Syllabus

- **Course Description:**
  The importance of digital circuits and systems cannot be overestimated in today's world. Digital circuits form the basis of most electronic devices -- from small electronic toys to large scale computers -- hence it is useful to understand how these circuits are designed and how they operate. All digital circuits, no matter how complex, operate using the concepts that will be presented in this class.
- **Course Objectives:** By the end of this class students should be able to:
  - ✓ Understand logic gate implementations and their electrical properties
  - ✓ Design, analyze, and optimize combinational logic circuits
  - ✓ Design, analyze, and optimize synchronous sequential logic circuits
  - ✓ Conduct timing analysis on combinational and sequential logic circuits
  - ✓ Understand and apply practical aspects of digital design to datapath components
- **Prerequisites:**
  Prerequisite: EE 2310
  Co-requisite: EE 3120
- **Instructor:** Diana Cogan
  Email: diana.cogan@utdallas.edu Course Website: http://elearning.utdallas.edu/
  Office: ECSN 3.312 Phone 972-883-XXXX
  Office hours: Monday, Tuesday & Thursday 2:00 - 3:00 pm or by appointment
- **Lectures:**
  - Section 001: TTh 8:30 a.m.- 9:45 a.m. in JSOM 2.714
  - Section 501: TTh 5:30 a.m.- 6:45 a.m. in MC 2.410
- **Required Textbook:**
  Digital Design with RTL Design, VHDL and Verilog, Frank Vahid, John Wiley Publishers, 2nd Edition, 2011.
  ISBN: 978-0-470-53108-2.
- **Additional References:**
  - 3 part Verilog video series by Dr. Bill Swartz (on course website)
  - Fundamentals of Digital Logic With Verilog Design, Stephen Brown and Zvonko Vranesic, McGraw-Hill Publishing, Second Edition, 2008.
  - Digital Design Principles and Practices, John F. Wakerly, Prentice Hall, Fourth Edition, 2006.
  - Contemporary Logic Design, Randy Katz and Gaetano Borriello, Prentice Hall, Second Edition, 2005.
- **Important Class Dates:**
  - First class: Tue., Aug. 23, 2016
  - *1st Exam*: Thur., Sept. 22, 2016 in JSOM 2.714 (Sec 001)/MC 2.410 (Sec 501)
  - *2nd Exam*: Thur., Oct. 27, 2016 in JSOM 2.714 (Sec 001)/MC 2.410 (Sec 501)
  - Fall Break/Thanksgiving: Nov. 21 - 26, 2016
  - Last lecture class: Tue., Dec. 6, 2016
  - *Final Exam*: TBA (Dec. 9-15, 2016) in JSOM 2.714 (Sec 001)/MC 2.410 (Sec 501)
- **Course Evaluation:**
  - Exam #1: 20%
  - Exam #2: 25%
  - Final Exam: 30%
  - Class participation and Homework: 15%
  - Quizzes: 10% (Dates marked with *.)

Grading scale:

$90 \leq A- < 93$	$93 \leq A < 97$	$97 \leq A+ \leq 100$
$80 \leq B- < 83$	$83 \leq B < 87$	$87 \leq B+ < 90$
$70 \leq C- < 73$	$73 \leq C < 77$	$77 \leq C+ < 80$
$60 \leq D- < 63$	$63 \leq D < 67$	$67 \leq D+ < 70$
$0 \leq F < 60$		

- **How to Succeed in this Class:**
  - Attend lectures and take notes.
  - Complete the readings and homework assignments in a timely fashion.
  - See the instructor during office hours or by appointment.
  - Email the instructor. (*PLEASE include EE/CE 3320 in the subject line.)*
- **Feedback:**
  If you have any concerns, comments or feedback about the course please inform the instructor early during the term so that a prompt effort can be made to resolve them. In addition, please do not hesitate to stop the instructor in class and ask questions. Remember that if you have a question, others may also and will benefit from your input.

