The University of Texas at Tyler
Department of Electrical Engineering

EENG 3302: Digital Systems Design (required)

Syllabus

Catalog Description:

EENG 3302: Digital Systems Design
Boolean algebra, logic gates; number systems and codes; combinational logic; sequential logic; design of logic circuits; analog-digital interface; memory devices. Two hours of lecture and one three-hour lab per week.

Prerequisites: MATH 2413 Calculus I

Credits: 3 (2 hours lecture, 1 hours laboratory per week)

Text(s): Thomas L. Floyd, **Digital Fundamentals, 11th ed**. Prentice Hall, 2015
ISBN-10: 0132737965 ISBN-13: 9780132737968

Additional Material: NI Multisim Software

Course Coordinator: Mukul V. Shirvaikar, Professor

Topics Covered: (paragraph of topics separated by semicolons)

Introductory Digital Concepts; Number Systems, Operations, and Codes; Logic Gates; Boolean Algebra and Logic Simplification; Karnaugh Maps; Combinational Logic; Functions of Combinational Logic; Flip-Flops and Related Devices; Counters; Shift Registers; Sequential Logic; Memory and Storage;.

Evaluation Methods: (only items in dark print apply):

1. Examinations / Quizzes
2. Homework
3. Report
4. Computer Programming
5. Project
6. Presentation
7. Course Participation
8. Peer Review

Course Learning Outcomes[1]: By the end of this course students will be able to:

1. Explain basic digital concepts including digital vs. analog, bits, logic levels, logic operations, functions and digital waveforms [1]
2. Solve problems involving conversions between decimal, binary, octal and hexadecimal number systems, signed numbers, arithmetic operations, digital codes such as BCD, ASCII, parity and error detection/correction [1]
3. Understand the operation of basic logic gates (NOT, AND, OR, ex-OR, NAND, NOR) using truth tables, logic circuit elements, timing diagrams and implementation using fixed-function integrated circuits [3]
4. Formulate and solve problems using Boolean Algebra including laws, rules, DeMorgan's theorem and boolean analysis of logic circuits [1]
5. Construct simplified logic circuits using boolean algebra, standard forms of boolean expressions, boolean expressions from truth tables and Karnaugh maps for minimization [1]
6. Apply combinational logic analysis to digital systems including realization techniques, the universal property of NAND/NOR gates, implementation and testing with pulse waveform inputs [1]
7. Analyze the operation of combinational logic circuits including adders, comparators, decoders, encoders, code converters, multiplexers, demultiplexers, parity generators/checkers [1]
8. Design combinational logic circuits including look-ahead carry adders, comparators, priority encoders, I/O drivers, parity generators/checkers [3]
9. Demonstrate knowledge of sequential logic circuit elements like flip-flops, latches, timers and their applications [1]
10. Design counter circuits to meet specifications including specified number sequences [1]

11. Outline the types of shift register circuits including various I/O configurations, Ring and Johnson counters [1]
12. Demonstrate knowledge of memory and storage including operation, types and circuits [1]
13. Explain a contemporary issue in the field of computer engineering [3]
14. Use modern engineering tools including modeling and simulation software and virtual instruments [3]
15. Perform laboratory experiments utilizing digital system analysis, design and implementation techniques [3]
16. Prepare laboratory reports that clearly communicate experimental information in a logical and scientific manner [3]

[1]*Numbers in brackets refer to method(s) used to evaluate the course learning outcome.*

Relationship to Student Outcomes (only items in dark print apply)[2]: This course supports the following Electrical Engineering Student Outcomes, which state that our students will possess:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics [1-7, 9, 11, 12]
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors [8, 10]
3. an ability to communicate effectively with a range of audiences [16]
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts [13]
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions [14, 15]
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

[2]*Numbers in brackets refer to course learning outcome(s) that address the Program Outcome.*

Contribution to Meeting Professional Component: (in semester hours)

Mathematics and Basic Sciences:		hours
Engineering Sciences and Design:	3	hours
General Education Component:		hours

Prepared By: Edited By:	Mukul Shirvaikar, Professor	Date:	18 August 2019 21 April 2020

