WELCOME!

Electrical Engineering

Junior Meeting 2023
WELCOME!
Senior Elective Requirements

- 8 Courses and 32 units minimum

- EE Senior Capstone, ECE 188A-B-C is required (4 units each)
  
  ECE 188A prerequisite is ECE 130A&B with a C- or better in both; or ECE 137A&B with a C- or better in both

- 1 Dept Approved Sequence

- Approx. 4 (minimum 32 units total) single elective courses
Approval Process

Discuss your senior elective plans with your faculty advisor and get course recommendations.

Faculty Advisor must sign and approve your senior elective plans.

Email the signed form to ECE Student Office for final approval.
Elective Sheets are Contracts

You MUST complete the required number of elective courses.

You do not have to list ALL electives you plan to take, just the required minimum (8 courses, 32 units minimum).

You are responsible for knowing the prerequisites of the courses.

PLAN CAREFULLY!!
<table>
<thead>
<tr>
<th>Last Name</th>
<th>Faculty Advisor</th>
<th>Faculty Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - D</td>
<td><a href="https://www.ece.ucsb.edu/undergrad/current">https://www.ece.ucsb.edu/undergrad/current</a></td>
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<tr>
<td>E - G</td>
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<td>R - V</td>
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<td>W - Z</td>
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EE SENIOR ELECTIVE FORM
Electrical Engineering
Schedule of Senior EE Electives, 2016-17 & Later
Department of Electrical and Computer Engineering – University of California, Santa Barbara

<table>
<thead>
<tr>
<th>Last Name, First Name</th>
<th>UCSB Email</th>
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</thead>
<tbody>
<tr>
<td>Perm Number</td>
<td>Phone Number</td>
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</table>

Students are responsible for determining and taking the necessary prerequisites for the classes listed. Your senior electives must include:
1) A minimum of 32 units;
2) A minimum of 8 courses;
3) EE Senior Capstone Project, ECE 188A-B-C (3 units each, total of 9 units); and one (1) additional sequence required;
4) Additional departmental electives of your choosing.

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tr>
<td>Capstone Senior Project</td>
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<tr>
<td>Second Sequence</td>
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</tr>
<tr>
<td>Departmental Electives</td>
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</tr>
</tbody>
</table>

Include all completed EE senior electives. Total Units: 32
Minimum Required: 32

Student’s Signature       Date
ECE Student Office Approval Signature Date
Faculty Adviser’s Signature Date

8/13/21
Electrical Engineering Program
Undergraduate Emphases

The ECE electives allow students to acquire more in-depth knowledge in one of several areas of specialization. Several possible tracks are illustrated below with recommendations for related electives. Note that these are NOT to be considered the only possibilities for electives. They are listed just to provide some guidance in choosing electives consistent with specific disciplines.

Course descriptions for many of these courses can be found in the General Engineering Academic Requirements (GEAR) <https://engineering.ucsb.edu/undergraduate/academic-advising/gear-publications>.

### Approved Departmental Electives

**Computer Engineering**
- ECE 122A-B
- ECE 123
- ECE 130
- ECE 154A-B
- ECE 157A-B

**Control Systems/Robotics**
- ECE 130C
- ECE 141A-B-C (3 units ea.)
- ECE 147A-B-C (5 units ea.)
- ECE 149
- ECE 179D
- ECE 179P
- ECE 181
- ECE 183

**Electronic Systems**
- ECE 122A-B
- ECE 123
- ECE 141C
- ECE 141D
- ECE 141E
- ECE 141A-B-C
- 5 units each
- ECE 146A-B
- 5 units each
- ECE 148

**Engineering & Technology Management**
- TMP 120
- TMP 122

*Students may count ONE TMP course as a departmental elective

**VLSI Design**
- ECE 113A-B

**GVF Signal Processing and Communications**
- ECE 130C
- ECE 146A-A
- ECE 148
- ECE 158
- ECE 160
- ECE 178
- ECE 180
- ECE 181

