SYSTEMS ENGINEERING & DESIGN, BS

for the degree of Bachelor of Science in Systems Engineering and Design (formerly General Engineering)

Systems Engineering and Design (SED) is a comprehensive, interdisciplinary program emphasizing interactions between parts of a whole. It brings together basic sciences, engineering analysis, and engineering design. The curriculum offers flexibility through a Secondary Field Option, while providing a broad background in engineering as a whole and decision-making that supports overall design. Systems Engineers understand how to coordinate interacting parts of a whole and to evaluate engineering within economic and physical constraints.

Through the Secondary Field Option electives, students can tailor their studies to one's interests and career goals in both technical and nontechnical areas. Secondary field options are of two types: pre-approved and customized. Pre-approved secondary fields have designated titles and a specified list of courses, from which several may be selected. Approval for the substitution of a course for one on the specified list may be requested via a petition form submitted to the department. Customized secondary fields may be created to achieve goals in areas not provided by pre-approved fields. To do this, a suitable title and all the courses must be petitioned for acceptance by the department. Petition approval is based on the merit of the secondary field and the coherence of the courses within it relative to the student's goals.

Pursuit of campus minors, dual degrees, and James Scholar contracts may be integrated with customized secondary field options. Courses taken may be applied to minors, dual degrees, or contracts as well as secondary field options.

Pre-approved Secondary Fields

- Automotive Engineering
- Bioengineering
- Business Systems Integration and Consulting
- Civil Engineering Structures
- Communications and Computer Systems
- Computer Science
- Construction
- Control Systems
- Digital Prototyping
- Engineering Administration
- Engineering Marketing
- Environmental Quality
- Internet of Things (IOT)
- Manufacturing Engineering
- Nondestructive Testing and Evaluation
- Operations Research
- Quality Control
- Rehabilitation Engineering
- Robotics
- Theoretical and Applied Mechanics

Customized Secondary Fields

Customized secondary fields differ from pre-approved ones in that no sets of specified courses to choose from have been predefined. For all customized secondary field options, a course list must be constructed and submitted for approval by the department.

The following list contains examples of over fifty titles of customized secondary field options which have been approved. The complete list may be found at the department's secondary field website (https://ise.illinois.edu/undergraduate/systems-engineering-and-design-degree/secondary-field-options/). Additional titles beyond those listed may be proposed.

- A foreign language (several)
- An engineering discipline (several)
- Audio Engineering
- Economics
- Entrepreneurship
- Finance
- Fluid Dynamics
- International Business
- Mathematics
- Pre-Law
- Pre-Med
- Renewable Energy

Design experience and project management are emphasized and integrated across the core with a focus on establishing critical problem-solving skills applied across disciplines, strong communication skills, and the ability to work effectively and get results in a team environment.

The capstone experience for Systems Engineering and Design undergraduates is the Senior Project Course. Students work collaboratively with industry and a team of faculty members on a real-world problem during their final semester. The results are documented in a final written report and a formal presentation at the end of the semester to the company so that the student recommendations may be implemented.

Current Program Educational Objectives (https://ise.illinois.edu/undergraduate/abet/)

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Graduation Requirements

Minimum Technical GPA (https://go.grainger.illinois.edu/TechnicalGPA/): 2.0

TGPA is required for Engineering and Technical Elective courses and MATH 257. See Technical GPA (https://go.grainger.illinois.edu/TechnicalGPA/) to clarify requirements.

Minimum Overall GPA: 2.0
Minimum hours required for graduation: 128 hours
General education: Students must complete the Campus General Education (https://courses.illinois.edu/gened/DEFAULT/DEFAULT/) **requirements including the campus general education language requirement. One of the SBS courses must be an introductory economics course** (ECON 102 **or** ECON 103)**.** SE 494 **and** SE 495 **will satisfy a core course requirement and the Campus General Education Advanced Composition requirement.**

Orientation and Professional Development

Code	Title	Hours
ENG 100	Grainger Engineering Orientation Seminar (External transfer students take ENG 300.)	1
SE 100	Introduction to ISE	1
SE 290	ISE Undergraduate Seminar	0
Total Hours		**2**

Foundational Mathematics and Science

Code	Title	Hours
CHEM 102	General Chemistry I	3
CHEM 103	General Chemistry Lab I	1
MATH 221	Calculus I (MATH 220 is appropriate for students with no background in calculus. 4 of 5 credit hours count towards degree.)	4
MATH 231	Calculus II	3
MATH 241	Calculus III	4
MATH 257	Linear Algebra with Computational Applications	3
MATH 285	Intro Differential Equations	3
PHYS 211	University Physics: Mechanics	4
PHYS 212	University Physics: Elec & Mag	4
PHYS 213	Univ Physics: Thermal Physics	2
Total Hours		**31**