The University of Texas at Tyler
Department of Electrical Engineering

EENG 3302: Digital Systems Design
2021 Fall Semester

COURSE OUTLINE v5 (28 Oct 2021)

Course Coordinator:

Instructor: David Beams, Associate Professor Emeritus, professional curmudgeon, and *raconteur extraordinaire.*
Office: Don't have one. My office is wherever I can find a working internet connection.
Phone: Who uses phones these days?
Email: dbeams@uttyler.edu
Department website: http://www.uttyler.edu/ee

Class Location/Time: 11:00AM-11:55AM T R / Zoom (Two-way interactive Zoom)
Laboratory – 2:00-4:45PM T

Office Hours:

12:00 – 1:30 PM Wednesdays. See Canvas for Zoom Link.

I stole this grading policy directly from Dr. Shirvaikar. If it's good enough for him, it's good enough for me!

Grading Policy:

Quizzes	25%
Mid-Term Examination	25%
Laboratory Projects	25%
Final Examination	25%

Note: Students are required to submit all lab reports to obtain a passing grade in the class. Instructor reserves the right to modify the above grading policy including final grade thresholds at any point of time.

This is the tentative course schedule. Adjustments will likely be necessary as the semester progresses…if you can call it "progress"…

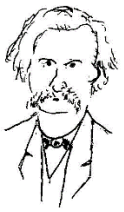
Semester Schedule:

WEEK	DATE	TOPICS COVERED	READING ASSIGNMENT	LABORATORY
1	23-Aug-2021	**1.** Introductory Digital Concepts	1.1-1.7	
2	30-Aug-2021	**2.** Number Systems, Operations and Codes	2.1-2.6	**Lab Introduction, Lab 1 –** Instruments
3	6-Sep-2021	**3.** Logic Gates **4.** Boolean Algebra	3.1-3.7; 4.1-4.3	**Lab 2** – Logic Gates and Boolean Laws
4	13-Sep-2021	**4.** Logic Simplification	4.4-4.11	**Lab 3** – DeMorgan's Theorems
5	20-Sep-2021	**5.** Combinational Logic	5.1-5.5	**Lab 4** – Combinatorial Logic Circuits [Karnaugh Maps]
6	27-Sep-2021	**2.** Number Systems, Operations and Codes	2.7-2.11	**Lab 5** – Universal Property of NAND and NOR Gates
7	4-Oct-2021	**6.** Functions of Combinational Logic **Quiz #2 7 Oct 2021**	6.1-6.5	**Lab 6** – Adders and Multiplexers
8	11-Oct-2021	**Midterm Review** **MIDTERM EXAM Thursday, Oct. 14**		**No laboratory**
9	18-Oct-2021	**6.** Functions of Combinational Logic	6.6-6.9	**Lab 7** – Encoders and Decoders
10	25-Oct-2021	**7.** Flip-Flops and Related Devices	7.1-7.7	**Lab 9** – Comparators
11	1-Nov-2021	**7.** Flip-Flops and Related Devices **Quiz #3 2 Nov 2021**	7.1-7.7	**Lab 10** – Latches and Flip-Flops
12	8-Nov-2021	**9.** Counters	9.1-9.4	**Lab 11a** – Arithmetic Logic Unit **Lab 11b –** Lookahead-Carry Adder
13	15-Nov-2021	**8.** Shift Registers **Quiz #4 18 Nov 2021**	8.1-8.8	
14	22-Nov-2021	**NO CLASS**	**NO LAB**	**THANKSGIVING**
15	29-Nov-2021	**11.** Memory and Storage; Final Exam Review	11.1-11.5;11.10	
16	6-Dec-2021	**Quiz #5 2 Dec 2021** **FINAL EXAM Tuesday, Dec. 7, 11:00AM-1:00AM**		

Computer Equipment Policy:
In order to take this class, integrated laboratory sessions and quizzes/exams, you will need the following items as specified below:

- Windows 10 Computer or Mac running Windows virtualization software
- High-speed Internet connection
- Webcam (internal or external)
- NI Multisim software

Type	Minimum	Recommended
Web Camera	640×480 resolution	1280×720 resolution
PC Users	Windows Vista	Windows 10 (10 S is not supported)
Mac Users	OS X 10.5 or higher	OS X 10.13 High Sierra
Internet Download Speed	.768 Mbps	1.5 Mbps
Internet Upload Speed	.384 Mbps	1 Mbps
RAM	1024 MB	2 GB
Ports	1935, 843, 80, 443, 61613, UDP/TCP	1935, 843, 80, 443, 61613, UDP/TCP



You should read the paragraphs below. This is *NOT* just some meaningless End User License Agreement you can safely ignore.