- **Course Policies**
  - Homework will be assigned throughout the semester, and will be due approximately once every two weeks. Homework cannot be submitted by email or fax.
  - Homework is considered **late** if it is turned in after the end of your assigned lecture period on the date it is due. There will be a 20% per day penalty for late homework up to 3 days excluding weekends and holidays. Late homework and reports will not be accepted after 3 days or after solutions are posted -- whichever comes first.
  - No makeup exams/quizzes/homework will be offered in this course. Any graded work can be disputed in writing within one week of the return of that work. In such cases, the entire work will be re-graded.
  - Copying on examinations, assignments and projects is cheating and is prohibited. Any instances of cheating or plagiarism is considered academic dishonesty and will be subject to disciplinary penalties according to the UT Dallas policy on scholastic dishonesty. The penalties include the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students and the integrity of the University, policies on scholastic dishonesty will be strictly enforced. Please carefully read this policy at **http://www.utdallas.edu/deanofstudents/dishonesty/.**
  - If a student has to be absent for several classes, e.g. because of job related obligations, he/she will not be eligible for an incomplete grade. In such cases, the student is advised to withdraw from the course.
  - Announcements, homework assignments and complementary materials will be posted on the course website. It is the responsibility of each student to check this web page regularly.

- **Syllabus & Tentative Lecture Plan:**

Week		*Readings*	*Topics to Be Covered*
Tue.	*Thur.*	*(from required text)*	
8/23		1.1-1.3	Introduction; motivation; review of base conversion
	8/25	2.1-2.4	Switches; The CMOS transistor; Boolean logic gates
8/30		2.5, A.1-A.3	Boolean algebra and algebraic proofs
	9/1	2.6	Representations of Boolean functions
9/6		2.7-2.8, pp. 419-422	Combinational logic design process; more gates
	9/8*	2.9-2.10	Decoders and muxes; additional considerations
9/13		2.12 (9.1-9.2)	Combinational logic description using HDL (for use in lab!)
	9/15	2.11 (6.1-6.2)	Combinational logic optimizations and tradeoffs
9/20		2.11 (6.2)	Combinational logic optimizations and tradeoffs
	9/22		**EXAM 1** (Fundamentals & Combinational Logic)
9/27		3.1-3.2	Flip flops
	9/29	3.2-3.3	Finite state machines
10/4		3.3-3.4	Controller design
	10/6	3.4-3.5	More on flip flops and controllers
10/11		3.6 (6.3)	Sequential logic optimizations and tradeoffs
	10/13*	3.6 (6.3)	Sequential logic optimizations and tradeoffs
10/18		3.7 (9.3)	Sequential logic description using HDL
	10/20	5.5, 5.7	Determining clock frequency; memory components
10/25		5.11 (6.5), 7.3	RTL design optimizations and tradeoffs; FPGAs
	10/27		**EXAM 2** (Sequential Logic)
11/1		4.1-4.2	Registers
	11/3	4.2-4.3	Adders
11/8		4.3-4.4	Comparators
	11/10	4.5-4.6	Multipliers; subtractors and signed numbers
11/15		4.7-4.8	Arithmetic Logic Units (ALUs); shifters
	11/17*	4.9-4.10	Counters and timers; register files
11/22			**Fall Break - University Holiday**
	11/24		**Thanksgiving - University Holiday**
11/29		4.11 (6.4)	Datapath component tradeoffs
	12/1	4.12 (9.4), B.1-B.2	Datapath component description using HDL; advanced binary numbers
12/6		9.5, C.1-C.3	RTL design using HDL; an RTL design example
Date TBD (on or before Dec. 15)			**Comprehensive Final Exam**

These descriptions and timelines are subject to change at the discretion of the instructor.