Systems Engineering and Design Technical Core

Code	Title	Hours
CS 101	Intro Computing: Engrg & Sci (CS 124 may be substituted.)	3
ECE 110	Introduction to Electronics	3
ECE 211	Analog Circuits & Systems	2
IE 300	Analysis of Data	3
IE 310	Deterministic Models in Optimization	3
SE 101	Engineering Graphics & Design	3
SE 261	Business Side of Engineering	2
SE 310	Design of Structures and Mechanisms	3
SE 311	Engineering Design Analysis	3
SE 312	Instrumentation and Test Lab	1
SE 320	Control Systems	4
SE 424	State Space Design for Control	3
SE 494	Senior Engineering Project I	3
SE 495	Senior Engineering Project II	2
TAM 211	Statics	3
TAM 212	Introductory Dynamics	3
TAM 251	Introductory Solid Mechanics	3
TAM 335	Introductory Fluid Mechanics	4
Total Hours		**51**

Secondary Field Option Electives

Code	Title	Hours
Students must select one Secondary Field Option from the list below or they may petition to create their own Secondary Field Option (SFO). Courses from these lists may only be used to fulfill one curricular requirement.		**12**
Automotive Engineering		
Dynamics/Controls Focus - complete at least 1 course from this list:		
ECE 470	Introduction to Robotics (same as AE 482 and ME 445)	4
ECE 486	Control Systems	4
ME 460	Industrial Control Systems	4
TAM 412	Intermediate Dynamics	4
TAM 416	Introduction to Nonlinear Dynamics and Vibrations	4
Automotive Power Systems Focus - complete at least 1 course from this list:		
ECE 431	Electric Machinery	4
ECE 464	Power Electronics	3
ME 400	Energy Conversion Systems	3
ME 403	Internal Combustion Engines	3
Other Elective Options - complete remaining courses from this list:		
CS 173	Discrete Structures	3
CS 440	Artificial Intelligence	3
CS 446	Machine Learning	3
ME 320	Heat Transfer	4
ME 360	Signal Processing	3.5
ME 461	Computer Cntrl of Mech Systems	3
SE 400	Engineering Law	3
SE 422	Robot Dynamics and Control	4
SE 497	Independent Study (May be taken for up to 3 credit hours, based on automotive Engineering project approved by SFO faculty mentor.)	1-4
Autonomous Systems and Robotics		
CS 173	Discrete Structures	3
CS 225	Data Structures	4
CS 440	Artificial Intelligence	3
CS 446	Machine Learning	3
ECE 470	Introduction to Robotics	4
ECE 486	Control Systems	4
ECE 490	Introduction to Optimization	3
ME 270	Design for Manufacturability	3
ME 461	Computer Cntrl of Mech Systems	3
SE 400	Engineering Law	3
SE 411	Reliability Engineering	3
SE 420	Digital Control Systems	4
SE 422	Robot Dynamics and Control	4
SE 423	Mechatronics	3

