Fundamentals of Semiconductor Devices
(US-MX Collaborative Hybrid Course)
Electrical and Computer Engineering
University of Texas at El Paso

Instructors:

Name	Email	Office Room	Office Hours
David Zubia	dzubia@utep.edu	A335 or online	M,T,W 3:30 to 4:30
Cesar Y. Sanchez Zambrano	cysanchezzambrano@miners.utep.edu	A322 or online	T, R, 10:00 to 11:30
Jose Mireles Jr.	jmireles@uacj.mx	IACenter 107	M,T,W 1:30 to 2:30

Content Delivery Modality:

- This course is listed as HyFlex. Content will be delivered through synchronous in-person and online lectures simultaneously.
- The first lecture of each week will be available to attend in-person at UTEP designated HyFlex classroom listed in this syllabus. The second lecture of each week will be available to attend in-person at Cd. Juarez in the A.I. center (click here for directions).
- Online lectures will be always available to attend via MS Teams through a provided link on Blackboard.
- Content will be provided in modules on a chapter-by-chapter basis and will follow a weekly routine.

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Content Description: This course combines theory of semiconductors with application of engineering analysis and design principles to predict the electrical performance of devices. Students will learn how to analyze and design semiconductor devices.

Learning Objectives: After completion of this course, students:

- Will learn to apply energy bands, density of states, and distribution functions to calculate carrier densities in semiconductors
- Will learn to apply carrier transport theories to calculate current in semiconductors
- Will learn to analyze and design the electrical performance of semiconductor devices.

Topics:

- Module 1: Energy bands and carrier concentration in thermal equilibrium
- Module 2: Carrier transport
  - Device 1: Resistors
- Module 3: p-n Junctions
  - Device 2: Diodes
  - Device 3: Capacitors
- Module 4: Bipolar junction transistors
  - Device 4: BJTs
- Module 5: Field-effect transistors
  - Device 5: MOSFETS
- Module 6: (If time permits) Survey of semiconductor devices

Prerequisites:

- Introductory Electromagnetism: Electric fields and potential; current and magnetism; time varying fields and electromagnetic waves.
    - UTEP PHYS 2421 or similar course with grade of "C" or better.
- Electronics I: Introduction to electronic devices and circuits: Diodes, field-effect transistor amplifiers, bipolar junction transistor amplifiers.
    - UTEP EE 3338 or similar course with grade of "C" or better.

Required Textbook:
Semiconductor Devices: Physics and Technology, 3rd Edition, S. M. Sze and M. K. Lee, Wiley, 2012

Student Tasks:
- **Attend Lectures:** twice per week
- **Read:** Assigned textbook chapters
- **View:** View lecture presentations
- **Discuss:** Discuss concepts and methods from textbook and presentations
- **Coursework:** Question Sets (These are Weekly Homework Assignments)
    - Answer conceptual and calculation questions
    - Can collaborate but submit individually and on-line (via Blackboard)
- **Teamwork:** Parameter Studies (approximately one per module as defined below)
    - Teams will be formed during the first week of the course (3 to 4 students/team).
    - Study device parameter relationships using graphs created with computational software (see software options below)
    - Work in a team and submit on-line as a team
- **Exam 1 (Mid-Term):** ~8th week (on-line)
- **Exam 2 (Final):** Finals week (on-line)

Evaluation:

Item	Question Sets	Parameter Studies	Exam 1 (Midterm)	Exam 2 (Final)	Attendance Factor	Total
Value	**30%**	**30%**	**20%**	**20%**	**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**	**1-3**	**4**	**5**	**6**	**7**	**8**	**9**	**>9**
Attendance Factor	**1.02**	**1.0**	**0.98**	**0.96**	**0.94**	**0.92**	**0.90**	**0.88**	**0.88**

Grading Policy:

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

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

Email	Laptop Computer	Web browser	Microsoft Word	Matlab, Octave, or MathCAD	Adobe Acrobat	Media Player

- Internet Access: Access to the internet is required for this course to view lectures, submit assignments, and take exams.
- Web Browser: Google Chrome and Mozilla Firefox are the best browsers for Blackboard.
- Matlab, Octave, or MathCAD: Computational software is needed to complete coursework and teamwork assignements.
- Microsoft Word: Teamwork assignments will be delivered in MS Word format.

Technical Difficulties Policy:

- If you are experiencing difficulties submitting your work through Blackboard, please contact the instructor. You can email your backup document as a last resort.
- It is 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.
- It is 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.

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: Meetings can be in-person or virtual. Please see the days and times at the top of this syllabus.
- Email: Email is the best way to contact the instructor. Attempt will be made to respond to your e-mail within 24 hours of receipt.

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.

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 Parameter Study assignments
    - To obtain ideas to write code for engineering problems
    - To obtain ideas for written parts of Parameter Study assignments
    - To revise English on Parameter Study assignments
- However, you may **not** use AI tools to complete the following activities:
    - Question Sets
    - 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.

Illness Precautions:
Please attend lectures online 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.

Scholastic Integrity:
Academic dishonesty is prohibited. 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 ones' own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted is unacceptable and will not be tolerated. All suspected violations of academic integrity will be reported to the appropriate official for possible disciplinary action.

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

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