EENG 2920.002 Analog & Digital Circuit Design Project
Spring 2026 – Syllabus

Subject to change according to circumstances.

Contents

Course Description
Introduction to lab experiments illustrating the principles of analog and digital circuits. Students will learn to use electrical engineering lab equipment, implement and test circuits in the lab, and design and analyze circuits using software tools. This course includes simulation and design experiments, hands-on exercises, and comprehensive design projects to complement the Circuit Analysis and Digital Logic Design courses. Credit hours: 3.

Course Prerequisites
EENG 1910, EENG 2610 (and EENG 2611 for Electrical Engineering students), and EENG 2710 (and EENG 2711 for Electrical Engineering students), each of which must be completed with a C or better.

Class Schedule
Monday 1:00 PM – 3:50 PM, Discovery Park B207

Instructor
- Miguel F. Acevedo, Regents Professor Electrical Engineering (EE), and Advanced Environmental Research Institute (AERI). Discovery Park Office B-260, Phone 940-891-6701, acevedo@unt.edu. Office hours: Monday and Wednesday 10:00 am- noon and by appointment.

Teaching Assistant
- Godslove Ebiega, Office hours Tuesday 11:30 am-1:30pm. Office number E245M/E245K (this is in the E-wing of DP).
- You can Email them via the message tool on Canvas.

Communication
The preferred means of communication with the instructor and TAs is by email message using Canvas or by email using your UNT student Email account. Please avoid other Email systems

Course Structure
- Online resources: Canvas https://unt.instructure.com/
- Class/Lab sessions per schedule. Attendance and active engagement in lab activity is required. Not attending or not performing the lab work during the lab session will result in a grade of zero for all assessments corresponding to that lab session.
- Lab exercises: conducted in teams of two students. Completion must be demonstrated to the TA during each lab session and submitted individually via Canvas.
- Design exercises: conducted in teams of two students and submitted individually by due date on Canvas. The instructor may require demonstrating completion during the next lab session.
- Weekly quizzes taken individually. Attending during the entire session and performing your work is required to take the quiz.
- Midterm and Final exam taken individually in class and via Canvas.

- Midterm and final design projects developed in teams of two students and submitted individually via Canvas. Progress and completion must be demonstrated to the instructor during these design lab sessions.

Assessments and Grading

Assessment	Modality	Late/makeup policy	Points possible	Percent of final grade
Weekly quizzes	In class	No make up allowed	100 using average of all quizzes	20%
Exams: Midterm and Final	In class	No make up allowed	100 using average of both exams	20%
Weekly lab exercises	In class	No late submittal accepted	100 using average of all labs	20%
Weekly design exercises	Submitted by due date on Canvas	No late submittal accepted	100 using average of all design	20%
Project reports: Midterm and Final	Submitted by due date on Canvas	No late submittal accepted	100 using average of all reports	20%
Total possible			100	100%

Grading scale to obtain final letter grade from percentage
A = 90.0-100.0
B = 80.0-89.9
C = 70.0-79.9
D = 60.0-69.9
F = 0.0-59.9

Schedules of exams

- Midterm: March 2, 2026, during class time.
- Final: May 4, 2026, 1:30 PM - 3:30 PM per UNT schedule of examination https://registrar.unt.edu/exams/final-exam-schedule/

Textbooks

Recommended:

- Attia J.O. 2010. *PSpice and MATLAB for Electronics: An Integrated Approach*, 2nd ed., CRC Press, 2010. 356 pp.
- Dally, W.J., and R.C. Harting. 2012. *Digital design: a systems approach*. Cambridge University Press. 614 pp.
- Dean, B.K., and D. Llamoca. 2021. *Introduction to Analog & Digital Circuits*, 2nd Ed.: Kendall & Hunt. 366 pp.

- Dean, B.K. 2021. *Introduction to Analog & Digital Circuits Lab Manual*, 2nd Edition: Kendall Hunt. 136 pp.

Recommended from prerequisite courses:

- Roth C.H. Jr., L. L. Kinney, and E. B. John. 2021. *Fundamentals of Logic Design*, 7th Enhanced. Ed., Cengage Learning, Inc., 791 pp.
- Alexander, C. and Sadiku M. 2020 *Fundamentals of Electric Circuit*s, Seventh Edition, McGraw Hill, 2020. 992 pp.

Recommended as supplementary:

- Horowitz, P., and W. Hill. 2015. *The art of electronics*, Third Edition: Cambridge University Press. 1230 pp.
- Agarwal, A., and J.H. Lang. 2005. *Foundations of Analog and Digital Electronic Circuits*: Morgan Kaufmann, Elsevier. 984 pp.
- Kaplan, D.M., and C.G. White. 2007. Hands-On Electronics, A practical introduction to Analog and Digital Circuits: Cambridge University Press. 204 pp.

