

# ELECTRICAL ENGINEERING AND MS IN ENGINEERING: EMBEDDED ELECTRICAL AND COMPUTER SYSTEMS SF SCHOLARS ROADMAP

The San Francisco State Scholars program provides undergraduate students with an accelerated pathway to a graduate degree. Students in this program pursue a bachelor's and master's degree simultaneously. This program allows students to earn graduate credit while in their junior and/or senior year, reducing the number of semesters required for completion of a master's degree.

**This roadmap is a suggested plan of study and does not replace meeting with an advisor. Please note that students may need to adjust the actual sequence of courses based on course availability. Please consult an advisor in your major program for further guidance.**

Course	Title	Units
<b>First Year</b>		
<b>Fall Semester</b>		
Select One (Major Core):		3-5
CHEM 115	General Chemistry I: Essential Concepts of Chemistry	
CHEM 180	Chemistry for the Energy and the Environment (B1, B3, ES)	
ENG 114	Writing the First Year: Finding Your Voice (A2) <sup>1</sup>	3
ENGR 100	Introduction to Engineering (Major Core)	1
MATH 226	Calculus I (Major Core, B4) <sup>2</sup>	4
GE Area A <sup>3,4</sup>		3
GE Area D		3
	Units	17-19
<b>Spring Semester</b>		
ENGR 213	Introduction to C Programming for Engineers (Major Core) <sup>4</sup>	3
MATH 227	Calculus II (Major Core)	4
PHYS 220 & PHYS 222	General Physics with Calculus I and General Physics with Calculus I Laboratory (Major Core, B1, B3)	4
GE Area C		3

GE Area E		3
	Units	17
<b>Second Year</b>		
<b>Fall Semester</b>		
Mechanical Engineering Elective - Select One:		3
ENGR 201	Dynamics	
ENGR 203	Materials of Electrical and Electronic Engineering	
ENGR 204	Engineering Mechanics	
ENGR 303	Engineering Thermodynamics	
MATH 228	Calculus III (Major Core)	4
PHYS 230 & PHYS 232	General Physics with Calculus II and General Physics with Calculus II Laboratory (Major Core)	4
GE Area B: Life Science (B2)		3
GE Area D		3
	Units	17
<b>Spring Semester</b>		
ENGR 205 & ENGR 206	Electric Circuits and Circuits and Instrumentation Laboratory (Major Core) <sup>4</sup>	4
ENGR 290	Modular Elective (Major Core)	1
MATH 245	Elementary Differential Equations and Linear Algebra (Major Core)	3
PHYS 240 & PHYS 242	General Physics with Calculus III and General Physics with Calculus III Laboratory (Major Core)	4
GE Area C		3
GE Area D		3
	Units	18
<b>Third Year</b>		
<b>Fall Semester</b>		
ENGR 300	Engineering Experimentation (Major Core) <sup>5</sup>	3
ENGR 305 & ENGR 315	Linear Systems Analysis and Systems Analysis Lab (Major Core)	4

ENGR 353	Microelectronics (Major Core)	3
ENGR 356 & ENGR 357	Digital Design and Digital Design Laboratory (Major Core)	4
GE Area C		3
Units		17

**Spring Semester**

ENGR 301	Microelectronics Laboratory (Major Core) <sup>5</sup>	1
ENGR 306	Electromechanical Systems (Major Core)	3
ENGR 442	Operational Amplifier Systems Design (Major Core)	3
ENGR 451	Digital Signal Processing (Major Core)	4
ENGR 478	Design with Microprocessors (Major Core)	4
Major Upper-Division Electives - Take One <sup>6</sup>		3
Units		18

**Fourth Year**

**Summer Semester**

GE Area UD-C: Upper-Division Arts and/or Humanities (Consider SF State Studies Course)		3
GE Area UD-D: Upper-Division Social Sciences (Consider SF State Studies Course)		3
Units		6

**Fall Semester**

ENGR 446 & ENGR 447	Control Systems Laboratory and Control Systems (Major Core)	4
ENGR 449	Communication Systems (Major Core)	3
ENGR 696	Engineering Design Project I (Major Core) <sup>7</sup>	1
ENGR 844	Embedded Systems (Graduate Core)	3
Major Upper-Division Electives - Take One <sup>6</sup>		3
Graduate Elective - Take One <sup>8,9</sup>		3
Units		17

**Spring Semester**

ENGR 350	Introduction to Engineering Electromagnetics (Major Core)	3
----------	---	---

ENGR 697GW	Engineering Design Project II - GVAR (Major Core)	2
ENGR 852	Advanced Digital Design (Graduate Core)	3
Major Upper-Division Electives - Take One <sup>6</sup>		3
Graduate Elective - Take One <sup>8,9</sup>		3
Units		14

**Fifth Year**

**Fall Semester**

ENGR 800	Engineering Communications (Graduate Core)	3
Select One:		3
ENGR 897	Research (if selecting Culminating Experience Option A)	
Graduate Elective (if selecting Culminating Experience Option B) <sup>8,9</sup>		
Graduate Elective - Take One <sup>8,9</sup>		3
Units		9

**Spring Semester**

ENGR 801	Engineering Management (Graduate Core)	3
Select One (Culminating Experience):		3
ENGR 895	Applied Research Project (if selecting Culminating Experience Option B)	
ENGR 898	Master's Thesis (if selecting Culminating Experience Option A)	
Graduate Elective <sup>8,9</sup>		3
Units		9
Total Units		159-161

<sup>1</sup> ENG 114 can only be taken if you complete Directed Self-Placement (DSP) and select ENG 114; if you choose ENG 104/ENG 105 through DSP you will satisfy A2 upon successful completion of ENG 105 in the second semester; multilingual students may be advised into alternative English courses.