**Nanotechnology: Material & Devices**
- ECE 123A-B
- ECE 130
- ECE 141A-B-C (A&B&C: 3 units ea.)
- ECE 141D
- ECE 141E
- ECE 141F
- Materials 100A-C (3 units ea)
- Materials 100B or Materials 101
- (3 units ea)

**Other**
- ECE 105 or ECE 106 (4 units combined max)
- ECE 194A-AZ (Except 194R)

### Approved Departmental Sequences

**Design Sequences**
- ECE 123A & ECE 130B
- ECE 123A & ECE 130B
- ECE 141A & ECE 145B (5 units each)
- ECE 146A & ECE 146B (5 units each)
- ECE 147A & ECE 147B (5 units each)
- ECE 151A & ECE 151B
- ECE 158 & ECE 178
- ECE 178 & ECE 181
- ECE 179D & ECE 179P

**Other Sequences**
- ECE 122A & ECE 130A
- ECE 123 & ECE 122B
- ECE 141A & ECE 141B (ECE 141A: 3 units)
- ECE 143 & ECE 141C (5 units each)
- ECE 144 & ECE 135
- ECE 145A & ECE 145C (5 units each)
- ECE 145A & ECE 146A (5 units each)
- ECE 148 & ECE 158
- ECE 154A & ECE 154B
- ECE 157A & ECE 157B
- ECE 158 & ECE 181
- ECE 160 & ECE 178
- ECE 160 & ECE 181
- ECE 162A & ECE 162B

8/13/21
EE Senior Elective Summary

- Capstone Project: ECE 188 ABC;
- One (1) Sequence
- 32 units, 8 courses

Include your completed electives!
Run quarterly progress report
Elective Course Scheduling Resources

ece.ucsb.edu/undergrad/curriculum
## ECE Undergraduate Courses 2023-24

This proposed schedule is subject to change. To review the most up-to-date listings of all courses, instructors, times and locations refer to [GOLD](https://ece.ucsb.edu/undergrad/courses) (UCSB Student Gaucho Online Data). If you do not have access to GOLD, refer to the UCSB Schedule of Classes.

Students are responsible for determining and completing the necessary prerequisites for all ECE courses.

See ECE Graduate Courses [here](https://ece.ucsb.edu/undergrad/courses) →

### Undergraduate Courses

Courses Offered: \( X = \) ECE Instructor | \( XD = \) External Dept Instructor

<table>
<thead>
<tr>
<th>Number</th>
<th>Undergraduate Course</th>
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<tr>
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<td>Computer Engineering Seminar</td>
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<td>1B</td>
<td>Ten Puzzling Problems in Computer Engineering</td>
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<td>3</td>
<td>Introduction to Electrical Engineering</td>
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<td>5</td>
<td>Introduction to Electrical and Computer Engineering</td>
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<td>The Physics of Energy, Information, and Communication</td>
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<td>10A/10AL</td>
<td>Foundations of Analog and Digital Circuits &amp; Systems</td>
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<td>Fundamentals of Logic Design</td>
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<td>Integrated Circuit Design &amp; Fabrication</td>
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<td>120B</td>
<td>Integrated Circuit Design &amp; Fabrication</td>
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<td>122A</td>
<td>VLSI Principles</td>
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<td>VLSI Architecture and Design</td>
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<td>Signal Analysis &amp; Processing</td>
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<td>130B</td>
<td>Signal Analysis &amp; Processing</td>
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<td>130C</td>
<td>Introduction to Applied Linear Algebra</td>
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</table>
DUE DATES

- Elective Sheets are due **no later than Friday, June 14, 2024!**
- Students who have not turned in an elective sheet will be placed on a **REGISTRATION BLOCK!**

*Don't miss the deadline*
Progress Checks

Can be run on GOLD using the degree audit system.

GE/College level questions refer to the College of Engineering advisors, coe-info@engineering.ucsb.edu or:
- Frances Fouch  francesf@engineering.ucsb.edu
- Shariq Hashmi  shasmi@engineering.ucsb.edu
- Sarah Ocampo  socampo@engineering.ucsb.edu

Major level questions refer to the ECE Student Office ugrad-advisor@ece.ucsb.edu or undergrad@ece.ucsb.edu
BS/MS Program

Electrical & Computer Engineering BS/MS

- BS in EE and MS in ECE.
- Go to: https://www.ece.ucsb.edu/grad/bs-ms

For Fall 2024 admission, the application deadline is June 14, 2024.

