The University of Texas at Tyler
Department of Electrical Engineering

EENG 4309.001 – Electronic Circuit Analysis II (Required)

Syllabus

Catalog Description:

CMOS digital circuits; structure of operational amplifiers; frequency response of operational amplifiers and multi-stage amplifiers; feedback concepts; oscillators; small-signal analysis; load-line analysis; introduction to nonlinear electronic circuits.

Prerequisites: EENG 3306, EENG 3106, EENG 3305

Credits: (3 hours lecture, 0 hours laboratory per week)

Text(s): Sedra, A. S., and Smith, K.C. *Microelectronic circuits, 8th Ed.* Oxford University Press, 2019. ISBN 9780190853464.

Additional Material: Engineering paper, scientific calculator; access to circuit-simulation software (Multisim), MATLAB, and Excel

Course Coordinator: Shawana Tabassum

Topics Covered: (paragraph of topics separated by semicolons)

Single- and multi-stage amplifiers for IC implementation; differential amplifiers and operational amplifiers; feedback concepts; criteria for oscillation in feedback circuits; oscillator circuits; active and passive filters; introduction to nonlinear electronic circuits.

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 Objectives[2]: By the end of this course students will be able to:

1. Analyze single- and multi-stage amplifiers. [1,2,7]
2. Analyze the transfer characteristics of a differential amplifier. [1]
3. Analyze a simple operational amplifier. [1]
4. Analyze systems involving feedback and determine their closed-loop gain, input impedance, output impedance, and frequency response. [1,2]
5. Design simple active filters to meet frequency-response requirements. [5]
6. Determine the conditions under which circuits with feedback will oscillate. [1, 2]
7. Design simple nonlinear oscillator circuits to meet specified requirements. [5]
8. Derive the transfer characteristics of a CMOS inverter by graphical or analytical methods. [1,2]
9. Determine V_{IL}, V_{IH}, V_{OL}, V_{OH}, and noise margins of a CMOS inverter from its voltage-transfer characteristic. [1]

10. Design simple logic gates using static CMOS, pseudo-NMOS, pass-transistor logic, and dynamic logic. [1]

[2]*Numbers in brackets refer to method(s) used to evaluate the course objective.*

Relationship to Program Outcomes (only items in dark print apply)[3]: This course supports the following Electrical Engineering Program Outcomes, which state that our students will:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics [1-4,9];
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 [5,6,7,10];
3. an ability to communicate effectively with a range of audiences
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
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 [8];
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

[3] *Numbers in brackets refer to course objective(s) that address the Program Outcome.*

Prepared By:	David M. Beams Revised by Shawana Tabassum	Date:	14 January 2018 06 January 2022

The University of Texas at Tyler
Department of Electrical Engineering

EENG 4309: Electronic Circuit Analysis II

"Learning is a 2-way street. I also look forward to learning from you!"

Class Information

Time**:** 10:10 – 11:05 AM, Mon Wed Fri

Place: First 3 weeks on Zoom, then RBN 3041

Zoom link:

https://uttyler.zoom.us/j/97379253960?pwd=bWwwU2NrMmt5c0FLeHhjYnZ0bUVvQT09

Meeting ID: 973 7925 3960
Passcode: 150262

Course-Instructor

Shawana Tabassum, PhD

Office: RBN 2009A

Email: stabassum@uttyler.edu (preferred)

Response time: I try to respond to all emails within one business day. So, please be patient.

Student Hours: Tue, Wed, and Thu 1-2 PM

Zoom link for student hours:

https://uttyler.zoom.us/j/97379253960?pwd=bWwwU2NrMmt5c0FLeHhjYnZ0bUVvQT09

Meeting ID: 973 7925 3960
Passcode: 150262

Graduate Teaching Assistant

Nafize Ishtiaque Hossain

Email: nhossain2@patriots.uttyler.edu

Student Hours:

Course Website

https://uttyler.instructure.com/courses/29092

Lecture notes and assignments will be posted on Canvas

Textbook & Resources

Sedra, A. S., and Smith, K. C., *Microelectronic circuits, 7th Ed.* Oxford University Press, 2014. ISBN-13 978-0199339136. Also usable is the 6th Edtion, published 2010 (ISBN-13 978-0195323030) (**required**)

Lecture notes, additional materials, and examples will be made available through Canvas.