The following information may also be found at: http://go.utdallas.edu/syllabus-policies

- **Sharing Confidential Information**
  Students considering sharing personal information in email, in person, or within assignments or exams should be aware that faculty members and teaching/research assistants are required by UT Dallas policy to report information about sexual misconduct to the UT Dallas Title IX Coordinator. Per university policy, faculty have been informed that they must identify the student to the UT Dallas Title IX Coordinator. Students who wish to have confidential discussions of incidents related to sexual harassment or sexual misconduct should contact the Student Counseling Center (972-883-2527 or after hours 972-UTD-TALK or 972-883-8255), the Women's Center (972-883-8255), a health care provider in the Student Health Center (972-883-2747), the clergyperson (or other legally recognized religious advisor) of their choice, or an off-campus resource (i.e., rape crisis center, doctor, psychologist). Students who are sexually assaulted, harassed, or victims of sexual misconduct, domestic violence, or stalking, are encouraged to directly report these incidents to the UT Dallas Police Department at 972-883-2222 or to the Title IX Coordinator at 972-883-2218. Additional information and resources may be found at http://www.utdallas.edu/oiec/title-ix/resources.

- **Technical Support**
  If you experience any issues with your UT Dallas account, contact the UT Dallas Office of Information Technology Help Desk: assist@utdallas.edu or call 972-883-2911.

  UT Dallas provides eLearning technical support 24 hours a day/7 days a week. The services include a toll free telephone number for immediate assistance (1-866-588-3192), email request service, and an online chat service. Please use this link to access the UTD eLearning Helpdesk: http://www.utdallas.edu/elearning/eLearningHelpdesk.html.

- **Field Trip Policies, Off-Campus Instruction and Course Activities**
  Off-campus, out-of-state, foreign instruction/travel, and course-related field trip activities are subject to state law and University policies and procedures regarding travel and risk-related activities.

  Detailed information regarding this policy, in accordance to *Texas Education Code*, Section 51.950, can be accessed at the UT Dallas Policy Navigator, http://policy.utdallas.edu/utdbp3023, and at http://www.utdallas.edu/administration/insurance/travel. Additional information is available from the office of the school dean.

- **Student Conduct and Discipline**
  The University of Texas System (Regents' Rule 50101) and The University of Texas at Dallas have rules and regulations for the orderly and efficient conduct of their business. It is the responsibility of each student and each student organization to be knowledgeable about the rules and regulations which govern student conduct and activities. General information on student conduct and discipline is contained in the UT Dallas online catalogs (http://catalog.utdallas.edu).

  The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the Student Code of Conduct, UTDSP5003 (http://policy.utdallas.edu/utdsp5003). Copies of these rules and regulations are available to students in the Office of Community Standards and Conduct, where staff members are available to assist students in interpreting the rules and regulations (SSB 4.400, 972-883-6391) and online at https://www.utdallas.edu/conduct/.

  A student at the University neither loses their rights nor escapes the responsibilities of citizenship. He or she is expected to obey federal, state, and local laws as well as the Regents' Rules, university regulations, and administrative rules. Students are subject to discipline for violating its standards of conduct whether such conduct takes place on or off campus, or whether civil or criminal penalties are also imposed for such conduct.

- **Academic Integrity**
  The faculty expects from its students a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrates a high standard of individual honor in his or her scholastic work.

  Academic Dishonesty: Academic dishonesty can occur in relation to any type of work submitted for academic credit or as a requirement for a class. It can include individual work or a group project. Academic dishonesty includes plagiarism, cheating, fabrication, and collaboration/collusion. In order to avoid academic dishonesty, it is important for students to fully understand the expectations of their professors. This is best accomplished through asking clarifying questions if an individual does not completely understand the requirements of an assignment.

  Additional information related to academic dishonesty and tips on how to avoid dishonesty may be found here: https://www.utdallas.edu/conduct/dishonesty/.