Bioengineering		
BIOE 120	Introduction to Bioengineering	1
BIOE 414	Biomedical Instrumentation (same as ECE 414)	3
BIOE 415	Biomedical Instrumentation Lab (same as ECE 415)	2
BIOE 498	Special Topics	3
BIOP 401	Introduction to Biophysics	3
CHEM 232	Elementary Organic Chemistry I	3 or 4
CHEM 233	Elementary Organic Chem Lab I	2
IE 340	Human Factors (same as PSYC 358)	4
KIN 355		
MCB 150	Molec & Cellular Basis of Life (recommended only if a prerequisite to another listed course.)	4
MCB 250	Molecular Genetics (recommended only if a prerequisite to another listed course.)	3
MCB 251	Exp Techniqs in Molecular Biol (recommended only if a prerequisite to another listed course.)	2
MCB 401	Cellular Physiology	3
MCB 402	Sys & Integrative Physiology	3
MCB 403		2
MCB 404		2
MCB 450	Introductory Biochemistry	3
SE 400	Engineering Law	3
Business Systems Integration & Consulting		
Core Requirement:		
SE 400	Engineering Law	3
Group I Requirement - complete at least 1 course from this list:		
BADM 352	Database Design and Management	3
BADM 353	Info Sys Analysis and Design	3
IE 405	Computing for ISE	3
Group II - select remaining courses from this list. Of these courses, only 1 selected may be at the 100 or 200 level.		
ACCY 200	Fundamentals of Accounting (A basic accounting course is highly recommended.)	3
ACCY 201	Accounting and Accountancy I (A basic accounting course is highly recommended.)	3
ACCY 202	Accounting and Accountancy II (A basic accounting course is highly recommended.)	3
ADV 150	Introduction to Advertising	3
BADM 310	Mgmt and Organizational Beh	3
BADM 311	Leading Individuals and Teams	3
BADM 312	Designing and Managing Orgs	3
BADM 320	Principles of Marketing	3
BADM 445	Small Business Consulting	4
BADM 446	Entrepreneurship: New Venture Creation	4
BTW 250	Principles Bus Comm	3
BTW 261	Principles Tech Comm	3
FIN 221	Corporate Finance	3
FIN 300	Financial Markets	3
IE 420	Financial Engineering	3
Civil Engineering Structures		
CEE 380	Geotechnical Engineering	3
CEE 460	Steel Structures I	3
CEE 461	Reinforced Concrete I	3
CEE 462	Steel Structures II	3
CEE 463	Reinforced Concrete II	3
CEE 465	Design of Structural Systems	3
SE 400	Engineering Law	3
Computer Science		
Core Courses:		
CS 173	Discrete Structures	3
CS 225	Data Structures	4
Elective Options - complete 2 of the following courses:		
CS 410	Text Information Systems	3
CS 411	Database Systems	3 or 4
CS 425	Distributed Systems	3 or 4
CS 438	Communication Networks	3 or 4
All 200-, 300-, and 400-level CS courses excluding CS 210, CS 211, CS 397, CS 398, and CS seminar and senior project courses.		
SE 400	Engineering Law	3
Construction		
CEE 300	Behavior of Materials (Credit will not be given for CEE 300, ME 330 and MSE 280; select only 1 of these courses.)	4
CEE 310	Transportation Engineering	3
CEE 320	Construction Engineering	3
CEE 380	Geotechnical Engineering	3
CEE 420	Construction Productivity	3
CEE 421	Construction Planning	3
CEE 422	Construction Cost Analysis	3
CEE 460	Steel Structures I	3
CEE 461	Reinforced Concrete I	3
CEE 465	Design of Structural Systems	3
ME 330	Engineering Materials (Credit will not be given for CEE 300, ME 330 and MSE 280; select only 1 of these courses.)	4
SE 400	Engineering Law	3
Control Systems		
CS 173	Discrete Structures	3
ECE 470	Introduction to Robotics (same as AE 482 and ME 445)	4
ECE 486	Control Systems	4
ECE 490	Introduction to Optimization	3
IE 410	Advanced Topics in Stochastic Processes & Applications	3
MATH 444	Elementary Real Analysis	3
MATH 461	Probability Theory	3
MATH 464	Statistics and Probability II	3
ME 360	Signal Processing	3.5
ME 460	Industrial Control Systems	4
ME 461	Computer Cntrl of Mech Systems	3

