

ECE 5343 Nanoelectronics
Electrical and Computer Engineering
University of Texas at El Paso

Instructor:

Name	Email	Office Room	Office Hours
David Zubia	dzubia@utep.edu	A335 Engineering	W, Th: 1:30 - 2:30

Course Description:

Review of quantum mechanics of free and confined electrons in quantum wells, wires and dots. Study of modern electronic devices that possess dimensions at which the quantum mechanical behavior of matter is manifested including devices with single, few, and many electron phenomena. This course covers key nanoscale aspects of semiconductors, properties of heterostructures, and the utilization of these structures in electronic devices. We will follow the book by Hanson and expand and give supplementary material where needed.

Learning Objectives:

After completion of this course, students should be able to:

- Apply fundamentals of nanoscopic physics to nanoscale structures
- Analyze many-electron phenomena in nanoscale devices
- (If time permits) Analyze single-electron and few-electron phenomena in nanoscale devices

Student Tasks:

- **Attend Lectures:** twice per week
- **Read:** Assigned textbook chapters
- **View:** View lecture presentations
- **Discuss:** Discuss concepts and methods from textbook and presentations
- **Complete:** Problem Sets
 - Study device parameter relationships using graphs
 - Work in a team and submit on-line as a team
- **Exam 1 (Mid-Term):** ~8th week
- **Exam 2 (Final):** Finals week

Evaluation:

Item	Homework	Exam 1	Exam 2	Attendance Factor	Total
Value	40%	30%	30%	See Below	100% × (Att. Factor)

Attendance Factor: The attendance factor below will be applied to the final grade. **Note:** Only official university absences will be excused.

Absences	0-3	4	5	6	7	8	9	>9
Attendance Factor	1.0	0.97	0.93	0.90	0.87	0.83	0.80	0.80

Grading Policy:

Score	90% - 100%	80% - <90%	70% - <80%	60% - <70%	0% - <60%
Grade	A	B	C	D	F

Required Textbooks:

Fundamentals of Nanoelectronics, Hanson, Prentice Hall

Advanced Semiconductor Fundamentals, Pierret, Prentice Hall

Course Topics:

- Review of semiconductor fundamentals
- Classic and quantum waves and particles
- Quantum mechanics of electrons
- Free and confined electrons
- Band theory of solids
- Many electron phenomena
 - -Density of states; Quantum wells, Q-wires and Q-dots; Ballistic transport; Spin transport
- (If time permits) Single-electron and few-electron phenomena and devices
 - -Tunnel Junctions; Coulomb Blockade; Single-electron Transistor

*Use of Artificial Intelligence Tools

- The use of generative AI tools such as Chat GPT is **permitted** in this course for the following activities, however they must be noted or cited:
 - To obtain ideas to solve engineering problems in Problem Sets assignments
 - To obtain ideas to write code for engineering problems
 - To obtain ideas for written parts of Problem Sets assignments
 - To perfect English on Problem Sets assignments
- However, you may **not** use AI tools to complete the following activities:
 - Exams
- Students must cite any borrowed content sources to comply with all applicable citation guidelines, copyright law, and avoid plagiarism. Instances that violate these guidelines will be referred to the Office of Student Conduct and Conflict Resolution.

Content Delivery:

- The course is listed as in-person however if needed all content will be delivered online through synchronous lectures and other online materials.
- Content will be provided in modules on a chapter-by-chapter basis and will follow a weekly routine.

Technology Requirements:

Course content is delivered via through the Blackboard learning management system. All assignments will require use of a computer and software. The table below shows the hardware and software that will be needed.

UTEP Email	Laptop Computer	Web browser	Microsoft Office	Matlab or MathCAD	Adobe Acrobat	Media Player
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- Web Browser: Google Chrome and Mozilla Firefox are the best browsers for Blackboard.
- Microsoft Office: Download Microsoft Office programs (including Excel, PowerPoint, Teams, Outlook, and more) for free via UTEP's [Microsoft Office 365 Portal](#).
- Matlab or MathCAD: Contact the [Engineering Technology Center](#) to install software.

Technical Difficulties Policy:

- If you are experiencing difficulties submitting your work through Blackboard, please contact the UTEP Help Desk or ETC. You can email me your backup document as a last resort.
- I strongly suggest that you submit your work with plenty of time to spare in the event that you have a technical issue with the course website, network, and/or your computer.

- I also suggest you save all your work (answers to discussion points, quizzes, exams, and essays) in a separate Word document as a backup. This way, you will have evidence that you completed the work and will not lose credit.

Non-Compliance Policies:

- **Late Work:** Late course work will not be accepted or unless it is the result of a *documented* emergency or official university event.
- **Make-up Work:** Make-up work will be given *only* in the case of a *documented* emergency or official university event.
- **Posting Netiquette:** Postings that violate UTEP policy will be investigated and appropriate actions will be taken.
- **Group Work:** Lack of significant contribution to group (team) work will result in zero credit. If lack of contribution persists for any one or more than one exercise, the instructor will take action to ensure equity for group members that are contributing significantly and meaningfully.