- **Copyright Notice**
  It is the policy of the University of Texas at Dallas to adhere to the requirements of the United States Copyright Law of 1976, as amended, (*Title 17, United States Code*), including ensuring that the restrictions that apply to the reproduction of software are adhered to and that the bounds of copying permissible under the fair use doctrine are not exceeded. Copying, displaying,

reproducing, or distributing copyrighted material may infringe upon the copyright owner's rights. Unauthorized distribution of copyrighted material, including unauthorized peer-to-peer file sharing, may subject students to appropriate disciplinary action as well as civil and criminal penalties. Usage of such material is only appropriate when that usage constitutes "fair use" under the Copyright Act. For more information about the fair use exemption, see http://copyright.lib.utexas.edu/copypol2.html. As a UT Dallas student, you are required to follow UT Dallas' copyright policy (UTDPP1043 at http://policy.utdallas.edu/utdpp1043) and the UT System's policy, UTS107 at http://www.utsystem.edu/board-of-regents/policy-library/policies/uts107-use-copyrighted-materials.

- **Email Use**
  The University of Texas at Dallas recognizes the value and efficiency of communication between faculty/staff and students through electronic mail. At the same time, email raises some issues concerning security and the identity of each individual in an email exchange. All official student email correspondence will be sent only to a student's UT Dallas email address and UT Dallas will only consider email requests originating from an official UT Dallas student email account. This allows the University to maintain a high degree of confidence in the identity of each individual's corresponding via email and the security of the transmitted information. The University of Texas at Dallas furnishes each student with a free email account that is to be used in all communication with university personnel. The Office of Information Technology provides a method for students to have their UT Dallas mail forwarded to other email accounts. To activate a student UT Dallas computer account and forward email to another account, go to http://netid.utdallas.edu.
- **Class Attendance**
  Regular and punctual class attendance is expected. Students who fail to attend class regularly are inviting scholastic difficulty. Absences may lower a student's grade where class attendance and class participation are deemed essential by the instructor. In some courses, instructors may have special attendance requirements; these should be made known to students during the first week of classes.
- **Withdrawal from Class**
  The administration at UT Dallas has established deadlines for withdrawal from any course. These dates and times are published in the Comet Calendar (http://www.utdallas.edu/calendar) and in the Academic Calendar http://www.utdallas.edu/academiccalendar). It is the student's responsibility to handle withdrawal requirements from any class. In other words, a professor or other instructor cannot drop or withdraw any student unless there is an administrative drop such as the following:
  - Have not met the prerequisites for a specific course
  - Have not satisfied the academic probationary requirements resulting in suspension
  - Office of Community Standards and Conduct request
  - Have not made appropriate tuition and fee payments
  - Enrollment is in violation of academic policy
  - Was not admitted for the term in which they registered

  It is the student's responsibility to complete and submit the appropriate forms to the Registrar's Office and ensure that he or she will not receive a final grade of "F" in a course if he or she chooses not to attend the class after being enrolled.
- **Student Grievance Procedures**
  Procedures for student grievances are found in university policy UTDSP5005 (http://policy.utdallas.edu/utdsp5005). In attempting to resolve any student grievance regarding disputes over grades, application of degree plan, graduation/degree program requirements, and thesis/and dissertation committee, adviser actions and/or decisions, evaluations, and/or other fulfillments of academic responsibility, it is the obligation of the student first to make a serious effort to resolve the matter with the instructor, supervisor, administrator, or committee with whom the grievance originated.
- **Incomplete Grade Policy**
  As per university policy, incomplete grades may be given, at the discretion of the instructor of record for a course, when a student has completed at least 70% of the required course material but cannot complete all requirements by the end of the semester. An incomplete course grade (grade of 'I') must be completed within the time period specified by the instructor, not to exceed eight (8) weeks from the first day of the subsequent long semester. Upon completion of the required work, the symbol 'I' may be converted into a letter grade (A through F). If the grade of Incomplete is not removed by the end of the specified period, it will automatically be changed to F.
- **AccessAbility Services**
  It is the policy and practice of The University of Texas at Dallas to make reasonable accommodations for students with properly documented disabilities. However, written notification from the Office of Student AccessAbility (OSA) is required. If you are eligible to receive an accommodation and would like to request it for this course, please discuss it with your professor and allow one week advance notice. Students who have questions about receiving accommodations, or those who have, or think they may have, a disability (mobility, sensory, health, psychological, learning, etc.) are invited to contact OSA for a confidential discussion. OSA is located in the Student Services Building, SSB 3.200. They can be reached by phone at 972-883-2098, or by email at studentaccess@utdallas.edu.