SE 400	Engineering Law	3
SE 420	Digital Control Systems	4
SE 422	Robot Dynamics and Control	4
SE 423	Mechatronics	3
Digital Prototyping		
ME 270	Design for Manufacturability	3
ME 451	Computer-Aided Mfg Systems	3
ME 452	Num Control of Mfg Processes	3
ME 471	Finite Element Analysis (same as AE 420 and CSE 451)	3
SE 400	Engineering Law	3
SE 402	Comp-Aided Product Realization	3
SE 410	Component Design (This course cannot count as an SFO elective and an SED Design Elective.)	3
SE 413	Engineering Design Optimization (This course cannot count as an SFO elective and an SED Design Elective.)	3
SE 423	Mechatronics (This course cannot count as an SFO elective and an SED Design Elective.)	3
TAM 470	Computational Mechanics	3
Engineering Administration		
Core Requirement:		
SE 400	Engineering Law	3
Elective Options - select remaining courses from this list. Of these courses, only 1 selected may be at the 100 or 200 level.		
ACCY 200	Fundamentals of Accounting	3
ACCY 201	Accounting and Accountancy I	3
ACCY 202	Accounting and Accountancy II	3
ADV 150	Introduction to Advertising	3
BADM 310	Mgmt and Organizational Beh	3
BADM 311	Leading Individuals and Teams	3
BADM 312	Designing and Managing Orgs	3
BADM 313	Strategic Human Resource Management	3
BADM 375	Operations Strategy	3
BADM 380	International Business	3
BADM 381	Multinational Management	3
BTW 250	Principles Bus Comm	3
BTW 261	Principles Tech Comm	3
ECON 302	Inter Microeconomic Theory	3
FIN 221	Corporate Finance	3
IE 330	Industrial Quality Control	3
IE 340	Human Factors (same as PSYC 358)	4
IE 361	Production Planning & Control	3
IE 420	Financial Engineering	3
IE 445	Human Performance and Cognition in Context	3
PS 321	Principles of Public Policy	3
SE 411	Reliability Engineering	3
Engineering Marketing		
Core Requirement:		
SE 400	Engineering Law	3
Elective Options - select remaining courses from this list. Of these courses, only 1 selected may be at the 100 or 200 level.		
ACCY 200	Fundamentals of Accounting	3
ACCY 201	Accounting and Accountancy I	3
ACCY 202	Accounting and Accountancy II	3
ADV 150	Introduction to Advertising	3
BADM 310	Mgmt and Organizational Beh	3
BADM 320	Principles of Marketing	3
BADM 322	Marketing Research	3
BADM 323	Marketing Communications	3
BADM 325	Consumer Behavior	3
BADM 327	Marketing to Business and Govt	3
BADM 380	International Business	3
BADM 382	International Marketing	3
BADM 420	Advanced Marketing Management	3
BTW 250	Principles Bus Comm	3
BTW 261	Principles Tech Comm	3
PSYC 245	Industrial Org Psych	3
Environmental Quality		
ACE 310	Natural Resource Economics	3
CEE 330	Environmental Engineering	3
CEE 437	Water Quality Engineering	3
CEE 440	Fate Cleanup Environ Pollutant	4
CEE 442	Environmental Engineering Principles, Physical	4
CEE 443	Env Eng Principles, Chemical	4
CEE 444	Env Eng Principles, Biological	4
ENVS 336	Tomorrow's Environment	3
IB 105	Environmental Biology	3
NRES 419	Env and Plant Ecosystems	3
NRES 472	Environmental Psychology	4
SE 400	Engineering Law	3
Manufacturing Engineering		
IE 370	Stochastic Processes and Applications	3
ME 330	Engineering Materials (Credit will not be given for CEE 300, ME 330 and MSE 280; select only 1 of these courses.)	4
SE 400	Engineering Law	3
SE 402	Comp-Aided Product Realization	3
SE 420	Digital Control Systems	4
SE 422	Robot Dynamics and Control	4
SE 423	Mechatronics	3
Any courses from Digital Prototyping and Control Systems Secondary Field Option.		
Nondestructive Testing and Evaluation		
Core Requirement:		
SE 412	Nondestructive Evaluation	3
Elective Options - complete remaining courses from this list:		
CEE 300	Behavior of Materials (Credit will not be given for CEE 300, ME 330 and MSE 280; select only 1 of these courses.)	4
CS 173	Discrete Structures	3
CS 225	Data Structures	4

CS 440	Artificial Intelligence	3
CS 446	Machine Learning	3
ECE 470	Introduction to Robotics	4
ECE 473	Fund of Engrg Acoustics	3
ME 270	Design for Manufacturability	3
ME 471	Finite Element Analysis	3
SE 400	Engineering Law	3
TAM 412	Intermediate Dynamics	4
TAM 456	Experimental Stress Analysis	3
Operations Research		
IE 360	Facilities Planning and Design	3
IE 361	Production Planning & Control	3
IE 370	Stochastic Processes and Applications	3
IE 400	Design & Anlys of Experiments	3
IE 410	Advanced Topics in Stochastic Processes & Applications	3
IE 411	Optimization of Large Systems	3
MATH 461	Probability Theory	3
MATH 464	Statistics and Probability II	3 or 4
ME 451	Computer-Aided Mfg Systems	3
SE 400	Engineering Law	3
SE 411	Reliability Engineering	3
Rehabilitation Engineering		
CHEM 232	Elementary Organic Chemistry I	3 or 4
ECE 414	Biomedical Instrumentation	3
ECE 415	Biomedical Instrumentation Lab	2
MCB 150	Molec & Cellular Basis of Life	4
MCB 250	Molecular Genetics	3
MCB 251	Exp Techniqs in Molecular Biol	2
REHB 401		
REHB 402		
SE 400	Engineering Law	3
Theoretical and Applied Mechanics		
CEE 300	Behavior of Materials (Credit will not be given for CEE 300, ME 330 and MSE 280; select only 1 of these courses.)	4
ME 471	Finite Element Analysis	3 or 4
SE 400	Engineering Law	3
TAM 412	Intermediate Dynamics	4
TAM 424	Mechanics of Structural Metals	3
TAM 428	Mechanics of Composites	3
TAM 435	Intermediate Fluid Mechanics	4
TAM 445	Continuum Mechanics	4
TAM 451	Intermediate Solid Mechanics	4
TAM 456	Experimental Stress Analysis	3