Instructor-Student Communications:

- We will use formal English in all our written communications
- Announcements:
 - Check the Blackboard announcements frequently for any updates, deadlines, or other important messages.
- Office Hours:
 - Hours are in-person; however, you can request a virtual meeting. Please see the days and times at the top of this syllabus.
- Email:
 - UTEP e-mail is the best way to contact me. I will make every attempt to respond to your e-mail within 24 hours of receipt.

ILLNESS PRECAUTIONS

Please stay home if you have symptoms of a communicable illness. If you are feeling unwell, please let me know as soon as possible, so that we can work on appropriate accommodations.

EXCUSED ABSENCES AND/OR COURSE DROP POLICY

According to UTEP Catalog,

“At the discretion of the instructor, a student can be dropped from a course because of excessive absences or lack of effort. A grade of “W” will be assigned before the course drop deadline and a grade of “F” after the course drop deadline.”

See Policies and Regulations in the UTEP Undergraduate Catalog for a list of excuse absences. Therefore, if I find that, due to non-performance in the course, you are at risk of failing, I may drop you from the course. I will provide 24 hours advance notice via email.

However, if you feel that you are unable to complete the course successfully, please let me know and then contact the [Registrar’s Office](#) to initiate the drop process. If you do not, you are at risk of receiving an “F” for the course.

INCOMPLETE GRADE POLICY

I do not give incomplete grades.

ACCOMMODATIONS POLICY

The University is committed to providing reasonable accommodations and auxiliary services to students, staff, faculty, job applicants, applicants for admissions, and other beneficiaries of University programs,

services and activities with documented disabilities in order to provide them with equal opportunities to participate in programs, services, and activities in compliance with sections 503 and 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act (ADA) of 1990 and the Americans with Disabilities Act Amendments Act (ADAAA) of 2008. Reasonable accommodations will be made unless it is determined that doing so would cause undue hardship on the University. Students requesting an accommodation based on a disability must register with the UTEP Center for Accommodations and Support Services (CASS). Contact the Center for Accommodations and Support Services at 915-747-5148, email them at cass@utep.edu, or apply for accommodations online via the CASS portal.

SCHOLASTIC INTEGRITY

Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as one's own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. All suspected violations of academic integrity at The University of Texas at El Paso must be reported to the [Office of Student Conduct and Conflict Resolution \(OSCCR\)](#) for possible disciplinary action. To learn more, please visit [HOOP: Student Conduct and Discipline](#).

PLAGIARISM DETECTING SOFTWARE

Some of your course work and assessments may be submitted to SafeAssign, a plagiarism detecting software. SafeAssign is used to review assignment submissions for originality and will help you learn how to properly attribute sources rather than paraphrase.

COURSE RESOURCES: Where you can go for assistance
UTEP provides a variety of student services and support:

Technology Resources

- [ETC](#): The ENGINEERING TECHNOLOGY CENTER, College of Engineering
- [Help Desk](#): Students experiencing technological challenges (email, Blackboard, software, etc.) can submit a ticket to the UTEP Helpdesk for assistance. Contact the Helpdesk via phone, email, chat, website, or in person if on campus.

Academic Resources

- [UTEP Library](#): Access a wide range of resources including online, full-text access to thousands of journals and eBooks plus reference service and librarian assistance for enrolled students.
- [University Writing Center \(UWC\)](#): Submit papers here for assistance with writing style and formatting, ask a tutor for help and explore other writing resources.
- [Math Tutoring Center \(MaRCS\)](#): Ask a tutor for help and explore other available math resources.
- [History Tutoring Center \(HTC\)](#): Receive assistance with writing history papers, get help from a tutor and explore other history resources.
- [RefWorks](#): A bibliographic citation tool; check out the RefWorks tutorial and Fact Sheet and Quick-Start Guide.
- [The Miner Learning Center](#): Join peer-led study sessions in person or online to review content and discover study strategies in core curriculum courses.
- [UTEP Edge](#): UTEP's cross-campus framework for student success and empowerment – develops students' assets through high-impact experiences made possible by the expertise and dedication of faculty, staff, alumni, and community partners.

Individual Resources

- [Student Success Help Desk \(SSHD\)](#): Students experiencing challenges or obstacles to academic success including registration, financial, food, housing, and transposition resources may submit a ticket request assistance to studentsuccess@utep.edu
- [Military Student Success Center](#): Assists personnel in any branch of service to reach their educational goals.
- [Center for Accommodations and Support Services](#): Assists students with ADA-related accommodations for coursework, housing, and internships.
- [Counseling and Psychological Services](#): Provides a variety of counseling services including individual, couples, and group sessions as well as career and disability assessments.
- [UTEP Food Pantry](#): Non-perishable food items are available to students who are currently enrolled in classes. Bring a Miner Gold Card to Memorial Gym, Room 105, Monday through Friday, 10 a.m. to 2 p.m.

Syllabus Changes: The content in the syllabus is subject to change for improvements or other factors. Any changes will be communicated.