<sup>2</sup> Depending on courses completed through Early Start, students in Pathway/Category III or IV may be required to enroll in a support course to complement their Quantitative Reasoning/B4 requirement. There are multiple course options for this pathway. Before enrolling in a B4 course, students should verify their MATH Pathway/Category in their Student Center (<http://cms.sfsu.edu/content/student-center/>). Information regarding the courses that correspond with your MATH Pathway/Category can be found on the Developmental Studies Office Website (<http://developmentalstudies.sfsu.edu/>).

<sup>3</sup> To avoid taking additional units, it is recommended that you meet **SF State Studies** requirements (AERM, GP, ES, SJ) within your GE or major.

- <sup>4</sup> GE Area A: Critical Thinking (A3) is satisfied upon completion of ENGR 205 and either ENGR 201 or ENGR 213.
- <sup>5</sup> Upper-Division General Education, Physical and Life Sciences (UD-B) is satisfied upon completion of ENGR 300 and either ENGR 301 or ENGR 302.
- <sup>6</sup> **Major Upper-Division Electives (9 units)**  
ENGR 378 Digital Systems Design (3 units)  
ENGR 410 Process Instrumentation and Control (3 units) (Hidden Prerequisite for ENGR 411)  
ENGR 411 Instrumentation and Process Control Laboratory (1 units)  
ENGR 415 Mechatronics (4 units)  
ENGR 445 Analog Integrated Circuit Design (4 units)  
ENGR 448 Electrical Power Systems (3 units)  
ENGR 453 Digital Integrated Circuit Design (4 units)  
ENGR 454 Application Specific Integrated Circuit Design (4 units)  
ENGR 455 Power Electronics (4 units)  
ENGR 456 Computer Systems (3 units)  
ENGR 458 Renewable Electrical Power Systems and Smart Grid (3 units)  
ENGR 476 Computer Communications Networks (3 units)  
ENGR 610 Engineering Cost Analysis (3 units)  
ENGR 699 Independent Study (1-3 units)  
ENGR 844 Embedded Systems (3 units)  
ENGR 848 Digital VLSI Design (3 units)  
ENGR 849 Advanced Analog IC Design (3 units)  
ENGR 851 Advanced Microprocessor Architectures (3 units)  
ENGR 852 Advanced Digital Design (3 units)  
ENGR 853 Advanced Topics in Computer Communication and Networks (3 units)  
ENGR 854 Wireless Data Communication Standards (3 units)  
ENGR 856 Nanoscale Circuits and Systems (3 units)  
ENGR 868 Advanced Control Systems (3 units)  
ENGR 869 Robotics (3 units)
- <sup>7</sup> Students must complete 21 units of upper-division Engineering units before registering for ENGR 696.

- <sup>8</sup> **Graduate Engineering Electives (6-15 units)\***  
Elective technical engineering courses are selected from the following, unless already taken to fulfill other requirements:  
ENGR 446 Control Systems Laboratory (1 unit)  
& ENGR 447 Control Systems (3 units)  
ENGR 449 Communication Systems (3 units) ENGR 451 Digital Signal Processing (4 units)  
ENGR 453 Digital Integrated Circuit Design (4 units)  
ENGR 454 Application Specific Integrated Circuit Design (4 units)  
ENGR 456 Computer Systems (3 units)  
ENGR 476 Computer Communications Networks (3 units)  
ENGR 478 Design with Microprocessors (4 units)  
ENGR 491 Real-time Digital Signal Processing (3 units)  
ENGR 498 Advanced Design with Microcontrollers (4 units)  
ENGR 845 Neural-Machine Interfaces: Design and Applications (3 units)  
ENGR 848 Digital VLSI Design (3 units)  
ENGR 849 Advanced Analog IC Design (3 units)  
ENGR 850 Digital Design Verification (3 units)  
ENGR 851 Advanced Microprocessor Architectures (3 units)  
ENGR 853 Advanced Topics in Computer Communication and Networks (3 units)  
ENGR 854 Wireless Data Communication Standards (3 units)  
ENGR 855 Advanced Wireless Communication Technologies (3 units)  
ENGR 856 Nanoscale Circuits and Systems (3 units)  
ENGR 868 Advanced Control Systems (3 units)  
ENGR 890 RF Devices and Transceiver Principles and Design (3 units)  
ENGR 897 Research (3 units)  
ENGR 899 Independent Study (1-3 units)
- <sup>9</sup> **Non-Engineering Electives (0-6 units)\***  
Courses selected primarily from sciences, mathematics, social science, or business, upon approval of the graduate coordinator. Elective courses must not duplicate subjects used in satisfying the student's undergraduate degree requirement.
- \* The total number of units required will depend on the number of engineering electives taken, the number of non-engineering electives taken, and the culminating experience option selected.