Technical Electives

Code	Title	Hours
Design elective selected from the departmentally approved list of Design Electives below:		**3**
SE 410	Component Design	3
SE 420	Digital Control Systems	4
SE 423	Mechatronics	3
SE 413	Engineering Design Optimization	3 or 4
Engineering science elective selected from the departmentally approved list of Engineering Science Electives below:		**3**
ME 200	Thermodynamics	3
MSE 280	Engineering Materials	3

Free Electives

Code	Title	Hours
Additional course work, subject to the Grainger College of Engineering restrictions to Free Electives, so that there are at least 128 credit hours earned toward the degree. (https://go.grainger.illinois.edu/FreeElectives/)		10
Total Hours of Curriculum to Graduate		**128**

for the degree of Bachelor of Science in Systems Engineering and Design (formerly General Engineering)

Sample Sequence

This sample sequence is intended to be used only as a guide for degree completion. All students should work individually with their academic advisors to decide the actual course selection and sequence that works best for them based on their academic preparation and goals. Enrichment programming such as study abroad, minors, internships, and so on may impact the structure of this four-year plan. Course availability is not guaranteed during the semester indicated in the sample sequence. The curriculum sequence can also be viewed via dynamic and static curricular maps (https://grainger.illinois.edu/academics/undergraduate/majors-and-minors/systems-engineering-map/), which include prerequisite sequencing.

Students must fulfill their Language Other Than English requirement by successfully completing a third level of a language other than English. See the corresponding section on the Degree and General Education Requirements. One of the SBS courses must be an introductory economics course (ECON 102 or ECON 103). SE 494 and SE 495 will satisfy a core course requirement and the Campus General Education Advanced Composition requirement.

Free Electives: Additional course work, subject to the Grainger College of Engineering restrictions to Free Electives, so that there are at least 128 credit hours earned toward the degree.

First Year

First Semester	Hours		Second Semester	Hours
SE 100	1		CS 101 (CS 124 may be substituted)	3
MATH 221 (MATH 220 may be substituted)	4		MATH 231	3
CHEM 102	3		PHYS 211	4
CHEM 103	1		ECE 110	3
ENG 100	1		SE 101 or Composition I course	3-4
Composition I course or SE 101	4-3			
	14			**16**

Second Year

First Semester	Hours	Second Semester	Hours
SE 261	2	IE 300	3
MATH 241	4	MATH 285	3
PHYS 212	4	PHYS 213	2
TAM 211	3	TAM 212	3
ECON 102 or ECON 103 (counts as General Education course)	3	TAM 251	3
		SE 290	0
		General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3
	16		**17**

Third Year

First Semester	Hours	Second Semester	Hours
SE 310	3	SE 311	3
SE 320	4	SE 312	1
MATH 257	3	SE 424	3
ECE 211	2	IE 310	3
Secondary Field Option course	3	TAM 335	4
		General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3
	15		**17**

Fourth Year

First Semester	Hours	Second Semester	Hours
Secondary Field Option course or SE 494 & SE 495	3-5	SE 494 & SE 495 or Secondary Field Option course	5-3
Design elective course	3	Secondary Field Option course	3
Engineering Science elective course	3	Language Other Than English (3rd level) course	4
Secondary Field Option course	3	Free elective course	3
General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3	Free elective course	3
	15		**18**

Total Hours 128

for the degree of Bachelor of Science Major in Systems Engineering and Design (formerly General Engineering)

Student learning outcomes are based on learning outcomes in line with the ABET accreditation process.

Systems Engineering and Design graduates will have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
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.
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.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

for the degree of Bachelor of Science in Systems Engineering and Design (formerly General Engineering)

Industrial & Enterprise Systems Website (https://ise.illinois.edu/)
Industrial & Enterprise Systems Faculty (https://ise.illinois.edu/directory/faculty.html)

The Grainger College of Engineering Admissions (https://grainger.illinois.edu/admissions/)

The Grainger College of Engineering (https://grainger.illinois.edu/)