Software

- MATLAB for theoretical verification, simulations, and calculations.
- Multisim 14.3 for SPICE analog and digital circuit simulation.
- Quartus II to design and implement logic circuits on CPLD.
- Arduino IDE to program ESP 8266.
- Optional: Visual Studio Code and Icarus Verilog as alternatives to Quartus for Verilog design.

Class Evaluation by Students

The SPOT (Student Perceptions of Teaching) evaluation is a requirement for all organized classes at UNT and is available for your input at the end of the semester.

Course Learning Outcomes

The Course Learning Outcomes (CLOs) are listed below and are evaluated by surveys of self-assessment from students at the beginning and end of the semester. The results become part of ABET accreditation reports of the EE department.

CLO-1 Use Multisim to simulate analog and digital circuits.
CLO-2 Use the Verilog hardware description language (HDL) to design and test digital circuits.
CLO-3 Design and implement digital circuits using Quartus II and complex programmable logic devices (CPLD).
CLO-4 Analyze and design analog circuits using MATLAB and integrate with Multisim simulation results.
CLO-5 Design and implement nonlinear circuits, comparators, multivibrators, and pulse width modulation (PWM).
CLO-6 Design and implement Finite State Machines (FSM) as logic circuits.
CLO-7 Use voltage-controlled oscillators (VCO) and phase locked loop (PLL) circuits.
CLO-8 Application of analog multipliers to analog PLL and modulation.
CLO-9 Design and implement analog sensors and transducers.
CLO-10 Use of analog to digital converters (ADC) and digital to analog converters (DAC).
CLO-11 Programming ESP microprocessors using Arduino software.

Spring Tentative Course Calendar
Subject to changes according to circumstances.

Week	Date	Assessment	Due	Activity and Topic
1	1/12	ABET Pre-Survey		Lab 1 Intro, equipment, combinational logic circuits, Multisim, Verilog, Quartus II
2	1/20-21-22	Quiz	Design Exercises 1	Lab 2 Combinational logic circuits, adders, Multisim, Quartus II, Verilog, CPLD Note: UNT closed 1/19 for MLK day. Lab exercises can be conducted on 1/20, or 1/21, or 1/22. See Canvas for details.
3	1/26	Quiz	Design Exercises 2	Lab 3 Combinational logic circuits, encoders, multiplexing, Quartus II, Verilog, CPLD
4	2/2	Quiz	Design Exercises 3	Lab 4 Sequential logic circuits, finite state machines (FSM), 4-bit Counters, Verilog, CPLD
5	2/9	Quiz	Design Exercises 4	Lab 5 Nonlinear analog and mixed signal: Comparators Multivibrators, PWM.
6	2/16	Quiz	Design Exercises 5	Lab 6 MCU ESP 8266 digital pins, logic, timers
7	2/23	Quiz	Design Exercises 6	Midterm project: FSM. Traffic controllers. ESP 8266 MCU, logic, digital ports, timers
8	3/2	Midterm exam	Midterm project	Midterm project continued, report due 3/16
	3/9	NA	NA	No Lab – Spring break
9	3/16			Lab 7 VCO, PLL and frequency synthesis
10	3/23	Quiz	Design Exercises 7	Lab 8 Active filters: low-pass, bandpass
11	3/30	Quiz	Design Exercises 8	Lab 9 Analog multiplier, modulation, PLL
12	4/6	Quiz	Design Exercises 9	Lab 10 Sensors, Transducer, Security Alarm
13	4/13	Quiz	Design Exercises 10	Lab 11 Digital to Analog Converters (DAC) R-2R and PWM-LPF, Analog to Digital Converter (ADC) SAR.
14	4/20	Quiz	Design Exercises 11	Final Project: Sensors linear, multiplexer, ADC and 8266. DAC, 8266 MCU, and ADC-DAC closing the signal loop
15	4/27	ABET survey - Quiz	Final project	Final project continued lab kit return- Project report Due 4/28
	5/4	Final exam		

Required Technology and Skills

Computer Skills and Digital Literacy

Course-specific computer skills learners must have to succeed in the course:

- Using Canvas for accessing materials, submitting assignments, and taking quizzes and exams.
- Converting files to PDF.
- Using UNT email with attachments.
- Downloading and installing software.
- Using spreadsheet and graphics programs.
- Performing online library searches.

Laboratory Skills

Course-specific technical skills learners must have to succeed in the course:

- Using bench equipment to power and measure circuits.
- Wiring circuits on breadboard.
- Using computers in conjunction with bench work.

Technical Assistance

UNT has a Student Help Desk that you can contact for help with Canvas or other technology issues.

UIT Help Desk: UIT Student Help Desk site (http://www.unt.edu/helpdesk/index.htm)
Email: helpdesk@unt.edu
Phone: 940-565-2324
In Person: Sage Hall, Room 130
Laptop Checkout: 8am-7pm
For additional support, visit Canvas Technical Help

Course Policies

Syllabus Change Policy

Information provided in the syllabus is subject to change according to circumstances.

