Subject to change according to circumstances.

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Course Description
Introduction to lab experiments illustrating the basic principles of analog and digital circuits. Students will learn to use basic electrical engineering lab equipment, build and test simple 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
Wednesday 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 or Lab E245M, Phone 940-891-6701, acevedo@unt.edu. Office hours: Monday-Wednesday 9-10 AM, and 11:30- 12:00 or by appointment.
- The preferred means of communication with the instructor is by email message using Canvas.
- Alternatively, you can email the instructor using your UNT student Email account. Please avoid other Email systems.

Teaching Assistant
- Ovis Irefu, PhD Student, UNT EE, Office: Discovery Park E245M Email: ovisirefu@my.unt.edu. Office hours (To be announced)
- The preferred means of communication with the TA is by email message using Canvas.
- Alternatively, you can email the TA 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 is required. Lack of attendance for a given lab session will result in a grade of zero.
- Lab exercises conducted individually.
- Weekly quizzes. Attendance during full session is required to take the quiz.
- Midterm and Final exam.
- Lab and project reports developed individually and submitted via Canvas per course calendar. Lab report will receive a grade of zero if missing the lab that week.
Assessments and Grading

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Modality</th>
<th>Late/makeup policy</th>
<th>Points possible</th>
<th>Percent of final grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly quizzes</td>
<td>In class</td>
<td>No make up allowed</td>
<td>100 using average of all quizzes</td>
<td>25%</td>
</tr>
<tr>
<td>Exams: Midterm and Final</td>
<td>In class</td>
<td>No make up allowed</td>
<td>100 using average of both exams</td>
<td>25%</td>
</tr>
<tr>
<td>Weekly lab reports</td>
<td>Submitted via Canvas per schedule</td>
<td>No late submittal accepted</td>
<td>100 using average of all reports</td>
<td>25%</td>
</tr>
<tr>
<td>Project reports</td>
<td>Submitted via Canvas per schedule</td>
<td>No late submittal accepted</td>
<td>100 using average of all reports</td>
<td>25%</td>
</tr>
<tr>
<td><strong>Total possible</strong></td>
<td></td>
<td></td>
<td>100</td>
<td>100%</td>
</tr>
</tbody>
</table>

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 and project reports submittal
- Midterm: March 6, 2024, during class time.
- Final: May 04, 2024, 10:30 AM - 12:30 PM per UNT schedule of examination https://registrar.unt.edu/exams/final-exam-schedule/spring.html

Textbooks
Required:

Recommended from prerequisite courses:

Recommended as supplementary:
Software
- MATLAB for theoretical verification, simulations, and calculations
- Multisim 14.3 and Multisim Live online for SPICE analog and digital circuit simulation
- Notepad++ to write SPICE code and edit text files.
- Icarus Verilog for digital circuit design
- Visual Studio Code to write and run Verilog code or to write SPICE code.
- Arduino IDE to program ESP 8266
- LTSpice for SPICE analog and digital circuit simulation

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 MATLAB for analog circuit design based on theoretical circuit response.
CLO-2 Integrate MATLAB with SPICE simulation results.
CLO-3 Integrate CAD design with circuit implementation.
CLO-4 Use SPICE and Multisim software to simulate analog and digital circuits.
CLO-5 Designing and implementing nonlinear analog circuits and multivibrators.
CLO-6 Designing Finite State Machines (FSM) and implementing FSM as logic circuits.
CLO-7 Use the Verilog HDL standard to design and simulate digital circuits.
CLO-8 Use VCO and Phase Locked Loop (PLL) circuits.
CLO-9 Application of A/D and D/A conversion.
CLO-10 Programming ESP microprocessors using Arduino software.
Tentative Course Calendar
Subject to changes according to circumstances.