- **Religious Holy Days**
  The University of Texas at Dallas will excuse a student from class or other required activities, including examinations and travel time for the observance of a religious holy day for a religion whose places of worship are exempt from property tax under Section 11.20, of the *Texas Tax Code*.

  Students are encouraged to notify the instructor or activity sponsor as soon as possible regarding the absence, preferably in advance of the assignment.

  Excused students will be allowed to take missed exams or complete assignments within a reasonable time after the absence: a period equal to the length of the absence, up to a maximum of one week. A student who notifies the instructor and completes any missed exam or assignment may not be penalized for the absence. A student who fails to complete the exam or assignment within the prescribed period may receive a failing grade for that exam or assignment.

  If a student or an instructor disagrees about the nature of the absence [i.e., for the purpose of observing a religious holy day] or if there is similar disagreement about whether the student has been given a reasonable time to complete any missed assignments or examinations, either the student or the instructor may request a ruling from the President of UT Dallas or from the President's designee. The chief executive officer or designee must take into account the legislative intent of *Texas Education Code* 51.911(b), and the student and instructor will abide by the decision of the chief executive officer or designee.
- **Resources to Help You Succeed**
  The Office of Student Success operates the Student Success Center (SSC, http://www.utdallas.edu/studentsuccess), which offers assistance to students in the areas of writing, mathematics, communication, multiple science fields, reading, study skills, and other academic disciplines. These services are available through individual and small group appointments, workshops, short courses, and a variety of online and instructional technologies. All students enrolled at UT Dallas are eligible for these services.

  The **Math Lab** gives short-term and semester long support for a variety of introductory and advanced mathematics courses. Students may drop in to visit with a math tutor on a regular basis. Comet card is required.

  The **Writing Center** offers a collaborative learning environment for one-to-one and small group assistance with general and advanced writing assignments and overall writing skills. Scheduling an appointment is strongly recommended, but walk in appointments are possible if a tutor is available.

  The **Peer Tutoring** program offers free tutoring assistance in multiple locations for many of the historically challenging undergraduate subjects at UT Dallas. Tutoring sessions, offered every weekday on a drop-in basis, are one-on-one or in a small group format. The sessions are designed to meet students' individual questions and needs related to course/subject concepts. All peer tutors are current UT Dallas students who made an A- or better in the course and have a strong faculty/staff recommendation. Students should check the Student Success Center website each semester for subject offerings and session times.

  The **Peer-Led Team Learning (PLTL)** program provides an active, engaged learning experience for students who meet in small groups once a week with a Peer Leader who helps guide them through a potentially difficult gateway course. Students that attend sessions regularly typically earn a half to a whole letter grade higher than students that do not participate in the PLTL program.

  Supplemental Instruction (SI) provides free, peer-facilitated weekly study sessions for students taking historically difficult courses. SI sessions encourage active, collaborative learning based on critical thinking and transferable study skills. SI leaders attend lectures, take notes, and read assigned material just like the enrolled students. Students should check the SSC website for subject and session times.

  The **Communication Lab (CommLab)** offers one-on-one and group consultations where you will gain practical feedback for improving oral and group presentations.

  Success Coaches are available for individual student appointments to discuss study skills, time management, note taking, test taking and preparation, and other success strategies.

  The Student Success Center's main office is located in the McDermott Library Building and can be contacted by calling 972-883-6707 or by sending an email to ssc@utdallas.edu.

Content of this document was last modified by the Provost's Office, 2016-07-20
Webpage updated by the Provost's Technology Group, 2016-08-02