Homework, Examination and Lab Project Policy:
Homework and project reports will be due in Canvas one week after assignment. Project reports should be written as per the guidelines provided. A 25% penalty will be assessed for missing the submission deadline and an additional 25% penalty will apply per week for late project reports and homework. Any deviation from this rule will be at the sole discretion of the instructor.

All submissions are required to be in Microsoft Word format with machine readable text. Images of text or other representations of text are not acceptable. This rule will be applied to all sections of the report including the appendices and program code with comments. All flowcharts and diagrams must be prepared using Microsoft Office and not by hand. Any attempts to defeat the plagiarism checking software by submission of documents that include images instead of body text or any other mechanism will result in a grade of zero. The instructor or responsible grader reserves all rights to make this judgement and reject a project report if the above rules are not followed. Any violations may result in ACADEMIC DISHONESTY charges to be filed against the student.

Student waives all rights to a make-up exam if they miss a scheduled testing date. Any make-up testing will be at the sole discretion of the instructor.

Academic Integrity:
Students should be aware that absolute academic integrity is expected of every student in all undertakings at The University of Texas at Tyler. Failure to comply can result in strong university-imposed penalties. **All lab reports and assignments will be verified using plagiarism checking software and violations will result in a grade of zero for the lab report or assignment at a minimum, and possibly stronger penalties such as a failing grade in the course and a scholastic dishonesty report submitted to the university.**

Proctoring

The assessments in this course may be proctored using ProctorU or two-way interactive Zoom sessions. Beyond the cost of initial equipment needed (e.g. a camera for your computer), there will not be any additional cost for proctoring. You will need to create a ProctorU account and install the ProctorU extension before attempting any assessment.

To create a ProctorU account, follow the ProctorU tool within Canvas. Please make sure you are using the current version of Chrome or Firefox and download the ProctorU extension available at http://bit.ly/proctoruchrome or https://www.proctoru.com/firefox.

In order to use ProctorU, you will need the following:

- High-speed Internet connection
- Webcam (internal or external)
- Windows, Mac, or Chrome Operating System
- Up-to-date Chrome or Firefox browser and ProctorU extension installed
- Valid photo ID
- Quiet environment to take your assessment

You can visit the Test Taker Resource Page for additional information at https://bit.ly/ProctorMe

UT Tyler Honor Code

Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

Students Rights and Responsibilities

To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link: http://www.uttyler.edu/wellness/rightsresponsibilities.php

Grade Replacement/Forgiveness and Census Date Policies

Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the Census Date of the semester in which the course will be repeated. Grade Replacement Contracts are available in the Enrollment Services Center or at http://www.uttyler.edu/registrar. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar.

Failure to file a Grade Replacement Contract will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract.

The Census Date is the deadline for many forms and enrollment actions of which students need to be aware. These include:

- Submitting Grade Replacement Contracts, Transient Forms, requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit.
- Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
- Schedule adjustments (section changes, adding a new class, dropping without a "W" grade)
- Being reinstated or re-enrolled in classes after being dropped for non-payment
- Completing the process for tuition exemptions or waivers through Financial Aid

State-Mandated Course Drop Policy

Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date).

Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.

Disability/Accessibility Services

In accordance with Section 504 of the Rehabilitation Act, Americans with Disabilities Act (ADA) and the ADA Amendments Act (ADAAA) the University of Texas at Tyler offers accommodations to students with learning, physical and/or psychological disabilities. If you have a disability, including a non-visible diagnosis such as a learning disorder, chronic illness, TBI, PTSD, ADHD, or you have a history of modifications or accommodations in a previous educational environment, you are encouraged to visit https://hood.accessiblelearning.com/UTTyler and fill out the New Student application.