Course Description

The purpose of this course is to provide a detailed understanding of single- and multi-stage amplifiers for IC implementation, differential amplifiers and operational amplifiers, feedback concepts, criteria for oscillation in feedback circuits, oscillator circuits, active and passive filters, and nonlinear electronic circuits.

Learning Objectives

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

- Analyze single- and multi-stage amplifiers.
- Analyze the transfer characteristics of a differential amplifier.
- Analyze a simple operational amplifier.
- Analyze systems involving feedback and determine their closed-loop gain, input impedance, output impedance, and frequency response.
- Design simple active filters to meet frequency-response requirements.
- Determine the conditions under which circuits with feedback will oscillate.
- Design simple nonlinear oscillator circuits to meet specified requirements.
- Derive the transfer characteristics of a CMOS inverter by graphical or analytical methods.
- Determine V_{IL}, V_{IH}, V_{OL}, V_{OH}, and noise margins of a CMOS inverter from its voltage-transfer characteristic.
- Design simple logic gates using static CMOS, pseudo-NMOS, pass-transistor logic, and dynamic logic.

Course Outline

The numbers in the two right-hand columns refer to the chapter numbers of the 6th and 7th Editions of the Sedra and Smith text.

Week	Topics	6th Ed.	7th Ed.
Week 1	Introduction		
Week 2	Frequency Response	9	10
Week 3	Frequency Response	9	10
Week 4	Negative Feedback **Quiz 1**	10	11
Week 5	Negative Feedback	10	11
Week 6	Building blocks of IC Amplifiers	7	8
Week 7	Differential- and Multi-Stage Amplifiers	8	9
Week 8	**Midterm Exam**		
Week 9	Spring Break		

Week 10	Operational Amplifier Circuits	12	13
Week 11	Active Filters	16	17
Week 12	Active Filters **Quiz 2**	16	17
Week 13	Oscillators	17	18
Week 14	Digital Integrated Circuits	13	14
Week 15	Project presentation and Final exam review		
Week 16	**Final exam**		

Grading Scheme

The overall distribution of grades is obtained as:

Quizzes	20%
Homework	10%
Project	15%
Class participation	5%

Midterm exam	20%
Final Exam	30%
Total	100%

Grading Scale

Letter Grades	Range
A	89-100
B	77-88
C	65-76
D	53-64
F	52 and below

Any deviation from the above policy such as scaling or curving to calculate the individual item or final scores will be at the sole discretion of the instructor and performed by the instructor uniformly for all students in the class.

Course Policies

Attendance Policy:

The progressive nature of the class means that perfect attendance is recommended if a good grade is desired. Moreover, class participation is 5% of the total grade. Makeup quizzes, exams, or projects will only be provided for valid absences and at the sole discretion of the instructor.

Course communication:

Course communication will take place by e-mail and by announcements on UT-Tyler's Learning Management System (LMS). University policy requires that official e-mail communication be sent only to Patriot e-mail accounts.

Homework Policy:

- There will be homework assignments. Please look for Canvas announcements for their due dates.

- Late assignments will NOT be graded. Make-up or late submission will be allowed only with a prior arrangement with the instructor, or for emergency (e.g., medical); adequate documentation should be provided for the same. (See the late assignments and make-up policy below)

- You will have to submit the assignments/projects through Canvas using pdf or word format. But, please remember if you take pictures and upload, your writing has to be LEGIBLE. Otherwise, we might ask you to resubmit.

You are always welcome to discuss with your peers regarding any assignments, as cooperative learning can result in higher achievement than individual learning. However, do NOT copy, paste and use materials from your peers. That will be counted as PLAGIARISM.

All resources, including materials obtained from the internet, should be properly acknowledged.

Quiz & Exam Policy:

- Quiz and exams will be closed book/note and no collaboration is allowed

- There will be one midterm and one final exam (check the course outline above)

- Review sessions for the midterm and final will be held at class time

Late assignments and make-up policy:

Accommodation of the following absences will be ensured.

1. Extra-curricular activities as a representative of UT Tyler (e.g., sponsored sports, band, conference presentations, etc.).

2. Military service (including National Guard, ROTC).

3. Officially mandated court appearances (including jury duty).

In all cases, the person or agency responsible for the event or activity should provide participants with a letter explaining the proposed absence and its duration, including travel times for off-campus events and activities. Students must provide this documentation to instructors **at least two weeks prior** to the activity or event, except when such notice is not possible.