Applications for the BS/MS in ECE are due at the end of the spring quarter of the junior year. As this is an accelerated program, it is expected that all of the required courses for the CE major are completed including all of the junior required courses. GRE exams are not required to apply.

Contact the Graduate Admissions Coordinator for questions about applying to the BS/MS program: grad-admit@ece.ucsb.edu
BS/MS Programs

- BS in EE and MS in MATRL, see the Materials Department website: [materials.ucsb.edu/academics/bsms-5-year-program](http://materials.ucsb.edu/academics/bsms-5-year-program)
- Express your interest as early as possible by emailing:
  - [academic@engineering.ucsb.edu](mailto:academic@engineering.ucsb.edu)
Maddie W. Foster
Associate Director, Career Education
Engineering + Technology

Career Advising

**Career Peer Advising**

Start here for all of your career planning needs by meeting with a Career Peer Advisor in a 15-minute session. Choose from two methods below.

**DROP-IN**
- **Hours:** Mon.-Fri. 9:00 a.m.-4:00 p.m.
- **Step 1:** Enter the queue in Clarity
- **Step 2:** Select your preferred medium:
  - In-person (Career Resources Room, Building 599)
  - Virtual (Zoom)
  - Phone (Zoom)
- **Step 3:** Check your phone for updates — when it’s your turn, you will receive a text with information to begin your meeting

**APPOINTMENT**
- **Hours:** Mon.-Fri. 11:00 a.m.-6:00 p.m.
- **Step 1:** Login to Handshake and click the Career Center menu to find the Appointments option (must schedule 24 hours prior)
- **Step 2:** Choose the Career Peer Advising appointment category, include details about your request in the Help Requested box, and select your preferred medium:
  - In-person (Career Resources Room, Building 599)
  - Virtual (Zoom)
  - Phone (Zoom)
- **Step 3:** Review your confirmation email for instructions to check in to your appointment

**Career Path Advising**

Dive deeper into your goals in a 30-minute session with a Career Counselor. Gain a referral from Career Peer Advising to utilize this service.

**APPOINTMENT**
- **Hours:** Mon.-Fri. 8:30 a.m.-4:00 p.m.
- **Step 1:** Login to Handshake and click the Career Center menu to find the Appointments option (must schedule 24 hours prior)
- **Step 2:** Choose the best appointment category and type, include details about your request in the Help Requested box, and select your preferred medium:
  - Virtual (Zoom)

Maddie.Foster@sa.ucsb.edu
career.ucsb.edu
Career Paths
Your Gauchos Paths to Success

Engineering + Technology

Get Your Gears Turning

How many engineering disciplines can you name?

UCSB educates students in five key areas: chemical engineering, mechanical engineering, electrical engineering, computer engineering, and computer science. However, there are over 50 other engineering disciplines to discover including aerospace, automotive, bioengineering, civil, environmental, geotechnical, industrial, manufacturing, nanotechnology, nuclear, petroleum, security, telecommunications, and traffic engineering. All areas overlap with basic engineering knowledge and skills.

Learn how you can pursue your discipline or pivot your UCSB education into the area of your choice through a career path in Engineering + Technology.

Recent Postings

Click to view opportunities related to Engineering + Technology in Manhakita.

Customize your filters and learn how to search for UCSB career success.

Related Events >>
How to Prepare for Success >>

Related Jobs & Internships >>
How to Search / Search Safely >>

https://career.ucsb.edu/
Handshake Help Center

Handshake is the premium platform for Gauchos to find jobs, internships, and career connections. Ranging from part-time to full-time positions, on-campus and off campus. Handshake is a gateway to gainful employment in the world of work. Many postings are viewable exclusively to students/alumni of UCSB, providing an edge to engage with employers. Handshake also offers approved Work-Study positions, a database of thousands of employers, and much more.

☀️ Looking to schedule an appointment via Handshake? Visit our Students page.