The Student Accessibility and Resources (SAR) office will contact you when your application has been submitted and an appointment with Cynthia Lowery, Assistant Director of Student Services/ADA Coordinator. For more information, including filling out an application for services, please visit the SAR webpage at http://www.uttyler.edu/disabilityservices, the SAR office located in the University Center, # 3150 or call 903.566.7079.

Student Absence due to Religious Observance

Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

Student Absence for University-Sponsored Events and Activities

If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

Social Security and FERPA Statement

It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

Student Standards of Academic Conduct

Disciplinary proceedings may be initiated against any student who engages in scholastic dishonesty, including, but not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

i. "Cheating" includes, but is not limited to:

- copying from another student's test paper;
- using, during a test, materials not authorized by the person giving the test;
- failure to comply with instructions given by the person administering the test;
- possession during a test of materials which are not authorized by the person giving the test, such as class notes or specifically designed "crib notes". The presence of textbooks constitutes a violation if they have been specifically prohibited by the person administering the test;
- using, buying, stealing, transporting, or soliciting in whole or part the contents of an unadministered test, test key, homework solution, or computer program;
- collaborating with or seeking aid from another student during a test or other assignment without authority;
- discussing the contents of an examination with another student who will take the examination;
- divulging the contents of an examination, for the purpose of preserving questions for use by another, when the instructors has designated that the examination is not to be removed from the examination room or not to be returned or to be kept by the student;
- substituting for another person, or permitting another person to substitute for oneself to take a course, a test, or any course-related assignment;
- paying or offering money or other valuable thing to, or coercing another person to obtain an unadministered test, test key, homework solution, or computer program or information about an unadministered test, test key, home solution or computer program;
- falsifying research data, laboratory reports, and/or other academic work offered for credit;
- taking, keeping, misplacing, or damaging the property of The University of Texas at Tyler, or of another, if the student knows or reasonably should know that an unfair academic advantage would be gained by such conduct; and

- misrepresenting facts, including providing false grades or resumes, for the purpose of obtaining an academic or financial benefit or injuring another student academically or financially.

ii. "Plagiarism" includes, but is not limited to, the appropriation, buying, receiving as a gift, or obtaining by any means another's work and the submission of it as one's own academic work offered for credit.

iii. "Collusion" includes, but is not limited to, the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any section of the rules on scholastic dishonesty.

iv. All written work that is submitted will be subject to review by plagiarism software.

UT Tyler Resources for Students

- UT Tyler Writing Center (903.565.5995), writingcenter@uttyler.edu
- UT Tyler Tutoring Center (903.565.5964), tutoring@uttyler.edu
- The Mathematics Learning Center, RBN 4021, this is the open access computer lab for math students, with tutors on duty to assist students who are enrolled in early-career courses.
- UT Tyler Counseling Center (903.566.7254)

Important Covid-19 Information for Classrooms and Laboratories

Students are expected to wear face masks covering their nose and mouth in public settings (including classrooms and laboratories). The UT Tyler community of Patriots views adoption of these practices consistent with its Honor Code (Links to an external site.) and a sign of good citizenship and respectful care of fellow classmates, faculty, and staff.

Students who are feeling ill or experiencing symptoms such as sneezing, coughing, digestive issues (e.g. nausea, diarrhea), or a higher than normal temperature should stay at home and are encouraged to use the UT Tyler COVID-19 Information and Procedures (Links to an external site.)website to review protocols, check symptoms, and report possible exposure. Students needing additional accommodations may contact the Office of Student Accessibility and Resources at University Center 3150, or call (903) 566-7079 or email saroffice@uttyler.edu.

Recording of Class Sessions

Class sessions may be recorded by the instructor for use by students enrolled in this course. Recordings that contain personally identifiable information or other information subject to FERPA shall not be shared with individuals not enrolled in this course unless appropriate consent is obtained from all relevant students. Class recordings are reserved only for the use of students enrolled in the course and only for educational purposes. Course recordings should not be shared outside of the course in any form without express permission.