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Assessment</th>
<th>Due</th>
<th>Activity and Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/17</td>
<td>ABET Pre-Survey, Quiz</td>
<td></td>
<td>Lab 1 Analog &amp; Digital, equipment, analog software, 1st-order filters</td>
</tr>
<tr>
<td>2</td>
<td>1/24</td>
<td>Quiz</td>
<td>Report 1</td>
<td>Lab 2 Combinational logic circuits, adders, Verilog design</td>
</tr>
<tr>
<td>3</td>
<td>1/31</td>
<td>Quiz</td>
<td>Report 2</td>
<td>Lab 3 Combinational logic circuits, encoders, multiplexing, Verilog design</td>
</tr>
<tr>
<td>4</td>
<td>2/7</td>
<td>Quiz</td>
<td>Report 3</td>
<td>Lab 4 Sequential logic circuits, finite state machines (FSM), Verilog design</td>
</tr>
<tr>
<td>5</td>
<td>2/14</td>
<td>Quiz</td>
<td>Report 4</td>
<td>Lab 5 Nonlinear analog and mixed signal: Comparators Multivibrators, Timers</td>
</tr>
<tr>
<td>6</td>
<td>2/21</td>
<td>Quiz</td>
<td>Report 5</td>
<td>Lab 6 VCO, PLL and frequency synthesis</td>
</tr>
<tr>
<td>7</td>
<td>2/28</td>
<td>Quiz</td>
<td>Report 6</td>
<td>Midterm project: FSM. Traffic controllers. ESP 8266 MCU, logic, digital ports, timers</td>
</tr>
<tr>
<td>8</td>
<td>3/6</td>
<td>Midterm exam</td>
<td>Midterm report 3/7</td>
<td>Midterm project</td>
</tr>
<tr>
<td></td>
<td>3/13</td>
<td>Spring break</td>
<td></td>
<td>Spring break</td>
</tr>
<tr>
<td>9</td>
<td>3/20</td>
<td>Quiz</td>
<td></td>
<td>Lab 7 Active filters: low-pass, high-pass, bandpass</td>
</tr>
<tr>
<td>10</td>
<td>3/27</td>
<td>Quiz</td>
<td>Report 7</td>
<td>Lab 8 Analog multiplier, modulation, PLL</td>
</tr>
<tr>
<td>11</td>
<td>4/3</td>
<td>Quiz</td>
<td>Report 8</td>
<td>Lab 9 Sensors, Transducer, Security Alarm</td>
</tr>
<tr>
<td>12</td>
<td>4/10</td>
<td>Quiz</td>
<td>Report 9</td>
<td>Lab 10 Sensors linear: instrumentation amp</td>
</tr>
<tr>
<td>13</td>
<td>4/17</td>
<td>Quiz</td>
<td>Report 10</td>
<td>Lab 11 ADC and 8266</td>
</tr>
<tr>
<td>14</td>
<td>4/24</td>
<td>Quiz</td>
<td>Report 11</td>
<td>Final Project: PWM and DAC, 8266 MCU, and ADC-DAC closing the signal loop</td>
</tr>
<tr>
<td>15</td>
<td>5/1</td>
<td>ABET survey</td>
<td>Final project report 5/2</td>
<td>Final project and review</td>
</tr>
<tr>
<td>15</td>
<td>5/4</td>
<td>Final exam</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Required Technology and Skills
Students will need access to a set of minimum technological resources and skills to succeed in this class. This course has digital components. To fully participate in this class, students will need internet access to reference content on the Canvas Learning Management System and other requirements as described below. Information on how to be successful in a digital learning environment can be found at Learn Anywhere (https://online.unt.edu/learn).

Computer Skills and Digital Literacy
Course-specific technical skills learners must have to succeed in the course:

- Using Canvas for accessing materials and grades, as well as submitting files.
- Converting files to PDF
- Using email with attachments
- Using presentation and graphics programs

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. Research has shown that students who attend class are more likely to be successful. You should 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. Your safety and well-being are important to me. 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
Reports are to be submitted 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 in all activities. 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 conduct and 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).