Get Access to Handshake

Who Has Access?

Access is available to all registered students with an active UCSB NetID and all UCSB alumni. For others looking to login to Handshake, visit our Handshake information for Alumni, Faculty and Staff, and Recruiters.

Special Note During COVID: UCSB students who take time off due to COVID can request access to Handshake for the first quarter of their time off. Inquiries can be directed to CareerHelp@sa.ucsb.edu.

https://career.ucsb.edu/handshake-help-center
Winter 2024
Career & Internship Fair
Science, Technology & Engineering

Wed., January 24, 2024, 10am – 4pm, Corwin Pavilion
career.ucsb.edu
Website

http://www.ece.ucsb.edu/undergrad/

This website has all the information regarding the undergraduate program.

For course offerings in ECE, the website is:

http://www.ece.ucsb.edu/undergrad/courses/
Mandatory - Sign in Below:

- Will let us know who is in attendance
- Give us feedback!

https://forms.gle/m1hSuwdXk4Xcc7z1A
QUESTIONS?

Beth English
ugrad-advisor@ece.ucsb.edu
or
Joanna Villalobos
undergrad@ece.ucsb.edu

Submit an inquiry below:
What is Electronics/Photonics?

- Understanding the physics of devices
  - diodes, transistors, lasers, detectors, ...
- Understand the materials
  - semiconductors, metals, insulators, superconductors
- Application to IC design and fabrication
  - analog, digital, microwave, optical
Senior Electives

- Semiconductor physics: ECE162ABC
- Integrated electronics: ECE 123, 120A/120B, 122A
- MEMs: ECE141ABC
- High frequency electronics: ECE145ABC
- E/M and optical fiber: ECE144, 135
Semiconductor Physics Series

162A Quantum Mechanics
  – learn to think small! put an electron in a box

162B Solid State Physics
  – crystal structure, electrons in solids, applications

162C Optoelectronic Materials and Devices
  – “sheds light” on semiconductor photonic devices!
  – lasers, LEDs, detectors, solar cells

• Prerequisites: ECE 130AB + ECE 134
Integrated Electronics

122A (F), 122B (W) VLSI Principles

- IC design at the transistor level
- Issues in nanoscale CMOS
- CAD tools
- Interconnections and packaging
- Design project

• ECE 122A prerequisites: ECE152A
• ECE 122B prerequisites: ECE 123 or ECE 122A
Integrated Electronics

120A or 123 and 120B
IC Design and Fabrication (WS)
– Semiconductor device processing
– Fabricate ICs in the solid state lab
• ECE 120A prerequisite: ECE132
Micro-Electro-Mechanical (MEMs)

- ECE141ABC MicroElectroMechanical Systems (MEMS)
  - Integrated actuators, sensors, processing techniques, microfluids

- Prerequisites: ECE130A; ECE137A
High Frequency Electronics

- 145AB  Communication Electronics (FW)
  - Design of high frequency wireless communication circuits
- 145C  High Speed Bipolar Mixed Signal IC design (S)
  - High speed circuits for broadband communications
- Prerequisites: ECE137A/B
E/M and applications

- ECE144 Electromagnetic Fields & Waves (W)
  - Physics and applications of E&M
- Prerequisite: ECE134
- ECE135 Optical Fiber Communication (S)
  - Physics, components, and applications
- Prerequisites: ECE132 and ECE134
Other Sequences

- ECE 120A & 120B
- ECE 122A & 120A
- ECE 122A & 122B
- ECE 123 & 122B
- ECE 145A & 145C
- ECE 145A & 145B
CE Senior Elective Courses

- ECE 122A       VLSI Principles
- ECE 122B       VLSI Architecture and Design
- ECE 123        High-Performance Digital Circuit Design
- ECE 153A       The Hardware/Software Interface
- ECE 153B       Sensor and Peripheral Interface Design
- ECE 154A       Introduction to Computer Architecture
- ECE 154B       Advanced Computer Architecture
- ECE 157A       Machine Learning in Design/Test Automation
- ECE 157B       Artificial Intelligence in Design/Test Automation
- ECE 189A-189B-189C  Computer Engineering Project (Senior Capstone)
CE Senior Elective
Track Courses

