	**Lecture 15** **10/27** **HW6**	Metastability. Setup time. CMOS Master–slave D-flip-flop. Preset and clear.	Lab 6. Adders	261-316, 326 -330
10	**Lecture 16** **10/30** **Quiz 7**	**Lecture 17** **11/3** **HW7**	Analysis and design of synchronous Finite State Machines. Mealy and Moore outputs.	Lab 7. Latches and flip-flops	352-365
11	**Lecture 18** **11/6** **Quiz 8**	**Lecture 19** **11/10** **HW8**	Max clock frequency. Counters. Registers. Register-based counters. Hang-up states. State decoding.	Lab 8. Sequence generator	430-540

12	**Lecture 21 11/13 Quiz 9**	**Lecture 22 11/17 HW9**	Register Transfer Level design. Datapath and controller. Algorithmic State Machine chart. Review. Design problems.	Lab 9. Counter	Ch. 4-8 review
13	**Midterm 2 11/20**	**No Lecture**		No lab	300-305
14	**Lecture 24 11/27**	**Lecture 25 12/1 HW10**	Serial Peripheral Interface. Inter-Integrated Circuit interface. Data scrambling. Cycling Redundancy Check.	Lab 10. Datapath and controller for ADC with serial output	378-424
15	**Lecture 26 12/4 Quiz 10**	**Lecture 27 12/8**	Field Programmable Gate Arrays. Flash, static, dynamic memories. Review for the final exam	Bonus for EEO219. Datapath and controller project (simulation only)	Assigned reading
			Final exam (TBA)		

Part 4: Grading, Attendance, and Late Work Policies

Viewing Grades on Blackboard: *VoiceThread Quizzes will be graded within 48 hours of closing each week. Submitted HW papers and midterm papers will be graded within 1 week of being submitted.*
In this course, you will be assessed on the following:

Activity/Assignment	**Points**	**Due date**
A brief video introduction on VoiceThread (bonus)	5	By the end of the 1st week, 11:59PM, EST
10 Quizzes (video responses to questions on BrightSpace)	20	See the course schedule, by the end of the day, EST
10 Homeworks (handwritten solutions uploaded to BSpace)	40	See the course schedule, by the end of the day, EST
Posting questions in lecture units on VoiceThread	5	Questions should be posted within a week of scheduled lecture units
Two Midterms (10 pts each) taken synchronously for 2 hours and final exam (15 pts) for 3 hours. All tests are taken with Respondus browser and a webcam recording.	35	Midterms: October 6 (Monday, 1-3PM), November 20 (Monday, 1-3PM), Final exam: TBA during the final exam week.

Letter Grades: Final grades assigned for the course will be based on the percentage of total points earned and are assigned as follows:

Letter Grade	Points or Percentage
A	>90
A-	89-85
B+	84-80
B	79-75
B-	74-70
C+	69-65
C	65-60
C-	59-55
D+	54-50
D	49-45
F	< 44

Attendance Policy: *Attendance is not graded. When requested by the school, the last day of student attendance is determined from the records of student posts on Bspace.*

Late Work Policy: *Late work is accepted with a 50 % penalty. No credit will be given after posting solutions.*

Quiz Grading Rubric

Exemplary (2 points): The comment is accurate, relevant and properly points attributed. Adds substantial learner presence to the course and stimulates additional thought about the issue. Participates steadily under discussion. Collegial and friendly tone throughout the semester.

Accomplished (1.5 points): The comment lacks at least one of the above qualities, before deadline. but is above average in quality. Makes a significant contribution to our understanding of the issue being discussed.

Developing (1 point): The comment lacks two or three of the required qualities. Comments which are based solely upon personal opinion or personal experience often fall within this category.

Needs work (0.5 points): The comment presents little information. Deadlines not met.

Part 5: University and Course Policies

University 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 at sasc@stonybrook.edu. 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 the Student Accessibility Support Center. For procedures and information go to the following website:

https://ehs.stonybrook.edu/programs/firehttps://ehs.stonybrook.edu/programs/firesafety/emergencyevacuation/evacuation-guide-people-physical-disabilitiessafety/emergencyevacuation/evacuation-guide-people-physical-disabilities and search Fire Safety and Evacuation and Disabilities.

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. 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 http://www.stonybrook.edu/commcms/academic_integrity/index.html

Important Note: Any form of academic dishonesty, including cheating and plagiarism, will be reported to the Academic Judiciary.

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.

Course Policies:

Understand When You May Drop This Course:

It is the student's responsibility to understand when they need to consider withdrawing from a course. Refer to the Stony Brook Academic Schedule for dates and deadlines for registration: http://www.stonybrook.edu/commcms/registrar/calendars/academic_calendars.