Other Absences Granting requests for accommodating other absences is at the discretion of the instructor. That is, the instructor will review the situation in an effort to provide a reasonable accommodation and arrange for possible make-up when possible to do so, without fundamentally altering a course or creating an undue burden for the instructor or department. The official documentation is required whenever possible and must be provided at the earliest opportunity. This policy is intended primarily for the following situations:

1. Medical excuse.

2. Family emergency.

3. Religious observances and practices. Students who request religious accommodation should do so in writing during the first week of the semester. Students may seek assistance from the Dean of Students Office.

Expected online or classroom behaviors:

Students are highly encouraged to be considerate.

- ***Be respectful:*** Please be respectful even in an online environment. Do not say anything you would not say in a face-to-face classroom. This includes attacking someone, dominating a discussion, controlling the class agenda, etc.

- ***Be a responsible citizen:*** Please do not engage in activities that is disruptive to the rest of the class. The instructor should also take into consideration complaints of disruptive behavior brought to their attention by students. Should any student officially enrolled for credit or audit in a class disrupt the instructor's ability to ensure a safe environment and/or deliver the approved curriculum, the instructor has the right to ask that the disruptive action cease immediately. The responsible student should cease the disruption and utilize non-disruptive means for expressing disagreement or concern. If the disruption continues, the instructor can pursue various forms of intervention, including suspension from class and use of student disciplinary regulations.

Campus resources:

- UT Tyler Writing Center (903.565.5995), writingcenter@uttyler.edu , https://www.uttyler.edu/writingcenter/onlinetutoringinfo.php

- 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 Academic Advising, https://www.uttyler.edu/advising/

- UT Tyler Counseling Center (903.566.7254), https://www.uttyler.edu/counseling/

- UT Tyler Canvas support, https://www.uttyler.edu/canvas/. See below for more information

- UT Tyler Technology support, https://www.uttyler.edu/ccs/

- UT Tyler Student Accessibility and Resources, https://www.uttyler.edu/disabilityservices/

- UT Tyler Library support, https://www.uttyler.edu/library/

- UT Tyler PASS Tutoring Center, https://www.uttyler.edu/tutoring/

- UT Tyler Veterans Resources, https://www.uttyler.edu/military-and-veterans-success-center/?r=/veteransaffairs/

- UT Tyler Student Health and Wellness, https://www.uttyler.edu/wellness/onlineresources.php

Academic Misconduct

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 an unfair advantage to a student or the attempt to commit such acts.

1. "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 that 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 have 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 things 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.

1. "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.

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

University Policies

People learn differently, and our goal is to ensure everyone is learning, regardless of their needs. We will make every effort to accommodate the needs of students with different learning abilities.

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

Campus Carry:

We respect the right and privacy of students 21 and over who are duly licensed to carry concealed weapons in this class. License holders are expected to behave responsibly and keep a handgun secure and concealed. More information is available at http://www.uttyler.edu/about/campus-carry/index.php

UT Tyler a Tobacco-Free University:

All forms of tobacco will not be permitted on the UT Tyler main campus, branch campuses, and any property owned by UT Tyler. This applies to all members of the University community, including students, faculty, staff, University affiliates, contractors, and visitors.

Forms of tobacco not permitted include cigarettes, cigars, pipes, water pipes (hookah), bidis, kreteks, electronic cigarettes, smokeless tobacco, snuff, chewing tobacco, and all other tobacco products.

There are several cessation programs available to students looking to quit smoking, including counseling, quitlines, and group support. For more information on cessation programs please visit www.uttyler.edu/tobacco-free.

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.

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.

Emergency Exits and Evacuation:

Everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.

Canvas for Students at UT Tyler

Getting Started:

1. Be sure to have a UT Tyler username. If you do not, please visit Passwords and Accounts (https://www.it.iastate.edu/services/accounts)
2. Login to Canvas with your UT Tyler username and password and look for your course for this semester.

General Help with Canvas:

In your Canvas course page, on the global navigation on the left panel, you will see a Help Tab. Clicking on that will take to various available options. Generally, you have:

- Canvas Live Chat – 24*7 live chat with Canvas specialists
- Canvas Guides-a repository of how-tos
- Ask the Canvas Community-Online support forum for canvas users.

Visit UT Tyler Canvas support if your questions are not answered