• Very Large Scale Integration (VLSI) ECE 123/122A or 122A/B
• Embedded Systems Design ECE 153A/B
• Computer Architecture ECE 154A/B
• Design and Test Automation ECE 157A/B
• Capstone Design Project ECE 189A/B/C
ECE 123/122B or 122A/B
Very Large Scale Integration

• Modern VLSI design of integrated circuits
  – Architectural and circuit design issues and constraints for high-performance, low-power, large-scale systems
  – Field effect transistors, layout rules, parasitics, pin limitations, noise and crosstalk, clock and power distribution

• Practical issues in integrated circuit design
  – Noise/Crosstalk/EMI, variability and yield
• Technology from which modern embedded digital computer systems are built
  – Real time programming
  – Modal and reactive systems
• Major hardware/software components, design issues, implementation mechanisms, and interfaces between components
  – Hardware/software interface
  – Sensor and peripheral interface
• ECE 154A: Introduction to Computer Architecture

• ECE 154B: Advanced Computer Architecture
  - Topics include computer architectures with various types (data-, task-, instruction level) of parallelism and memory systems design.
• Hardware design and verification through use of software tools: applying machine learning for data analytics in hardware design and verification process

• Design workflows to model engineering processes in hardware test and verification: capturing human perception in an engineering workflow with AI approaches
ECE 189 A/B/C
Computer Engineering Project

• Design and implementation of a complete digital system including both hardware and software
  – ECE 189A (Fall) – Project definition, high-level system requirements, detailed system design, ready for manufacture
  – ECE 189B (Winter)- Printed circuit boards (PCB) are fabricated and assembled. Focus shifts to software development on a development kit
  – ECE 189C (Spring) – Final assembly, debugging, verification, subsystem and system integration, final presentation
Has completely transformed our lives over the last 2-3 decades
Internet Edge--Cellular, WiFi (Qualcomm, Broadcom, Apple, Samsung)
Internet core (Cisco, Juniper)
Applications (Google, Facebook)

UCSB’s ComSenter aims to drive the next phase in this revolution

1000-10000X increased capacity at the edge
COMMUNICATIONS SEQUENCE

• ECE 146A: Digital Communication Fundamentals
• ECE 146B: Communication Systems Design

Intellectual framework
Probabilistic modeling, Systematic design principles
Goal is to approach fundamental limits
Portable skillset in modeling and signal processing algorithms
CONTROLS

How feedback can be used to make systems behave in a desired manner

Planes, trains, automobile, robots,…

UCSB is a world leader in controls
Center for Control, Dynamical Systems and Control (CCDC) spans multiple depts in CoE
CONTROL SEQUENCE

• ECE 147A: Feedback Control Systems – Theory and Design
• ECE 147B: Digital Control Systems – Theory and Design
• ECE 147C: Control System Design Project
SIGNAL PROCESSING

Very broad term: Understanding and manipulating signals
Core skillset used in pretty much every engineering discipline
Communications, control, sensing/imaging
• ECE 148: Applications of Signal Analysis and Processing
• ECE 158: Digital Signal Processing
• ECE 178: Introduction to Digital Image and Video Processing
• ECE 181: Introduction to Computer Vision
## ECE Undergraduate Courses 2023-24

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Students are responsible for determining and completing the necessary prerequisites for all ECE courses.

See [ECE Graduate Courses →](https://www.ece.ucsb.edu/undergrad/courses)

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**Courses Offered: X = ECE Instructor | XD = External Dept Instructor**

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SEQUENCES

- ECE 146A & 146B
- ECE 147A & B, 147A & C
- ECE 178 & 181
- ECE 158 & 178
<table>
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<th>Winter</th>
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<td>ECE</td>
<td>ECE 145A</td>
<td>ECE 145B</td>
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<td>Fall</td>
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<td>ECE 144</td>
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OTHERS

- ECE 192: ECE projects
- ECE 193: Research internship
- ECE 196: Undergraduate research
- ECE 199: Independent study
- ECE 200+: Graduate courses