Grades

All grades for the course will be final. No extra credit assignments or work will be considered.

Attendance

Attendance to class is required. You must attend every class unless you have a university excused absence such as active military service, a religious holy day, or an official university function as stated in the Student Attendance and Authorized Absences Policy (PDF) (https://policy.unt.edu/policy/06-039). If you cannot attend a class due to an emergency, please let me know.

Punctuality

Please arrive on time and do not leave the classroom early unless you request the instructor's authorization to do so before the class starts. Being punctual and staying for the full period indicates our respect for others. Being late to class is sometimes inevitable. If you are late, know that you are welcome to join the class, but please do so without distracting others.

Class Participation

Students are required to be fully engaged and participate in developing the labs.

Late work

Submit assignments by the due date and time. Late work is not accepted.

Assignment Policy
Instructions, due dates, submittal format for each assignment will be given in Canvas. Consider submitting assignments ahead of the due date to avoid potential last minute technical difficulties, including server unavailability. If you experience technical difficulties at the due date and time, you should immediately contact the instructor and the Student Helpdesk helpdesk@unt.edu or 940.565.2324.

Lab Safety Procedures and Guidelines
While working in laboratory sessions, students enrolled in EENG 2920.001 Analog and Digital Circuit Design Project are required to follow proper safety procedures and guidelines. Students should be aware that UNT is not liable for injuries incurred while students are participating in class activities. All students are encouraged to secure adequate insurance coverage in the event of accidental injury. Students who do not have insurance coverage should consider obtaining Student Health Insurance. Brochures for student insurance are available in the UNT Student Health and Wellness Center. Students who are injured during class activities may seek medical attention at the Student Health and Wellness Center at rates that are reduced compared to other medical facilities. If students have an insurance plan other than Student Health Insurance at UNT, they should be sure that the plan covers treatment at this facility. If students choose not to go to the UNT Student Health and Wellness Center, they may be transported to an emergency room at a local hospital. Students are responsible for expenses incurred there.

UNT policies

Academic Integrity Policy
Academic Integrity Standards and Consequences. According to UNT Policy 06.003, Student Academic Integrity, academic dishonesty occurs when students engage in behaviors including, but not limited to cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, and sabotage. A finding of academic dishonesty may result in a range of academic penalties or sanctions ranging from admonition to expulsion from the University. Examples of categories of academic dishonesty are:

A. Cheating. The use of unauthorized assistance in an academic exercise, including but not limited to:
    a. Use of any unauthorized assistance to take exams, tests, quizzes or other assessments.
    b. Dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems or carrying out other assignments.
    c. Acquisition, without permission, of tests, notes or other academic materials belonging to a faculty or staff member of the University.
    d. Dual submission of a paper or project, or re-submission of a paper or project to a different class without express permission from the instructor.
    e. Any other act designed to give a student an unfair advantage on an academic assignment.
B. Plagiarism. Use of another's thoughts or words without proper attribution in any academic exercise, regardless of the student's intent, including but not limited to:
    a. The knowing or negligent use by paraphrase or direct quotation of the published or unpublished work of another person without full and clear acknowledgement or citation.
    b. The knowing or negligent unacknowledged use of materials prepared by another

person or by an agency engaged in selling term papers or other academic materials.

C. Forgery. Altering a score, grade or official academic university record or forging the signature of an instructor or other student.
D. Fabrication. Falsifying or inventing any information, data or research as part of an academic exercise.
E. Facilitating Academic Dishonesty. Helping or assisting another in the commission of academic dishonesty.
F. Sabotage. Acting to prevent others from completing their work or willfully disrupting the academic work of others.

ADA Policy

The University of North Texas makes reasonable academic accommodation for students with disabilities. Students seeking reasonable accommodation must first register with the Office of Disability Access (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with a reasonable accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request reasonable accommodations at any time; however, ODA notices of reasonable accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of reasonable accommodation for every semester and must meet with each faculty member prior to implementation in each class. Students are strongly encouraged to deliver letters of reasonable accommodation during faculty office hours or by appointment. Faculty members have the authority to ask students to discuss such letters during their designated office hours to protect the privacy of the student. For additional information, refer to the Office of Disability Access website (http://www.unt.edu/oda). You may also contact ODA by phone at (940) 565-4323.

Prohibition of Discrimination, Harassment, and Retaliation (Policy 16.004)

The University of North Texas (UNT) prohibits discrimination and harassment because of race, color, national origin, religion, sex, sexual orientation, gender identity, gender expression, age, disability, genetic information, veteran status, or any other characteristic protected under applicable federal or state law in its application and admission processes; educational programs and activities; employment policies, procedures, and processes; and university facilities. The University takes active measures to prevent and investigate such conductand takes remedial action when appropriate.

Emergency Notification & Procedures

UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). In the event of a university closure, please refer to Canvas for contingency plans for covering course materials. You can find the Emergency Notifications and Procedures Policy at (https://policy.unt.edu/policy/06-049).