- Undergraduate Course Load and Course Withdrawal Policy
- Graduate Course Changes Policy

Incomplete Policy:

Under emergency/special circumstances, students may petition for an incomplete grade. Circumstances must be documented and significant enough to merit an incomplete. If you need to request an incomplete for this course, contact me for approval as far in advance as possible.

Course Materials and Copyright Statement:

Course material accessed from Blackboard, SB Connect, SB Capture or a Stony Brook Course website is for the exclusive use of students who are currently enrolled in the course. Content from these systems cannot be reused or distributed without written permission of the instructor and/or the copyright holder.

Duplication of materials protected by copyright, without permission of the copyright holder is a violation of the Federal copyright law, as well as a violation of Stony Brook's Academic Integrity.

Online Communication Guidelines and Learning Resources:

Maintain professional conduct both in the classroom and online. The classroom is a professional environment where academic debate and learning take place. I will make every effort to make this environment safe for you to share your opinions, ideas, and beliefs. In return, you are expected to respect the opinions, ideas, and beliefs of other students—both in the face-to-face classroom and online communication. Students have the right and privilege to learn in the class, free from harassment and disruption. The course follows the standards set in the Student Code of Conduct, and students are subject to disciplinary action for violation of that code. If your behavior does not follow the course etiquette standards stated below, the grade you receive for a posting may suffer. I reserve the right to remove any discussion messages that display inappropriate language or content.

Online Etiquette:

- Offensive language or rudeness will not be tolerated. Discuss ideas, not the person.
- Avoid cluttering your messages with excessive emphasis (stars, arrows, exclamations).
- If you are responding to a message, include the relevant part of the original message in your reply, or refer to the original post to avoid confusion;
- Be specific and clear, especially when asking questions.
- Use standard punctuation and capitalization. Using all UPPERCASE characters gives the appearance of shouting and makes the message less legible;
- Remember that not all readers have English as their native language, so make allowances for possible misunderstandings and unintended discourtesies. **Online Classes Require Better Communication:**

It is important to remember that we will not have the non-verbal cues that occur in a face-to-face classroom. I cannot see the confused, frustrated, or unhappy expressions on your face if you encounter problems. You MUST communicate with me so that I can help. To make the experience go smoothly, remember that you're responsible for initiating more contact, and being direct, persistent, and vocal when you don't understand something.

Instructor roles:

The instructor will serve as a "guide" in online classroom. While I will not respond to every post, I will read what is posted, and reply when necessary. Expect instructor posts in the following situations:

- To assist each of you when it comes to making connections between discussion, lectures, and textbook material.
- To fill in important things that may have been missed. • To re-direct discussion when it gets "out of hand."
- To point out key points or to identify valuable posts.

Part 6: Student Resources

Academic and Major Advising (*undergraduate only*): Have questions about choosing the right course? Contact an advisor today. Phone and emails vary-please see website for additional contact information; website: https://www.stonybrook.edu/for-students/academic-advising/

Academic Success and Tutoring Center *(undergraduate only)*: https://www.stonybrook.edu/tutoring/
Amazon @ Stony Brook: Order your books before classes begin. Phone: 631-632-9828; email: Bookstore_Liaison@stonybrook.edu; website: http://www.stonybrook.edu/ bookstore/
Bursar: For help with billing and payment. Phone: 631-632-9316; email: bursar@stonybrook.edu; website: http://www.stonybrook.edu/bursar/
Career Center: The Career Center's mission is to support the academic mission of Stony Brook University by educating students about the career decision-making process, helping them plan and attain their career goals, and assisting with their smooth transition to the workplace or further education. Phone: 631-632-6810; email: sbucareercenter@stonybrook.edu; website: http://www.stonybrook.edu/careercenter/
Counseling and Psychological Services: CAPS staff are available by phone, day or night. http://studentaffairs.stonybrook.edu/caps/
Ombuds Office: The Stony Brook University Ombuds Office provides an alternative channel for confidential, impartial, independent and informal dispute resolution services for the entire University community. We provide a safe place to voice your concerns and explore options for productive conflict management and resolution. The Ombuds Office is a source of confidential advice and information about University policies and procedures and helps individuals and groups address university-related conflicts and concerns. http://www.stonybrook.edu/ombuds/
Registrar: Having a registration issue? Let them know. Phone: 631-632-6175; email: registrar_office@stonybrook.edu; http://www.stonybrook.edu/registrar/
SBU Libraries: access to and help in using databases, ebooks, and other sources for your research.

- Research Guides and Tutorials: http://guides.library.stonybrook.edu/
- Getting Help: https://library.stonybrook.edu/research/ask-a-librarian/

Student Accessibility Support Center: Students in need of special accommodations should contact SASC. Phone: 631-632-6748; email: sasc@stonybrook.edu; https://www.stonybrook.edu/sasc/
Support for Online Learning: https://www.stonybrook.edu/online/
Writing Center: Students are able to schedule face-to-face and online appointments. https://www.stonybrook.edu/writingcenter/